Gender Dynamics in the Management of Commercial and Public Biotechnology Organisations

by

Janine Fay Pickering

A thesis submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

Faculty of Business and Law

Swinburne University of Technology

Melbourne, Australia

2015

Abstract

This thesis compares the career experiences of Australian managers working in two very different forms of biotech organisation: small, networked commercial firms; and hierarchical academic research institutes. It draws on quantitative data from 30 organisations covering 401 scientific managers and qualitative data from interviews with 26 biotech managers. In combination these data reveal female managers in commercial biotech experience no significant difference in their scope of responsibilities or pay compared with male managers. By contrast, academic biotech is characterised by vertical segregation with female managers concentrated in lower level management positions, earning lower salaries than their male colleagues. While interviews indicate career challenges such as job insecurity and work-family balance are common across both sectors, the management practices and organisational structures of the two have vastly different impacts. Two key factors - the organisation of work and the criteria for career advancement - mitigate the challenges in firms, but amplify them in academia. Differences in structural and cultural factors are driven by particular views of productivity. In firms, technical skills are a pre-requisite, but productivity equates with versatility, project-management, collaboration and inter-organisational networks. Managers are appointed on potential and reputation. In academia, productivity equates with a 'track record' of individual achievement in a specialist field. Managers are appointed on their scientific contribution grounded in the 'ethos of science'. Promotion is often directly linked to grant funding, and teamwork and collaboration while important, are less valued. The commercial biotech sector is unashamedly driven by business imperatives, not gender equity, yet due to its network form, is more accommodating of working mothers. This is because it offers different types of management work and temporal arrangements that suit women at different stages of the life-course. Job mobility is rewarded; long hours are punctuated; part-time work and consulting are normalised. In academia, the 'race for discovery' drives relentlessly long hours and precludes part-time work or career breaks. This suggests that rather than focusing on ‘family friendly’ initiatives to accommodate women in existing patterns of work, research institutes seeking improved gender equity should re-examine how they define and evaluate productivity.

Declaration

The candidate hereby certifies that:

- This thesis contains no material which has been accepted for the award to the candidate of any other degree or diploma, except where due reference is made in the text of the thesis;
- To the best of the candidate's knowledge this thesis contains no material previously published or written by another person except where due reference is made in the text of the thesis;
- Any editorial work, paid or unpaid, carried out by a third party is acknowledged; and,
- The thesis has met all the requirements of the Ethics Approval from Swinburne University of Technology (refer appendix 4.9) and the final ethics report has been submitted.

…………………………………………………

Janine Fay Pickering

Acknowledgements

Thank you to Michael, Tom and Dean for your patience, generosity and wisdom. It has been an absolute privilege to be your student.

Thank you to Graeme for your unconditional love and support, as always.

Thank you to Matt for your cuddles and for waiting. Thank you to Jack, Ben and Evan for keeping me grounded. You each have a thesis in you.

Thank you to Mum and Dad for always believing in me.

Thank you to Bob (everyone's Uncle Bob) for your love and encouragement throughout.

Thank you to old friends and new: Louise and Ray for being there always; Vikki and Barb for sharing the PhD journey and much more. Thank you all for your wise counsel and editing advice. I could not have done this without you.

Thank you to my university buddies for your camaraderie and to my work colleagues for your consideration and understanding of my torn loyalties.

Thank you to the biotech interviewees and other participants for giving generously of your time and to my scientist friends over many years. You inspired me.

Thank you to my dear family and friends for your encouragement and support, and for knowing when to stop asking. Yes … it is done.

Contents

List of Tables

List of Figures

1. Introduction

The genesis of this thesis was the inaugural BioMelbourne Network's 'Connecting Women in Biotechnology' luncheon in May 2009. I attended with some colleagues from a biotechnology (biotech) firm I worked for at the time. I was struck by the high energy buzz in the large dining hall. This was not like other networking events I had been to; it was more like a large family reunion, together with hugs and kisses. And, although I am not a scientist, having worked as an human resources (HR) service provider for a number of firms, I felt very much a part of the 'biotech scene'. This women's only event was sold out, as have been the five held annually since then. Each year, attendees come from a diverse range of organisations representative of the Victorian field of biotechnology, including biotech firms, large pharmaceutical firms (large pharma), various service providers from legal through to manufacturing, research institutes and universities. There are always three or more guest speakers, but despite the wide-ranging backgrounds of the attendees, these speakers are overwhelmingly women who manage biotech firms. There is a popular view that women are taking great strides forward in management in commercial biotech and that their success stories are worth sharing and celebrating. Indeed, the Equal Opportunity for Women in the Workplace (EOWA) 2010 and 2012 leadership censuses show that despite the huge gender gap in top jobs, the few women who do manage to rise to top management jobs are more likely to be found in the pharmaceuticals and biotechnology sector than in any other industry. I was intrigued to know more.

By contrast, there are mixed messages around women managers in academic science. On the one hand there are great success stories. Noteworthy high profile appointments during this study included Megan Clarke's term as Chief Executive of the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Suzanne Corey's presidency of the Australian Academy of Science (AAS), Margaret Sheil's leadership of the Australian Research Council (ARC), and Cathy Foley's presidency of the Federation of Scientific and Technological Societies (FASTS). On the other hand, beneath these headline acts reports suggest a dispiriting picture, with women seriously under-represented in senior scientist and science management positions. In a 2009 report, *Women in Science: Diversity, Productivity and Opportunity*, commissioned by FASTS, Professor Sharon Bell and her colleagues report that, consistent with worldwide trends in science, Australian women academic scientists continue to be segregated vertically by level of seniority and progressively leave academia through the postdoctoral phase of their careers via the 'leaky pipeline', their destinations largely unknown. Whilst the Bell report focuses on science generally, rather than particular fields of science, it does draw on some academic biotech data to illustrate these patterns of employment, suggesting a bleak picture overall for women in that field (Bell 2009:52).

So the impressions are clear but specific data on women working as academic biotech managers is limited and data on women working as commercial biotech managers virtually non-existent (Bell 2009). Aiming to bridge this knowledge gap, this study compares the management careers of women across these two sectors. It examines why women are perceived as doing well in the commercial sector but less well in the academic sector of the same field, and whether this perception is warranted. It is based on information from two main sources: questionnaire responses from 19 biotech firms and 11 academic research organisations, all based in Victoria, Australia, that provide quantitative data on 401 biotech managers and their jobs; and 26 qualitative semi-structured interviews with Victorian biotech managers.

I draw on the quantitative data to compare the type, scope, pay and gender distribution of management jobs between women and men, both within and across these two sectors. My analysis reveals that women working in the commercial biotech sector are 3.5 times more likely to be a manager than women working in the academic sector. This explains the general perception that women are better represented in management in this sector. Yet this higher representation is largely accounted for by the greater proportion of management jobs available, thus revealing more about the structure of the two sectors than about gender equity.[1]

[1] I distinguish here between gender *equity*, defined as the ability of both men and women to participate fully in both work and personal life and gender *equality* which is often used in the sense of 'sameness' between men and women (Gambles *et al.*, 2006). In this thesis I use the term gender equity unless I am referring to particular literature that includes the term equality.

More relevant to gender equity is the comparison of women's and men's management jobs *within* each of the two sectors. These data show that women working in commercial biotech experience more egalitarian employment outcomes than their academic counterparts, with no significant difference in their seniority, scope of responsibilities or pay compared to their male colleagues. By contrast, academic biotech management is characterised by vertical segregation with female managers concentrated in lower level management positions and paid less than their male colleagues.

To understand these findings I draw on insights from my interviews with women and men working in this profession. Through their observations and personal career and family experiences, I explore how the culture, structure and management practices in these two sectors impact on opportunities for women to attain and retain management level positions. The interviews revealed that certain career challenges, such as job insecurity, long hours, and the pressure of combining work and family are common to managers across both sectors. However, the management practices and organisational structures of these two sectors have vastly different impacts on managers' ability to meet those challenges.

Based on both the survey and interviews, I find that two key factors, the organisation of work and the criteria for career advancement, mitigate these challenges in firms, but amplify them in research institutes. I argue that in both sectors, prevailing views of productivity drive these structural and cultural factors. 'What is productive' and 'who is productive' look very different in commercial and academic biotech. In the first instance, this stems from their very different goals: one focused on scientific discovery; the other on commercialising those discoveries. In the second instance, it stems from the very different institutional and organisational structures that support those goals: one characterised by large, hierarchical research institutes and the other by small, networked firms.

I examine the traditional notions of productivity that underpin academic science through the work of Robert Merton (1957; 1973[1942]) whose theories were instrumental in the establishment of the sociology of science as a field of study. His characterisation of scientific research as a ‘race for discovery’ is enduring, and, as I will argue in this study, has substantial negative consequences for women in academic science today. In my analysis of the commercial sector, I draw on the work of Walter Powell and his colleagues (Powell 1990, 2001; Powell, Koput and Smith-Doerr 1996; Powell, White, Koput and Owen-Smith 2005; Powell and Sandholtz 2012). Powell’s extensive research on the network form of organisation in the ‘New Economy’ provides a framework for my analysis of the structure of biotech firms, their broader inter-organisational networks, and the project-based nature of their work. I find the structure of the commercial sector and small size of the firms provide a wide variety of management opportunities and employment arrangements that are not available in traditional science management, including job mobility, variety, consulting and part-time work.

In particular, the work of Laurel Smith-Doerr, one of Powell’s collaborators, provides a launching pad for this study. In her study of US life science PhD graduates in the 1990s, Smith-Doerr (2004) finds that women are eight times more likely to hold a supervisory position in a biotech company than within a large hierarchical science organisation. She concludes that women’s relative success in management is due to the network form of biotech firms providing greater flexibility in the way women work, and with whom they work. Despite the differences in time and place, I find similar patterns in Victorian biotech, and reach similar conclusions about the work environment of the commercial sector. I build on Smith-Doerr’s research to include analysis and comparison of organisation-level management practices and specific job characteristics that impact on women’s careers across these different forms of organisation.

In this analysis of management practices and jobs, I also draw on Joan Acker’s (1990; 1992) theory of gendered organisations. According to Acker, gendering occurs through the interrelated processes of structure, culture, interaction and identity. This provides a framework for seeing inequality in a very practical sense (Britton and Logan 2008). I examine the gendered organisational logic behind ordinary policies, procedures and activities such as appointment, promotion, job design, work hours, and pay, and find this logic is often concealed within a dominant perception of gender equality. In this context, I argue that, despite emancipatory attempts to accommodate women in the academic biotech sector, women continue to be disadvantaged by a gendered logic that rewards continuous, full-time employment, and is unforgiving of any deviation from 'the race'. By contrast, commercial biotech provides greater opportunity for women, not through any emancipatory intent, but through a coincidental alignment between business needs and women's non-linear career preferences.

Biotech is an ideal field in which to test evolving theories of gender, work and organisations, particularly the effect of different forms of organisation on women's careers. This is because the field comprises different forms of organisation but has a relatively even gender distribution drawn largely from the same pool of science graduates. This is a highly skilled group of managers at the elite end of the workforce. Most managers working in biotech, either in academia or firms, have a PhD in the life sciences or chemistry, or another science qualification combined with post-graduate business qualifications. But unlike other science, engineering and technology (SET) fields such as information technology (IT), physics or mathematics, there is not an 'under-supply' of qualified women in biotech disciplines. Nor is there an 'over-supply' as in the case of highly feminised fields such as teaching or nursing. This clears the way to examine the effects of structure and culture on careers without confounding 'supply' factors.

The findings from this study add to a growing body of empirical work demonstrating that productivity is of concern to both employers and employees, and that gender equity initiatives are most effective if they are integrated with organisational needs in a 'dual agenda' (Bailyn 2006[1993], 2011; Meyerson and Kolb 2000; Rapoport, Bailyn, Fletcher and Pruitt 2002). The dual agenda is a relatively new approach to redesigning work that prioritises both organisational productivity and gender equity. In Australia, the link between these two aims is increasingly evident in high profile business reports

(Goldman Sachs 2009; Ernst and Young 2013) and in government communications that have shifted from portraying gender equity as a moral cause to portraying it as an economic imperative (Conway 2012).

This study raises the question of whether gender equity is actually improved by 'focusing on gender equity'. According to the managers I interviewed, gender equity is not a major focus in biotech firms; indeed it is 'below the central horizon of organisational matters' (Eveline and Bacchi 2009: 566). Yet, coincidentally, due to the organisational form and view of productivity in that sector, the management outcomes for women are more equitable than in the academic organisations where greater emphasis is placed on gender equity policies and programs. I argue that this is because the prevailing view of productivity in the academic sector is incompatible with its own gender equity initiatives. In the face of this complexity, it would be misleading to align commercial biotech with productivity and academic biotech with gender equity, thus obscuring the heterogeneity of both feminism and productivity. The women and men in this study, in both sectors, are highly attuned to issues of gender equity; they just seek to achieve it in different ways. In firms, a gender-neutral environment assumes talented women will progress into management on their merits without the need for special initiatives. In academic biotech, the extent of the 'leaky pipeline' demands more direct intervention.

By comparing and contrasting management outcomes for high achieving women across two very different forms of organisation, this study highlights the importance of structure, culture and management practices in women's careers. The findings have implications for the Australian academic biotech sector. In particular, they suggest that improved gender equity will require institutional change beyond policies that seek to accommodate women into existing arrangements based on the male ideal worker model (Rapoport et al. 2002; Acker 1990). Effective change calls for a re-evaluation of the received wisdom that determines both 'what is productive' and 'who is productive' in academic science. Whilst gender equity is not the primary goal of science, reviews of public science increasingly highlight the waste of public resources and diminished productivity when highly trained female scientists leave the sector. There is also increasing recognition that the advancement of society through science requires a workforce with diverse experiences. Such reviews typically recommend changes to grant funding criteria and more liberal assessments of track records to increase diversity and retain scientists (OCS 2014; ADoHA 2013), but stop short of questioning the fundamental focus on individualised competition as the best way to achieve excellence in science. I argue the possibilities for change have been limited by the institutionalisation of academic science and its leaders and that there is potential for improvements in scientific productivity through changing the way academic science is organised and rewarded. Indeed academic science could adapt some of the learnings from commercial science.

Whilst a dual agenda approach is normally focused on improving productivity and gender equity within a specific workplace context, my contribution in this thesis is to compare approaches across different types of organisations within one field. In biotechnology the 'workplace context' is a wide and varied network of scientists and others who interact and exchange knowledge and ideas across organisational boundaries. By expanding the unit of analysis beyond the immediate organisation or institution, this thesis promotes cross-fertilisation in thinking about productivity and gender equity. It focuses on what *does* work in progressing women's careers in science unlike most research in this area which focuses on what *doesn't* work. It also breaks with the tradition of academia holding itself as so different to other sectors that comparisons cannot be made. I argue they can and they should.

1.1 The structure of this thesis

This study comprises three main parts. The first four chapters set the scene for my findings. In this first chapter I have provided an overview of my main arguments. In chapter two I review literature on gender, work and organisations as it relates to professionals and managers. I discuss enduring societal norms which position women as homemakers and men as breadwinners. I review the literature on part-time and other non-standard work including the 'choices' available to professional women. Next

I discuss gendered organisational practices with a particular focus on working time, productivity, appointment and promotion in management. I review the literature on occupational gender segregation, highlighting the advantages and disadvantages of segregation to women and the persistent under-representation of women in management. I conclude the chapter by reviewing efforts to change workplace gender dynamics through a 'dual agenda' of gender equity and productivity.

In the third chapter I review literature on gender and careers in science, particularly in the field of biotechnology. I describe the inter-organisational networks that characterise this field before comparing how work is organised and skills valued in biotech firms and academia. Research reveals a stark contrast between the collaboration and interdependence of commercial biotech and the culture of competition and independence in academia. I discuss the disadvantages experienced by women under the traditional meritocratic career structure in academic science and policies aimed to address these. I also discuss tensions between 'New Economy' and traditional science careers and the gender implications of change. As it is relatively new, the literature on careers in commercial biotech is more limited but there is a sense that this sector provides new and surprising opportunities for women.

In the fourth chapter, I detail the methodology for this study. I provide a brief overview of Australian biotech in the state of Victoria, the capital of which, Melbourne, is the location of my research. I discuss features of the sector that impact on careers including locale and stage of development. I also situate myself as both researcher and an 'insider' in the Victorian biotech field. I describe my use of a mixed methods approach, providing details of the collection and analysis of both quantitative and qualitative data, and the use of triangulation to strengthen findings.

The fifth, sixth and seventh chapters form part two of the study where I present my findings. In chapter five, I compare the strategies and structure of Victorian academic biotech organisations and biotech firms, and describe how this leads to very different types of management jobs. I draw on my quantitative data to reveal that women are

3.5 times more likely to be managers in firms than in academic biotech and argue this is largely due to these different types of management jobs. In particular, the variety of jobs available in firms offers genuine choice to anyone seeking a career in non-traditional science management, including jobs that do not require lab-based activities. I also describe how work is organised in commercial biotech, particularly through outsourcing which minimises the need for in-house supervision and increases the opportunity for high-quality part-time management work. I compare these features of the commercial biotech sector with the traditional hierarchical structure and career path of academic science and the lack of variety or part-time career options available. I find the criteria for advancement differ across the two sectors and that women in firms earn a higher median salary than either women in academic biotech, men in academic biotech or indeed men in firms.

In chapter six I discuss firm managers and in chapter seven I discuss academic managers, drawing on quantitative and qualitative data for both. With reference to the quantitative sample I begin each chapter with a comparison of the type and scope of management jobs held and salaries earned by women and men *within* each sector. I then introduce the managers I interviewed, providing an overview of their career paths and family circumstances. Across these two sectors a common theme is the time pressure associated with managing work and family, the women experiencing this more acutely than the men in both sectors. In most other respects, however, the managers' experiences are substantially different across sectors.

In chapter six I find an egalitarian culture in commercial biotech where women and men hold management jobs of similar scope and earn relatively equal pay. A contributing factor to this is the congregation of women in highly paid development roles. Four recurring themes explain why women do well in this sector: job mobility and informal networking; a wide variety of management jobs and entry points; gender neutrality; and the normalisation of non-standard work arrangements. Interviews with managers suggest that all of these themes are directly linked to the network form of organisation rather than gender equity considerations. Yet coincidentally these structural characteristics lead to a better environment for combining work and family than can be found in many high-level occupations.

In chapter seven I find a distinctly unfriendly environment for combining work and family in academic biotech. The result is vertical segregation in management with women congregating in lower level management positions and earning lower pay than men. Interviews suggest this outcome is attributable to the way work is organised and rewarded in this sector. Management work is interwoven with discovery research, the criteria for advancement resting almost exclusively on individual research achievement, with both management skills and team contributions largely ignored. In the 'race for discovery' managers face constant pressure to achieve research outcomes and secure grant funding whilst managing increasingly larger research teams as they progress through the hierarchy. For many managers, this drives relentlessly long work hours for which workplace flexibility provides little respite. An institutionalised time-based view of productivity leads to negative attitudes toward part-time work or any kind of career break, despite gender equity policies, making it extremely difficult to combine work and family care in this sector.

In the final chapter, I provide a summary of the main themes and findings in this thesis, highlight how it extends existing literature on gender, work and organisations, and discuss its limitations. Drawing on 'what works' for women in commercial biotech, I present some initial recommendations for how both gender equity and productivity can be improved in the academic sector through a dual agenda approach.

2. Literature review: Gender and management work

This is the first of two 'gender and management work' literature reviews that provide context for this thesis; this one focusing on gender and management work broadly; the next on gender and management work in science and biotech specifically. In this chapter I begin with a discussion of societal norms that situate women as mothers, homemakers and secondary earners. I review research on part-time and other non-standard work; its availability; quality; and impact on women who are more likely than men to work in this way. A consistent theme is that part-time work undermines gender equity both at home and at work. In this context I discuss the limited 'choices' available to professional and managerial women with families. I draw on Acker's (1990) theory of gendered organisations to frame a discussion of management work. Two aspects are covered: the temporal arrangements of management work; and selection processes for career advancement. This includes a review of occupational gender segregation which is driven, in part, by these aspects of management work. I conclude the chapter with a brief overview of the 'dual agenda' approach to addressing gender equity and productivity in organisations.

2.1 Women, work and family

'Separate spheres' is a metaphor used widely in feminist literature. It represents the gendered distinction between the public world of work, or economic sphere, culturally defined as a men's world, and the private world of the family and domestic life, defined as a women's world (Connell 2009; Ross 2006; Davidoff 2003; Vickery 1993). It derives from the establishment of industrial capitalism in Western societies from the late 1700's when there was a shift from household and local production to family members selling their labour for wages. Women were increasingly expected to 'do work that was more and more privatised and less acknowledged as work' (Lindsay and Dempsey 2009) whilst men were identified with the emerging idea of 'occupation' (Ross 2006). New words such as 'housewife' and 'breadwinner' emerged to explain these distinctive roles (Gilding 1991).

Despite egalitarian forces of change during the second half of the twentieth century, researchers observe the persistence of separate spheres and the gender-power system it supports (Holter 2005; Ridgeway 2011). Holter (2005:27), for example, positions separate spheres as the structural basis of the modern Western gender order. The spheres represent 'production' and 'reproduction', one being a place of profits and the other a place of costs. In economic terms, one is seemingly dependent on the other, and in gender terms, 'everything may seem to rest on the man or male dominance'. Ridgeway also positions gender as a primary frame for organising social relations. She refers to widely held gender stereotypes that assume men's higher status. According to Ridgeway (2011:27), gender inequality is created and maintained through practices that operate at the institutional, organisational, interpersonal and individual levels, that 'provide men more resources and power, on average, than women have'. She maintains that status beliefs persist despite social, technological and economic changes that undermine positional inequalities between men and women, primarily because people bring their 'trailing cultural beliefs' about gender to frame new social contexts.

Gender stereotypes are grounded in separate spheres. Men are often perceived as more authoritative, assertive and competitive, consistent with their role in the workplace and as breadwinner. By contrast, women are perceived as being more helpful, kind and giving, consistent with their primary domestic and caring roles (Eagly and Carli 2009). Yet, despite their persistence, these stereotypes are not supported by evidence. Research has demonstrated that on average the differences between women and men are slight compared to the variations among women and among men (Hyde 2005), and are too small to fully account for the highly gendered social patterns we see in contemporary society (Ridgeway 2011). Nevertheless, a recurring theme through research into gender inequality is the ultimate link to gender stereotypes and the enduring legacy of separate spheres.

2.1.1 Work and care

The cultural mandate that women become homemakers and men breadwinners has been progressively eroded. Initial challenges from women's rights movements between the 1960s and early 1980s were followed by the establishment of equal opportunity and anti-discrimination legislation and substantial increases in women's educational levels and participation in paid employment (Williams 2010). These developments have led to the replacement of the male breadwinner model with a new norm of the 'dual income' family in most industrial societies (Lewis and Giullari 2005).

This dual income model has introduced new complexities around managing work and family. Moen (2011) describes the strategic choices individuals and families make in order to function within the limitations of socially organised working time. Such choices extend to whether and when to have children at all, and if so, whose career to prioritise. In some families both parents work full-time and utilise various forms of childcare, whilst others adopt non-standard work strategies including part-time hours, flexible hours including working from home; self-employment; or taking periods of time out from the workforce in order to care for children.

Amongst Australian dual earner couples it is primarily women who adjust their paid work around family commitments (Craig and Powell 2012; Craig and Mullan 2009). As a result, in Australia the dual income model has 'evolved in a lopsided way' (Pocock 2005: 43) into a 'modified male breadwinner' or 'one and a half earner' model where fathers work full time and mothers work part time as second or marginal income earners with continuing responsibility for family care (Hill 2007; Pocock 2005; Craig and Mullan 2009; Craig and Powell 2012).

Whilst women's labour force participation increased from around 43 per cent in 1980 (ABS 1980) to 65 per cent in 2010 (ABS 2012), much of this growth has been in part-time employment, defined in Australia as less than 35 hours per week (ABS 2013). Australian women are over-represented in part time work and under-represented in full time work, with 43 per cent of women employees working part-time compared to

14 per cent of men in 2010 (ABS 2012). By international comparison, this is a particularly high rate of part-time work for women, with around 19 percent of employed women working part-time in the US. Australia ranks second only behind the Netherlands among OECD countries for its rate of part-time employment, with three-quarters of these jobs held by women (Baxter and Hewitt 2013). There is a strong association between part time work and motherhood, with around 70 per cent of mothers working part-time compared to only 6 per cent of fathers (Charlesworth et al. 2011).

Researchers observe that Australian men and women are strongly tied to a traditional division of domestic labour which is reliant on, and perpetuated by women's disproportionate share of part-time employment (Baxter and Hewitt 2013; Craig and Powell 2012; Pocock 2005; Bittman et al. 2003). A consistent theme is that working part-time in paid employment does not reduce Australian working mothers' overall work burden. When part-time work and domestic responsibilities are combined, working mothers work longer hours than working fathers, and also longer hours than both working mothers and fathers in the US and a range of European countries (Pocock et al. 2012; Craig and Mullan 2012; Craig and Mullan 2009; van Egmond et al. 2010; Cassells, Miranti, Nepal and Tanton 2009). Australian mothers consistently report chronic time pressure, with 2012 data indicating 70 percent of working mothers are almost always rushed or pressed for time in comparison to 59 percent of fathers, a consistent trend since 2007 (Pocock, Charlesworth and Chapman 2013).

In all industrialised nations, women continue to spend significantly more time on domestic work (housework and care) than men. Whilst cross-national trends over the last forty years indicate a slight narrowing of this gender gap, the narrowing is mostly attributable to women doing less domestic work due to increased paid work, with men's domestic contribution increasing only marginally. The increase in men's domestic work has neither compensated for the decline in women's domestic work nor reached parity with it (Baxter et al. 2005; Craig et al. 2008; Craig and Powell 2012; Hook 2006; Kan et al. 2011).

Highly educated women are generally less likely to conform to the male breadwinner, female home-maker model than less educated women, and tend to have more egalitarian housework arrangements (Cunningham 2008; Brewster and Padavic 2000). Women in professional and managerial jobs and living in high income households are often well placed to outsource tasks such as cleaning and cooking. Research indicates that, depending on income, the more hours they work the more likely women are to outsource domestic tasks (Baxter, Hewitt and Western 2009). However, the decision to outsource also depends very strongly on beliefs about its legitimacy and in Australia there is a relatively low use of outsourced services due to a strong 'do-it-yourself' culture (Baxter et al. 2009; Baxter and Hewitt 2013).

Most studies of time use combine housework and childcare as 'domestic work' (Raley et al. 2012), but the distinction between the two is important. Research has shown that whilst high-earning mothers may be prepared to outsource housework, they do not necessarily wish to 'buy out' of childcare responsibility which is often a deeply felt moral imperative (Craig and Mullan 2011; Raley et al. 2012; Duncan et al. 2003). Even when dual earner families use non-parental childcare, it does not necessarily reduce the time they spend on childcare, with both mothers and fathers prioritising active time with children (Craig and Powell 2012). Research shows that where both parents are university-educated, they allocate extra time to talking, listening, playing, reading, teaching and reprimanding than less educated parents, although most of this extra parenting is done by mothers (Craig 2006). On top of this, highly educated women are also more likely than less educated women to adopt intensive parenting strategies even though they also spend more time in paid work (England and Srivastava 2013). Whilst fathers, especially in highly educated families, are increasingly involved in childcare their long work hours tend to limit their availability to weekends (Craig and Mullan 2012; Sullivan 2010; Raley et al. 2012). By contrast, mothers' routine tasks at certain times of the day such as picking up children from school or day-care, feeding, bathing and putting them to bed often preclude them from working back late, networking with colleagues and can limit career advancement and promotion (Craig and Mullan 2011). So although professional and managerial women may not subscribe to traditional homemaker roles, they view care as more than simply a constraint on paid work (Duncan et al. 2003).

Part-time or other non-standard work arrangements are a way for working mothers to ‘buy time’ with children and potentially alleviate the constant pressure to reconcile ‘the mechanical linear time-clock of the workplace and the natural body clock of care and reproduction’ (Pocock, Skinner and Williams 2012: 216). However, in a male bread-winner society, part-time work is a double-edged sword. First, as discussed, it does not necessarily alleviate time pressure. And second, as I discuss next, for professional and managerial women it can have a negative impact on career advancement. Due to these unintended consequences of part-time work, scholars are divided on whether it is in the best interests of women.

2.1.2 Flexible and part-time work

As many working mothers provide care for children from babies through to teenagers, they are likely to require different ‘family friendly’ work arrangements at different stages of the life-course (Moen 2011; Probert 2005). Part-time work is a pro-rata of the ‘standard’ working day or week; it involves (ostensibly) doing less work and being paid less than a full-time worker. Flexible work may or may not reduce overall hours of work, but provides some variation in the actual hours worked and may include remote working (including working from home). Both full-time workers and part-time workers may or may not have flexible hours. These differences are important to both employers and employees primarily because they impact on the quantum of work to be done.

Working time and flexible hours

Flexible work reflects significant changes in the spatial and temporal organisation of work in a globalised 24/7 environment. Often promoted as a way for staff to manage their paid work and family responsibilities, flexibility equally serves the desire of employers to reduce costs and extend the definition of working time (Heron and

Charlesworth 2012; Coyle 2005). Hence the extent to which workers can exert some degree of choice over their working time is a key determinant in whether flexible working is 'family-friendly' (Coyle 2005; Kossek, Lautsch and Eaton 2005).

In Australia, formal workplace flexibility is available to many employees. Government legislation gives parents or carers of pre-school children or older children with a disability the 'right to request' (RTR) changes to working arrangements in order to care for their child. This includes changes to hours, patterns of work or location of work, or other arrangements (Skinner, Hutchinson and Pocock 2012). However, flexibility is not available to everyone. Researchers observe the Australian RTR is 'weaker' than in many European countries, being subject to various qualifying conditions and not extended to all workers, including parents of older children (Skinner and Pocock 2011). In addition, Government policies requiring implementation at the workplace level are often undermined by working practices, structures, cultures and wider societal norms (Gambles et al. 2006). Overall, research indicates Australian workers have negative perceptions of organisational support for work-life balance (Fujimoto et al. 2013). Two groups stand out as experiencing particular problems with flexible working hours. The first is low-skill workers in insecure jobs, whose flexibility is at the behest of their employers' ad hoc daily requirements and who struggle to meet the qualifying conditions for the RTR. The second is high level managers and professionals who are too busy to utilise the flexible arrangements ostensibly available to them and can be stigmatised if they do. Australian studies indicate that around one third of employees who are dissatisfied with their working hours have not sought greater flexibility under RTR. Often these 'discontented non-requesters' are managers who work long hours (Skinner et al. 2012). Many claim that flexibility is simply not available to them, either because they are not convinced their employer will allow it or because they believe their job does not allow it.

Whilst control over work scheduling dominates much of the debate around working hours, studies indicate the quantity of work (work overload) is the strongest predictor of full-time employees' work-life conflict (Skinner and Pocock 2008; Allan, Loudoun and Peetz 2007). Work overload is a major cause of long working hours, with the overwhelming explanation provided by Australian employees for their 'unpaid overtime' that 'there is too much work to do' (Campbell 2007). In Australia there is not a consistent definition of long work hours. The standard weekly hours are 38 hours per week, with long hours variously defined as over 40 or 45 (long) or 50 (long or very long), or in terms of the mismatch between actual hours and preferred hours (Campbell 2007; Drago, Wooden and Black 2009; Skinner and Pocock 2008; Chapman, Skinner and Pocock 2014). Campbell (2007) observes the proportion of full-time employees working long and very long hours in Australia is large, and it has been growing larger over the past two decades, rivalling the US, and moving ahead of the UK and other EU countries. Although this trend to long hours is pervasive throughout the Australian workforce, professionals and managers stand out as working the longest hours and having the poorest work-life balance (Campbell 2007; Skinner et al. 2012). In particular, mothers working long full-time hours in management and professional roles report the highest work-life conflict (Chapman et al. 2014).

Managers are the workers with the highest degree of autonomy but are under the most pressure to work long hours. Alvesson and Willmott (2002) use the term 'micro emancipation' to describe managers' apparent greater control over their schedules and working arrangements when, in practice, this is severely constrained by high workloads and tight timelines. Others highlight that when work is 'results-based' rather than 'time-based', it creates new forms of pressure bound up with the subtleties of job design rather than direct control, especially in highly skilled jobs. Managers with professional autonomy 'self-organise' their long hours within a framework of intense workloads (Campbell 2007).

Professional and managerial work is highly portable, with extra hours often worked at home, on planes, trains and in cars. When flexibility is built into their jobs in this way, there is no need for managers to utilise formal flexibility policies (Kossek et al. 2012). However, this movement to a 'virtual' workplace where work extends to any hour of the day also highlights the importance of managing the boundary between work and home life. Kossek et al. (2012) find that a boundary management strategy favouring the integration of work and home is more likely to negatively affect family than work. In other words, employers gain from managers and professionals taking work home, but this is not necessarily in the family's best interests. The upshot is that time-based work-life policies and professional autonomy are necessary but not sufficient to address work-life conflict; attention must also be paid to problems of work overload (Skinner and Pocock 2008).

There is a growing US literature on the 'flexibility stigma' that applies to professionals and managers who take up flexible and part-time work options. Researchers identify both reputational and concrete career consequences for doing so, including reduced quality of work and advancement opportunities (Williams, Blair-Loy and Berdahl 2013; Stone and Hernandez 2013; Coltrane, Miller, DeHahn and Stewart 2013). Recent research has found the stigma is associated not so much with flexibility per se, but with the choice to utilise work-life policies for the purpose of family care-giving (Cech and Blair-Loy 2014). In this, both women and men are stigmatised. Women are stigmatised for the gender-conforming behaviour of putting their family responsibilities first and thereby taking the 'mommy track' (Williams et al. 2013; Stone and Hernandez 2013). Meanwhile men are stigmatised for the gender non-conforming behaviour of making caregiving responsibilities salient on the job (Berdahl and Moon 2013; Rudman and Mescher 2013). The flexibility stigma explains why most ambitious women do not use family policies or flexible work arrangements (Bailyn 2011; Moen 2011). It also provides context for why Australian managers make low use of RTR legislation.

Part-time work

Part-time jobs can be initiated by the employer or the employee, and they can be permanent roles or non-permanent (casual or fixed term). These differences often impact on the quality of part-time jobs, judged on a range of factors including the level of wages, work intensity, control over tasks, input into workplace decision making, job security, and career progression (Charlesworth et al. 2011). One measure of quality is how closely part-time jobs resemble full-time jobs on such factors (Burgess 2005). This leads researchers to differentiate between ‘good’ and ‘bad’ part-time jobs (Webber and Williams 2008).

In Australia as in other parts of the world, the high growth in employer-initiated part-time, casual work since the mid-1990s has been driven largely by global competitive pressures and the demand for flexibility (Barns and Preston 2010). Essentially this work is structured for the benefit of employers. It is often insecure with no access to paid leave and involving unpredictable hours (van Wanrooy 2009). The majority of Australian part-time jobs are in this ‘bad job’ category, concentrated in lower skill sectors such as retail and hospitality, with limited access to training and development, promotion and career opportunities (Charlesworth et al. 2011; Barns and Preston 2010).

By contrast, permanent part-time jobs are more likely to be in professional occupations and employee-initiated through RTR legislation. Such jobs have the potential to be high quality because they are based on equivalent full-time positions. However, many managers are reluctant to accommodate part-time requests so that in practice employees converting to part-time are given reduced responsibilities, lesser access to high status roles and projects, a lack of access to promotion opportunities and poor workplace support (McDonald, Bradley and Brown 2009; Webber and Williams 2008; Lewis and Humbert 2010). For professional and managerial women the prospect of being side-lined into less challenging work and the slowing of their career progress is a serious disincentive to working part-time (Eagly and Carli 2009).

Managers tend to have marketable skills that would normally place them in a better position than others to negotiate their hours (Coyle 2005). However, in practice, the reluctance to offer part-time work ‘on request’ is more pronounced for management jobs. It is commonly held that part-time employees cannot be effective managers because they are unavailable to supervise other staff (Skinner 1999) and there is also a strong perception that they lack commitment (McDonald et al. 2009; Liff and Ward 2001). Accordingly, managers tend to regard the entitlement to work part-time as largely irrelevant to themselves (Lewis and Humbert 2010). A recent European study found the largest gap between work-life policy and practice at management levels and no significant relationship between a legislated 'right to work part-time' and the percentage of managers actually working part-time (Hipp and Stuth 2013). The situation is slightly different for professionals who are not managers. Whilst many professionals are managers and vice versa, research shows that some professionals, such as general medical practitioners (GPs), are better able to maintain autonomy over their working-time (Crompton and Lyonette 2011). It is noteworthy that GPs usually have minimal if any supervisory responsibilities.

Given this attitude, it is not surprising that consistent with international trends there are relatively few part-time management jobs in Australia. For the period 2001-2008, 97 percent of male managers and 81 percent of female managers worked full time (Watson 2010: 61). Although women working part time are more likely to be in a managerial position than men working part time, they are over-represented in teaching and nursing. These management positions are relatively low paid because they are in feminised sectors and the highly regulated nature of this management work also makes it relatively inflexible compared to management work in other sectors (van Wanrooy 2009).

Part-time workers consistently report intensification of work, especially professional workers. They are often expected to complete a full-time, or close to full-time load in part-time hours, perform unpaid work at home and remain available on their non-work days to answer questions or deal with crises (McDonald et al. 2009; Lewis and Humbert 2010). In some high status professions part-time workers effectively work 'standard' full-time hours, underscoring their desire, not so much to work part-time, but to avoid very long work hours (Williams et al. 2013; Corwin et al. 2001). There are very few studies on managers (as opposed to professionals) who work part-time but what little research there is indicates minimal effort is made to reduce their workload to accompany a reduction in work hours. One study of part-time managers in the UK describes how women work through lunch and on trains to fit their work-load into part-time hours with most working in excess of their agreed hours. Very few achieve a clear demarcation of work and home life knowing that to draw a line would be to risk sending a message they are not serious about their careers (Tomlinson and Durbin 2010).

Research also suggests that professional women do not complain about this additional unpaid workload. Most often this is because they view the opportunity to 'buy' their flexibility as a 'luxury' or 'privilege' or 'choice'. As managers themselves, many also subscribe to the management view that only productive workers 'merit' part-time schedules, and want to retain their own reputation for productivity, especially if they want to return to full-time work later (Webber and Williams 2008). Reluctance to complain is also associated with the perception that part-time managers are 'one-offs and/or fortunate employees in strategic positions' with preferential working conditions. Yet despite this 'privilege', part-time managers experience a significant decline in career opportunities once they transition from full-time work. In particular, their career mobility is curtailed. They are bound to the organisation that has granted them part-time management status because high level part-time management is extremely difficult to find through the external labour market (Tomlinson and Durbin 2010).

There are also pecuniary penalties for mothers who have followed non-standard career paths, referred to as the 'motherhood penalty' (Budig and England 2001). In his review of the gender pay gap for Australian managers between 2001 and 2008, Watson (2010) finds that women full time managers earn around 27 percent less than their male counterparts and that up to 90 per cent of that pay gap cannot be explained by the different characteristics of managers. He concludes that the major part of the gap is simply due to women managers being female, in other words, direct discrimination. However, he also identifies components of the pay gap that arise from the intersection of work and family life The presence of children makes a difference, with female managers experiencing increasingly negative returns for each additional child, particularly the third. In addition, full-time women managers work, on average

3.3 hours fewer per week than men (although Watson notes this does not necessarily mean they achieve less) and have on average 3.2 fewer years of labour force experience. There is a slightly different emphasis on factors contributing to the motherhood penalty for high-earning women in the US. Budig and Hodges (2010) find less ‘unexplained’ difference, attributing over 50 percent of the penalty to lost experience surrounding childbearing, but virtually none of the penalty due to fewer hours worked. This may reflect differences in the accessibility of flexible working hours across the two countries. Budig and Hodges find a consistently smaller proportionate penalty for the highest paid mothers. In fact, they find a motherhood bonus for the very highest earners at the 90th and 95th percentiles (who are married). They suggest that these highly successful women, who are typically married to high-earning men, may be better placed to purchase household and high-quality childcare services allowing them to work longer hours and that they may also be motivated to negotiate higher salaries to cover these costs. However, they acknowledge other factors may be at play and more research is required to understand this phenomenon.

The motherhood penalty varies across professional occupations and has changed over time. Goldin and Katz (2011, 2012) find the heaviest penalties for career breaks and deviation from the norm of long hours are imposed by the corporate and financial sectors. By contrast, workplace flexibility has become less ‘expensive’ over time in many health-related occupations as well as in the technology sector. For example, US pharmacists who have worked shorter hours or taken time off early in their career do not appear to earn lower hourly earnings later in life. Pharmacy is a rare example of a sector where high-quality part-time work is normalised. That women do well under these conditions validates feminist calls for flexible and part time work arrangements to be embedded as part of ‘business as usual’ rather than treated as special arrangements for those who cannot fit in with the status quo (Conway 2012; Pocock et al. 2012; Liff and Wajcman 1996).

2.1.3 Choices

Research shows female professionals with children are much more likely than their male counterparts to reduce their role in the workforce or exit altogether, whilst having children does not significantly affect men's odds of quitting (Cha 2010; 2013; Lovejoy and Stone 2012). In their study of senior UK bank executives, Liff and Ward (2001) find conflict between work and family is experienced differently by men and women managers, with men regretting they cannot see more of their children and women exhausted from trying to maintain two roles. When highly educated women leave careers to care for their families it is often referred to as 'opting out'. Researchers have observed the tendency for the popular media and for many women themselves to frame such decisions in the language of choice (Stone and Lovejoy 2004; Williams 2000) and to portray these women as a socioeconomically privileged group often married to professional men who earn enough to support that decision (Lovejoy and Stone 2012). However whether women actually 'choose' this path or feel they have little 'real choice' in the face of rigid societal attitudes and workplace structures has divided researchers.

Central to this debate is Catherine Hakim's (2000) preference theory. Hakim maintains that due to the range of options and opportunities available in modern affluent societies, lifestyle preferences are now the most crucial factor in explaining women's work-care choices. She highlights a number of societal changes that have led to this situation including the widespread availability of contraception that allows women to remain childless or control how many children they have, equal opportunity legislation, the expansion of white collar occupations and the availability of part-time work. In this new scenario, Hakim claims men and women fall into one of three categories: 'work-centred' where they prioritise employment in the economic sphere; 'home-centred' where they prioritise home-making; or 'adaptive' where they prefer to combine work and family, gravitating to part-time and flexible work that offers work-family balance. Based on her analysis of British and international survey data, Hakim estimates adaptive women constitute the majority of the female workforce in most Western countries at around 60 percent, with home-centred and work-centred women each constituting around 20 percent. Interestingly, this polarisation is apparent among all socio-economic groups of women including the most highly educated. Hakim argues adaptive women are less likely to achieve significant success in the labour market because they do not aim for it consistently, as they prefer a balanced life. She concludes that because most men are work-centred and most women adaptive, women are likely to remain in a minority within the very top echelons of occupations where competition is more intense.

Preference theory has made an important contribution to explaining women's employment patterns by highlighting the heterogeneity of their work-care preferences and priorities. Indeed, empirical studies have demonstrated significant correlations between women's attitudes to gender roles and their employment behaviour (McRae 2003; Steiber and Hass 2012; Kangas and Rostgaard 2007). However, whilst the concept of different lifestyle preferences is generally accepted, Hakim's emphasis upon choice at the expense of constraint has proven highly controversial. Researchers argue that a wide range of structural factors can constrain women's employment choices such as the availability of childcare, leave provisions, job flexibility or part-time work, as can cultural norms and expectations including their male partners' work-family opinions (Kangas and Rostgaard 2007; Steiber and Hass 2012). Such factors tend to have differential effects on different types of women. For example, the employment decisions of less educated women are more strongly affected by parental leave provisions, childcare and the availability of part-time work than are the decisions of more highly educated work-centred women (Steiber and Hass 2012). McRae (2003: 329) observes that all decisions involve opportunity costs and all women encounter constraints but 'some women have substantially better chances than others of overcoming constraints and hence of living as if they faced no constraints'

Whilst Hakim does not entirely disregard the impact of social, economic and institutional factors, her assertion that child care responsibilities have little impact on the employment of highly educated work-centred women is contradicted by studies of professional women who have 'chosen' to leave the paid workforce despite their clear preference to stay (Stone and Lovejoy 2004; Lovejoy and Stone 2012) or stayed in the workforce despite their clear preference for traditional homemaking (Debacker 2008). Stone and Lovejoy (2004) find that professional women face enormous constraints in making the decision to quit work to care for their children and although these women often frame their decisions in the language of 'choice', freedom to 'choose' is rarely evident, with work-related factors such as inflexible and highly demanding schedules playing a primary role in their decisions. Meanwhile other studies find that opportunity costs, both financial and social, including the fear of losing career momentum prevent many high-skill women from either reducing their hours or taking time out for child-rearing when they would prefer to (Debacker 2008; McDonald, Bradley and Guthrie 2006). The attitude-behaviour inconsistencies highlighted by these and other studies (Steiber and Haas 2012) show that women are often constrained in their work-care options, irrespective of their lifestyle choices and educational levels, and that behaviours differ across situational contexts. It has been argued that Hakim's theory reduces women's struggle with structural and institutional barriers to a definitional problem whereby career-oriented women who 'choose' to spend some time raising children are assumed to be adaptive. Her conceptualisation of adaptive women is criticised on the grounds that it fails to capture the variability of women's aspirations to combine family and work, including the desire to combine high-level professional careers and motherhood, rather than aiming to be the 'secondary' earner in the family. They argue the concept that women must choose to focus either primarily on family or on career is incompatible with the reality of many modern women who want both (McRae 2003; Johnstone and Lee 2009).

When women leave their jobs to rear children during their prime career-building years, they usually face a major career setback, often not recovering their career trajectory or re-entering employment at their prior level of pay or authority (Eagly and Carli 2009; Lovejoy and Stone 2012). Moreover, they face 'artificially high penalties associated with taking a career break completely out of proportion to the deterioration of human capital' (Williams et al. 2013: 215). Indeed many women simply abandon their careers. There is limited research on the experiences of women 'returners' and the opportunities available to them. However, in a recent study of 54 at-home mothers who previously had held professional and managerial positions, Lovejoy and Stone (2012) find that although the majority wish to return to work, they plan to pursue alternative careers. This is largely due to their previous negative experiences in family inflexible occupations, a belief that their skills had depreciated and perceived age discrimination.

Researchers argue that in practice women are likely to have different preferences at different stages of their lives. Many highly paid professional women see part-time work as a temporary phase in their careers and aspire to return to the fast track once they have met their family obligations (Webber and Williams 2008). Bailyn (2004: 1519) describes such women as having a commitment to occupational work that is always high 'but varies in its temporal expression at different life stages'. Yet the linear nature of many professional careers limits women's ability to change their work and family circumstances without damaging their careers or foregoing them permanently.

The assumption that most women are adaptive and therefore not committed enough to compete effectively for the top jobs absolves organisations of any serious responsibility to examine how these roles are structured or to ensure the criteria for career advancement do not disadvantage women with family responsibilities. In positioning women as 'free to choose', Hakim places the onus on women to adapt their lifestyles to the needs of employers. She asserts the conflict between normative expectations of the workplace and the demands of family are grounded in issues of allegiance and personal identity rather than practical time management, arguing this wider problem 'is ultimately not one that employers create or can solve' (2000: 276). Whilst some organisational contexts are more constraining than others, this argument is largely accepted by high-achieving professional and managerial women who, as Evetts (2000) observes, adopt individual strategies for overcoming constraints that are mostly concerned with meeting, not challenging the needs and demands of their organisations and professions. In this context, Hakim predicts further polarisation of work- lifestyles of childless career women and adaptive mothers with jobs rather than a convergence on the egalitarian model of symmetrical conjugal roles. Although many career-oriented women may choose to remain childless, Hakim's analysis implies there is little opportunity now, or will be in the future, for high-achieving women and men to also play an active part in their children's lives. Indeed, according to Hakim, when work-centred women choose to have children it is likely to be 'an expression of normality and a weekend hobby' as she claims it is for men (2000: 280). Hakim's theory, whilst criticised heavily by many feminists and sociologists, nevertheless presents a plausible view of some women (and men) in today's workplace, where women often do choose between high level managerial work and children and where egalitarian couples who do share the care of their children are often viewed as not 'serious' about their careers. However, acceptance of Hakim's description of the status quo should be differentiated from acceptance of her explanation of its cause.

Hakim's lifestyle preference theory, and the debate it has sparked, is important because it brings into sharp focus how society categorises both women and men through the prism of separate spheres, both shaping and limiting their 'choices' and perpetuating the status quo. The advantage of the theory is that it highlights the importance of agency in career decisions. However, Hakim's emphasis on 'free choice' does not take into account the bounded nature of women's 'preferences' in the context of a gendered division of labour at home and gendered workplace practices. By contrast, Evetts (2000:65) calls for a more balanced approach that recognises the diverse and complex range of strategies adopted by women, arguing it is possible for 'feminist analysis to bring women as agents for change into sociological analysis and theory, while recognising the continuing force of structural and cultural imperatives'. In this context, feminist researchers argue the debate about women's workplace outcomes should focus not on which 'choices' women make, but how free they are to 'choose' (Reskin and Maroto 2011). As Williams (2000:106) observes, 'when women use choice rhetoric, they speak as people struggling with the constraints handed to them by a world they did not invent'.

2.2 Gender, management and organisations

The preceding discussion of women's role as carers provides context for women's experiences as professionals and managers in organisations. I review this literature from the standpoint of professional women whilst acknowledging that many of the problems confronting women in organisations also confront men in organisations, particularly those with caring responsibilities. Although not all mothers have responsibility for care and not all fathers have responsibility for breadwinning, most gender and work scholarship demonstrates the traditional expectations associated with separate spheres are embedded in workplace structures that assume core workers do not have caring or domestic responsibilities.

2.2.1 Gendered organisations

Large surveys of women and men in management consistently show a typical profile of the executive manager as a married male with children, whilst amongst female managers there is a strikingly high rate of single status and childlessness (Wood and Newton 2006; Wajcman 1999; Hewlett 2002). Moreover, the wives of these male managers are more likely than the wives of other workers to 'opt out' of the workforce, even if they have professional careers themselves. In this way, executive management jobs reintroduce separate spheres arrangement into many formerly dual-earner married couples (Cha 2010). Indeed, Wajcman (1999:105) observes the success of these men in the workplace is predicated on the services of a dependent wife. Viewed in this way, she argues men actually 'bring two people to the organisation – the man and his wife'.

Such executives are 'ideal workers' a concept central to Joan Acker's influential theory of gendered organisations (Acker 1990; 1992). During the 1980s and 1990s an understanding of organisations as 'gendered' social constructions emerged to challenge the classical rational model of organisation. Within this model, organisations were perceived as 'sex-neutral machines while at the same time supporting a ‘masculine ethic’ of rationality and reason that obscured organisational reality and supported managerial authority’ (Acker 1999: 178). Acker argues that administrative and managerial procedures based on the assumption that work is separate from the rest of life indirectly discriminate against women who carry the main responsibility for domestic life. She maintains the apparently gender-neutral organisational logic that presents jobs and hierarchies as ‘abstract categories that have no occupants, no human bodies, no gender’ (Acker 1990: 149) is, in fact, highly gendered because this hypothetical worker, who exists only for the work and does not have obligations outside the boundaries of the job, is in day to day reality a man.

According to Acker (1992), gendering occurs through the interrelated processes of structure, culture, interaction and identity. Researchers have drawn on her theory as a very practical framework to identify both ‘gendering practices’ and ‘practicing gender’ (Martin 2006; Britton and Logan 2008). Gender divisions, for example, are often produced and maintained by the ordinary policies, procedures and activities that maintain organisations (gendering practices). Meanwhile women and men actively participate in discriminatory processes as they routinely and unreflexively ‘do gender’ (practicing gender (Martin 2006)). Fletcher (1999:3) observes, ‘there is a masculine logic of effectiveness operating in organisations that is accepted as so natural and right that it may seem odd to call it masculine’. Acker (2012:209) claims the invisibility of these gendered practices is one of the most persistent barriers in efforts to improve equality in organisations. She argues ‘acceptance by both men and women of inequalities as just the way things are contributes to the invisibility of these inequalities’. For example, gender inequalities are often viewed as the inevitable consequence of apparently ‘gender-neutral’ factors such as differences in skills and training, part-time work and care responsibilities rather than the gendered structures that cause these differences in the first place (Benschop and Doorewaard 2012; Ely and Meyerson 2000b).

It follows that changing the culture, processes and practices that produce gender inequalities is a major challenge in highly institutionalised environments. First, institutional members may find it difficult to identify gendered organisational processes within a system they believe in, and particularly when that system maintains the stability of the institution (Acker 1990; Parsons and Priola 2013). Second, even those with an ideological commitment to feminism, who question the dominant logic, face the dilemma of wishing to change the current gender order in their own institution whilst maintaining a commitment to that same institution (Parsons and Priola 2013).

Meyerson and Scully (1995: 586) coined the term ‘tempered radicals’ to describe individuals who identify with and are committed to their organisations, but are also committed to a cause that is fundamentally different from, and possibly at odds with the dominant culture of their organisation. They also observe the increasing difficulties faced by those individuals as they progress through the organisational hierarchy. Whilst their more senior position provides greater potential to effect change, at the same time they also experience more pressure to incorporate the dominant culture’s values. Alvesson and Willmott (2012: 193) maintain that managers seeking to enact change are at a disadvantage because they are expected to regard themselves as ‘company people’. In many ways they are more ‘controlled’ than other employees, being expected to give priority to values, ideas, feelings and actions – including self-discipline – that are closely associated with being a ‘manager’.

2.2.2 Time and the organisation of management work

It is well-established in the literature that high-level management and professional jobs are characterised by a ‘long-hours culture’, although the degree to which managers ‘choose’ to work long hours is the subject of much debate. The work practices and ‘long hours’ culture in many workplaces would seem to indicate long hours are employer-driven, for example measuring productivity by ‘face time’ instead of accomplishments and chaotic work routines and a crisis-orientation that demands constant presence (Ely & Meyerson 2000). Increasingly, with the use of information technology, managers are also required to be available for communication at any time regardless of location (Wajcman 2008; Bailyn 2004). In the context of increasingly longer work hours and work intensification (Campbell 2007), Australian managers, more than workers in any other occupation, express a preference to reduce their working hours, in some cases by as much as a day per week (Skinner and Pocock 2010; Skinner et al. 2012; Chapman et al. 2014).

This begs the question as to why, when most managers ostensibly control their own work schedules, they do not exercise agency by resisting prevailing norms and driving change in workplace culture. Pocock (2012) suggests it is because, for most managers 'the possibility of 'walking the talk' about new ways of working, flexibility and finding a decent work-life balance is overwhelmed by daily pressures'. However, an alternative explanation portrays them as workaholics who create their own pressure-cooker environment. Researchers refer to the 'career mystique' (Moen and Roehling 2005; Moen 2011) or 'work devotion schema' (Blair-Loy 2003) to describe how elite workers prioritise work over all other aspects of life. The motivation behind this attitude can vary, ranging from a strong sense of commitment or fascination with the intrinsic demands of the work (Campbell 2007) to being caught up in a 'work and spend' cycle that requires the kind of high wages that typically accompany management jobs (Drago et al. 2009). Indeed, recent US research shows an astonishing growth in the financial returns for overwork for managers. Cha and Weeden (2014) find that overworking managers earned 11 percent more than their full-time counterparts in 2009, up from a 9 percent wage penalty in 1979 when employers did not 'reward' long hours through higher salaries. They note the effects of downsizing and a 24/7 workplace culture have ratcheted up what it means to be an ideal worker, especially for professional and managerial workers.

Managers use the rhetoric of 'choice' to explain their lack of resistance to these working arrangements whilst at the same time recognising long hours are a personal and social problem (Campbell and van Woonroy 2013; van Wanrooy and Wilson 2006). Most managers acknowledge the constraints within which they make choices, particularly in terms of heavy workloads and high employer expectations, but view their long hours as unavoidable and are resigned to them despite a 'muted undercurrent of dissatisfaction' (Campbell and van Woonroy 2013). Researchers link this attitude to an Australian institutional regime that sanctions unlimited hours and encourages both long-hours employment paths and job mobility as a form of career advancement. In a competitive economy where job security is far from assured, 'ideal workers' are considered more likely to achieve career success. Whilst long hours do not necessarily result in improved work performance, those who may prefer to work shorter hours, including highly educated elite professionals, may not want to risk damaging their careers by reducing their hours relative to their peers (van Wanrooy and Wilson 2006; Drago et al. 2009). In this way, the 'choice' to work long hours is a dialectic that is, perhaps, never resolved.

Whatever the motivation, and taking into account it may be part-employer, part-employee driven, the prioritisation of work, whilst experienced most intensely by managers, is not confined to managers; it is a societal phenomenon. It is understood more broadly through the 'collective conception of the daily time requirements for a successful career' (Bailyn 2004: 1509). This pervasive view is a reflection of the gender-power system of separate spheres where the economic is valued over the domestic (Holter 2005). Feminist academics observe the failure to place 'family and the value of parenting more generally on equal footing with all other value-creating institutions in society, including business organisations' (Calas and Smircich 2006:301). Within this general prioritisation of work, there is an acceptance that career advancement in prestigious occupations depends on meeting ideal worker requirements, and that penalties will apply for not doing so (Jacobs and Gerson 2006; Williams 2000; 2010). In this way, the long-hours culture derives from the dual assumption that work both *demands* and *deserves* undivided and intensive allegiance.

Bailyn (2004) observes the inherent assumption that time is linearly and incrementally related to productivity. She reminds us that 'twelve hours of work do not necessarily or even probably produce twice as much as six hours' and that 'such increments may be true of machines, but not of people – particularly not knowledge workers' (Bailyn 2004: 1510). This line of argument suggests that if an 'objective' measure is applied, where productivity equals the rate of output per unit of input, excessively long work hours are counter-productive. This time-based view of productivity is not only a false notion but also gendered in its application. Women are often disadvantaged when organisations apply these ostensibly gender neutral work conditions to men and women equally. It is rarely interpreted as indirect discrimination when 'good' employees are rewarded for working long and inflexible hours, a response that on the surface appears not only gender neutral but even honourable (Ely and Meyerson 2000a). Moreover, when domestic circumstances mean that women cannot conform to the 'long hours' culture and they take a less demanding position, or take up part time or other flexibility options, this reinforces the masculine model of organising by defining those who conform to it as serious committed workers and those who do not as unworthy of promotion, pay increases or management positions (Acker 2009; Wajcman 1999).

Most managers adopt 'work around' strategies to manage the conflict between work and family time, but nevertheless tend to define the long hours 'problem' as their own private troubles, taking intensive, escalating, and boundary-less work-time demands as the new normal of work in the 21st century (Moen, Lam, Ammons and Kelly 2013). However, such attitudes can drive care responsibilities underground, further perpetuating gendered notions of productivity. Research indicates that elite male professionals with family responsibilities try to 'pass' as ideal workers by 'masking' their deviant caregiving identities. Ironically, when they are successful in doing so, they lose the motivation to change the ideal worker culture (Reid 2011). Many women are either not prepared to, or are unable to 'mask' their care-giving identities and instead 'opt out'. As Liff and Ward (2001: 20) observe, they do so, 'not because they reject managerial work per se, but rather the particular way in which it is organised'.

Time, management and career congruence

For managers with care responsibilities there can be a tension between the time they have available and the type of work to which they are attracted. Holland (1996) posits that career congruence occurs when people work in both a job and an environment that matches their personality or 'vocational identity'. Those with a clear sense of their career goals, interests, skills and suitable occupations are more likely to find a job that is congruent with their personality. However, the suitability of a work environment is impacted by non-work factors including compatibility with family life. According to Holland, congruence between vocational identity and work environment contributes to work satisfaction and the intention to leave or stay in a particular job. Therefore, in circumstances of high work-family conflict individuals may move jobs, but if they have a strong vocational identity they are likely to move among similar jobs (Holland 1996).

A 'long-hours' work environment can impact negatively on job satisfaction for those with care responsibilities. However, the particular characteristics of long hours can vary depending on the type of management work. In this, project management work and academic work provide contrasting cases. In project management, long hours can occur in peaks and troughs. Wu and Passerini (2013:334) observe 'the definition of 'project' itself embeds the notion of time, with a project being a temporary endeavour that presupposes a beginning and an end'. The focus in project management is on tasks, budget, people, schedules and controlling risks. In most projects, activities need to be scheduled to run in parallel with each other and within a defined timeframe. Project management work suits individuals who can do and think about multiple things (activities or events) at the same time. In this context, Thoms and Pinto (1999:20) emphasise the importance of 'attunement between project leaders' temporal skills and the nature of the tasks', observing that an individual's temporal alignment tends to affect their choices of tasks and situations. The temporal arrangements of project management work can be seen as 'family-friendly' although the suitability of any particular manager to this work will depend on their temporal alignment as well as their vocational identity.

By contrast academic research traditionally has been associated with longer timeframes. Researchers highlight that academia offers a more flexible work environment than most corporate workplaces which can work both to the advantage of academics and their employing institutions. Academic work tends to be distributed unevenly over the year, with many female academics willing to work long hours during peak periods, knowing they can fit their work schedules around their family commitments most of the time (McDonald et al. 2006). This is not to mention the potential downside to this flexibility, where women academics may find it more difficult to exert the 'power of absence' (Probert 2005). When work can be done from home at night or on the weekend it enables academics (usually mothers) to constantly attend to family demands. Probert (2005) observes this availability can negatively impact research productivity and also reinforce traditional gender roles in the home.

Although academia is renowned for its flexibility, recent research suggests that many academics are caught up in the time pressures of daily routines, spending most of their time on practical tasks aimed at meeting deadlines imposed by institutions (Wu and Passerini 2013). Given that academics highly value their intellectual autonomy and the freedom to develop and pursue their own ideas (Fox and Colatrella 2006), this task-focus may be at odds with their temporal alignment. Despite flexible working arrangements, long hours can result when academics strive to meet multiple institutional deadlines as well as their primary goal of creating knowledge.

2.2.3 Gender Segregation

Sociologists and economists have long recognised the tendency for women to be concentrated in 'female' occupations and men in 'male' occupations. This 'occupational gender segregation' consists of two dimensions – horizontal segregation, which is a measure of difference, and vertical segregation, which is a measure of inequality. Segregation, or 'overall segregation', is the result of these two components (Blackburn et al. 2002).

At the aggregate level, patterns of segregation have changed since the 1970s, but without significant change to traditionally 'male' or 'female' occupations. Specific occupations, particularly professionals, technical workers, managers and sales occupations have become more integrated, largely due to the concurrent growth of those occupations and increases in women's workforce participation (Jacobs 1999; Blau, Brummond and Liu 2013). Worldwide the decline in segregation has been more dramatic for highly educated women, who have made major in-roads into formerly male-dominated occupations, including management and professions such as law, medicine, architecture, economics and veterinary medicine, all of which have moved out of the 'heavily male' category (Blau, Brummond and Liu 2013). However, professional occupations in science, technology, engineering and mathematics (STEM fields) continue to be male-dominated (Bell 2009). In Australia, horizontal segregation at the professional level manifests in the concentration of women with higher degrees overwhelmingly in two sectors – health and education – which have seen increased feminisation in recent years (Barns and Preston 2010).

Vertical segregation is evident in all sectors but is especially prevalent in professions where the hours are particularly long such as accounting and law (Crompton & Lyonette 2011; Goldin and Katz 2011). It is more prevalent in the private sector than the public sector. In Australia researchers have found that whilst women are equally likely to be professionals in the private sector, men are almost 2.5 times more likely to be in managerial or administrative occupations (Baron and Cobb-Clark 2010).

Increased levels of gender segregation tend to be revealed when more precise job level data is analysed within occupations or professions (Reskin and Bielby 2005; Reskin and Roos 1990; Cohen, Huffman and Knauer 2009). In terms of horizontal segregation, women often congregate in particular specialisms within professions, for example within companion rather than large-animal veterinarian practices (Irvine and Vermilya 2010; Goldin and Katz 2011) or general practice rather than hospital medicine (Crompton and Lyonette 2011). In some occupations they congregate in different types of organisations such as public sector rather than private sector, as is the case for IT professionals in Australia (Diamond and Whitehouse 2007). Moreover, within the one organisation, ostensibly undertaking the same job, women and men can be allocated different work tasks, for example, undertaking routine analysis compared to working with advanced instruments (Reskin and Beilby 2005; Holt and Lewis 2011).

It has been well established that horizontal segregation contributes to lower relative wages for women. One reason is that female-dominated occupations are generally lower paid than more integrated occupations. Although women who work in female-dominated professions are more likely to be managers, they are paid less than managers in integrated professions after education and experience are taken into account (Jacobs 1999; Williams 2000; Cohen et al. 2009). In Australia, Healy and Kidd (2013) find significant wage penalties for workers of both genders in female-dominated occupations, relative to comparable workers in male-dominated and integrated occupations. In their analysis, gender-based wage undervaluation accounts for 18 percent of the gender pay gap. Horizontal segregation within occupations and professions also contributes to the gender wage gap because wages are generally lower in feminised niches compared to more prestigious jobs, for example in female-dominated paediatrics compared to surgical specialisations in medicine, or in public interest law compared to private firm corporate law (Ku 2011). However, moderating factors can reduce the pay gap, such as the influence of professional bodies or employment sector. Crompton and Lyonette (2011) find that in the UK the feminised niche of general practice through the National Health Service is nearly as well paid as hospital medicine, whilst Baron and Cobb-Clark (2010) find that the magnitude of the gender wage gap tends to be smaller in the Australian public-sector than in the private-sector.

Vertical segregation contributes to the gender wage gap primarily because women congregate in lower level positions within more integrated occupations, although the pay gap also varies across the wage distribution. In Australia, the gender pay gap is more pronounced among workers earning relatively higher wages, including managers and professionals, especially in the private sector. Baron and Cobb-Clark (2010) find approximately 50-60 percent of the wage gap faced by high-earning women in Australia is unexplained by productivity-related characteristics such as qualifications and experience, suggesting other factors, including discriminatory practices, may be at play. In the US, Cha and Weeden (2014) find the gender pay gap for professionals and managers has been exacerbated by the premium paid for working long hours, given that men consistently work longer hours than women.

Various explanations have been proposed for why women congregate in particular occupations or in 'niches' within professional occupations. In the 1970s and 1980s theories were based on direct gender discrimination, most notably 'gendered job queues' (Reskin and Roos 1990; Jacobs 1999). This theory holds that following the restructure of industries and resultant deskilling of jobs during that period, women were offered inferior jobs that men no longer wanted, leaving them 'crowded' in a limited range of low paid, low status occupations or female 'ghettos'. However, more recent examples do not support this theory as feminisation of some occupations has in fact been accompanied by increased professionalisation (Jacobsen 2007; Bottero 1992). Pharmacy, for example, has resegregated from a male profession to a highly-skilled, prestigious female profession (Bottero 1992; Goldin and Katz 2012).

In light of equal opportunity legislation, contemporary explanations are presented in terms of women's choice, indirect discrimination arising from structural constraints, or a combination of both. As Jacobsen (2007) observes, it is difficult to identify the 'tipping point' of when and why occupations become female as sectors restructure and technology evolves. A common explanation is that women *gravitate to* occupations that offer more family friendly work practices, particularly part-time work and flexible schedules (Goldin and Katz 2012; Adamo 2013; Jacobsen 2007; Crompton and Lyonette 2011). Or, from a different perspective women are *prevented from* entering certain occupations by 'barriers to entry' such as rigid employment structures, long hours or hostile masculine environments. A further explanation reflects gender essentialism whereby women are considered suitable for, or indeed prefer, occupations that embody stereotypically female characteristics such as personal service, nurturance and interpersonal interaction (Charles and Grusky 2006).

Feminist researchers argue that gender segregation undermines principles of equal opportunity by reinforcing notions of gender differences in capabilities, preferences and social and economic roles. According to this view segregation limits the occupational choices of both women and men. It disadvantages women when they are segregated into occupations or jobs according to their 'special skills' especially when those jobs are lower paid; and it discriminates against them when segregation is underpinned by beliefs that men are better suited for positions of high pay or authority, both within and across occupations (Charles and Grusky 2006; Williams 2000; Ridgeway 2011; Reskin and Bielby 2005).

Notwithstanding these disadvantages, at the aggregate level, studies have consistently shown that women experience improved economic and social outcomes with increasing levels of horizontal segregation (Blackburn et al. 2002; Cohen et al. 2009; Jarman et al. 2012). Research indicates that, relative to men, women now work in healthier physical environments, have access to higher status networks, and work with better educated people. Whilst women continue to experience an overall pay disadvantage, this disadvantage reduces with increasing levels of horizontal occupational segregation. Essentially women are more likely to attain senior positions when they are not in competition with men. Scandinavian countries, for example, noted for their egalitarianism are the most horizontally segregated (Charles and Grusky 2006; Jarman et al. 2012).

Crompton and Lyonette (2011) provide an illustration of this at the occupational level. They compare career outcomes for women and men in two high status feminising professions in the UK - medicine and accounting. They find women in medicine gravitate to the family friendly occupational route of general practice with no evidence of penalties over the longer term for taking career breaks or working part-time at various life stages. By contrast, there is no alternative family friendly ‘niche’ available in corporate accounting. In this profession, women fail to rise through organisational hierarchies at the same rate as men, primarily due to the requirement for long hours which is closely bound up with promotion possibilities. The authors acknowledge the advantages of horizontal segregation to women in this comparative example, whilst also emphasising that crowding of women into family friendly niches has other negative flow-on effects including the reproduction of occupational sex segregation and gendered division of labour in the home.

2.2.4 Career advancement for professionals, managers and academics

Consistent with international trends, Australian women are underrepresented at all levels of management. Women make up around 53 percent of the professional workforce whilst holding around 34 percent of managerial jobs (ABS 2010a). Within the management ranks they are disproportionately segregated in middle and lower level management positions. The number of women in senior executive positions in the Australian top 200 listed companies (ASX 200) peaked at 12 percent in 2006 and has since reduced to 10.1 percent in 2012 (EOWA 2012). These figures also see Australia lagging behind countries with similar corporate governance structures, including the United States with 14.1 percent female executives, Canada with 14.3 percent, New Zealand 19 percent and South Africa 21.6 percent (EOWA 2012). When it comes to the top job, only 12 women held CEO positions in the Australian top 500 listed companies (ASX 500) in 2012. They were more highly represented in senior support management roles at 22.5 percent compared to senior line management roles of 6.2 percent (EOWA 2012).

The explanations provided by researchers for these and other similar statistics on women in management tend to fall into two major themes. The first theme focuses on gender stereotypes and discrimination. The second focuses on notions of meritocracy and gendered organisations, although aspects of the two themes overlap. Feminist researchers argue that in the selection of managers and leaders, men are advantaged by ‘unspoken masculine norms’ (Williams 2010). Binns (2010: 160), for example, observes that leadership ‘is a genderless practice, except when women do it’. Leadership ideals are consistently associated with the normatively masculine values of heroic individualism, toughness and decisiveness in contrast to the ‘unassuming and quiet achievement’ of female leadership. In this context researchers highlight how women in professional occupations adopt male characteristics and behaviours to advance their careers (Connell and Messerschmidt 2005), feeling obliged to ‘manage like a man’ to succeed (Wajcman 1999). Lewis (2006) observes that in doing so they become visible and accepted as a leader but disappear as women.

Fletcher (1999) observes that female traits in management have traditionally gone unnoticed and unrecognised, identifying relationally motivated behaviours enacted by women such as ensuring project work is accomplished, empowering others and building the team. She argues that when women exhibit communal behaviour at work 'it gets disappeared' because it is considered a natural expression of gender. Meanwhile, when men exhibit these behaviours they get recognised for demonstrating their sensitive side (Eagly and Carli 2007). It has been argued that when women 'do gender' (West and Zimmerman 1987), for example by accepting lower level routine work (Holt and Lewis 2011) or undertaking this relational work without recognition, they perpetuate 'the organisational myth of individual achievement' (Fletcher 1999: 10).

Eagly and Karau (2002) developed role congruity theory to explain prejudice toward female leaders. Reviewing the evidence from a range of empirical studies, the authors maintain that women are disadvantaged in achieving leadership status due firstly to the perception that women possess less leadership ability than men, and secondly, to the perception that when women do fulfil the prescriptions of a leader role, this violates female gender norms. This has been described as the 'double bind' faced by women where often they are assumed to lack the confidence or commanding presence to be successful in higher-level leadership roles, yet when they do exhibit these traits, they are criticised for lacking collective qualities (Eagly and Carli 2007).

Researchers also recognise that situational factors influence the management style required in any particular organisation. Some argue these are simply different forms of masculine management styles, for example 'technical' or 'entrepreneurial' or 'bureaucratic' (Connell 2008; Burris 1996; Wajcman 1999). Others envisage a new management and leadership landscape where stereotypical female characteristics are likely to be an advantage. They suggest masculine images of leadership will be tempered as rapidly changing, globally competitive high-technology environments call for flatter, less centralised and more flexible organisations. Such environments may be suited to a more open, participatory and delegatory management style (Eagly and Carli 2003; Eagly and Karau 2002).

Whilst this holds promise for improved gender equality in management, researchers warn of the dangers when women are valued for their stereotypical 'special qualities' potentially leading to congregation in less prestigious roles (Ridgeway 2011). For example, Ryan et al. (2011) have identified a 'think crisis – think female' association where feminine traits are seen as more desirable in times of crisis, especially in relation to managing people through tough times. This builds on an earlier study where the authors found management roles to be career-damaging for women in situations where they have been set up to fail or act as scapegoats for poor company performance, coining the phrase 'the glass cliff' (Ryan and Haslam 2005).

Many large organisations have established formal processes to prevent gender discrimination in appointment and promotion decisions. This approach is supported by research demonstrating that bureaucratic personnel practices such as written job descriptions and selection criteria, advertising vacancies, and written selection reports reduce individual discretion in decision-making, and therefore reduce stereotyping, 'in-group favouritism' and 'out-group hostility' (Bielby 2000; Reskin 2005) . A study by Reskin and McBrier (2000) of over 500 employers found that such open recruitment methods increase women's share of management jobs, whereas the use of informal recruitment methods increase men's share.

Nevertheless, researchers have observed that subtle forms of indirect gender discrimination persist. They argue selection decisions often come down to tacit interpretations of multiple criteria where unconscious gender biases can influence outcomes (Benschop and Brouns 2003; Van den brink et al. 2010; Doherty and Manfredi 2006). Indeed, some researchers suggest formal selection processes and apparent organisational 'openness' can have the effect of driving discriminatory practices underground (Smith-Doerr 2004; Williams 2000; Hearn 2003) and that, in effect, transparency and accountability protocols can be ‘paper tigresses’ (Van den Brink et al. 2010).

This line of argument suggests there are limits to how ‘objective’ processes can become. The implicit assumption that, at worst, employers actively seek to discriminate against women or, at best, are unaware of their unconscious biases, leaves little room for change in the employment practices of large organisations other than to implement more stringent accountability measures. Indeed, researchers continue to advocate specificity of criteria; the availability of relevant, objective and consistent information for all candidates; and the requirement for decision-makers to use the criteria as a means of combatting gender bias (Reskin and Bielby 2005; Fox and Colatrella 2006). This perseverance with formal processes reflects a strong commitment to the ideology of meritocracy.

Meritocracy is a widely held belief system according to which human capital and effort ‘foster merit, enhance productivity and deserve to be rewarded with higher pay and status’ (Cech and Blair-Loy 2010). This rationale is the basis for career advancement in business and in academia, particularly in large organisations, and is viewed more widely in society as an ‘objective’ and by implication ‘fair’ basis for such decision-making.

Different perspectives on meritocracy frame the discourse on women’s advancement in professional and managerial occupations. One perspective is that women’s career advancement is inhibited by a lack of human capital (skills, abilities, knowledge). Given that women now graduate from university in higher numbers than men in most industrialised countries (Bell 2010), this argument focuses primarily on the reduced time spent by women in the paid workforce due to their lifestyle choices (Hakim 2000) or because they carry a disproportionate share of domestic responsibilities (Probert 2005). This human capital explanation is common amongst professional and academic women who have ‘made it in the system’, a US study finding that a large minority of professional women blame women’s human capital deficiencies for gender inequality in corporate leadership (Cech and Blair-Loy 2010). Many researchers hold the view that meritocracy is a reasonable basis for decision-making whilst at the same time recognising the 'uneven playing field' that disadvantages women. For instance, Probert (2005: 70) writes of the 'insatiable demand for increased research outputs', but points to the 'importance of the household as the critical sphere in which mothers' ability to develop their careers is negotiated'. At the same time she asserts the gender neutrality of selection processes in the university. This approach places the onus on households to change; not workplace practices.

An alternative perspective is that processes associated with meritocracy are gendered, in particular the assessment of human capital which is usually based on an individual's past experience and achievements. In business, for instance, an oft-quoted maxim is 'the best indicator of future performance is past performance'. A common example of this is the expectation that to be appointed to CEO, a candidate will have a track record as a senior line manager with direct responsibility for profit and loss or client service (EOWA 2012). In academia, the same concept is expressed as 'track record'. The criteria for advancement are generally understood to be research productivity, a record of grant funding with prospects for continuing funding (the importance of this varying between disciplines), adequate teaching performance and at the higher levels demonstration of service and leadership, although these latter criteria are less clear (Fox and Colatrella 2006). Research productivity is most often demonstrated through the quantity and quality of a researcher's publications, with rigour, impact and prestige of publications assessed through citations and publication in 'top tier' journals (West and Rich 2012).

Researchers argue that uncritical acceptance of 'common sense' beliefs in business and academia, such as promotion is 'merit based' and 'gender free', perpetuate both inequitable family structures and organisational processes, which may appear fair and reasonable, but, in practice, are gendered (Acker 1990; Benschop and Dooreward 2012; Evetts 2000). This is because selection processes that favour candidates with an established career history disadvantage women who are more likely than men to have followed non-linear career paths, taken career breaks or worked part-time. In either of these work environments, little credit is given, for example, to the skills learned in the family or in community work during periods out of paid work (Bailyn 2011; Valian 2008). Indeed, in academia, Crang (2007: 511) describes the academic curriculum vitae (or track record) as far from being an objective measure of achievement, but rather 'a shrine to the notion of linear career development'. In the corporate world, the unstated criteria for advancement often involves a record of working long hours, seen as a major indicator of ambition and commitment (Liff and Ward 2001). In this, women are not only disadvantaged if they have not worked long hours, but if they have worked in roles that offer possibility of more family-friendly work conditions. In business, for example, female managers tend to be horizontally segregated in 'support' or 'staff' roles such as human resources and public affairs (EOWA 2010)[2] where they can avoid the often excessive work hours of operational management roles. These support roles sometimes lead to a position on the executive team, but rarely to CEO (Wellington et al. 2003).

Notions of meritocracy, objectivity and fairness give rise to strategic HR management (SHRM) practices in large, bureaucratic and established organisations, but there is little examination in the literature of SHRM in small businesses (Krenn 2013). One reason is that, due to financial constraints, many small firms do not employ a strategic HR professional to implement 'best practice'. Most rely on line managers to take the lead in people management (Finegold and Frenkel 2006), although research suggests small businesses that employ a highly skilled workforce are more likely to implement SHRM (Wu, Bacon and Hoque 2014). In addition, many small businesses are managed by or employ individuals who have worked in large organisations and bring professional management practices and an appreciation of 'best practice' HRM with them (Bacon et al. 1996). Notwithstanding this, most small, entrepreneurial businesses operate in an environment of risk, uncertainty and with limited resources. In this context Krenn

[2] Executive functions classified as 'support' roles include: legal; company secretary; strategy and business development; human resources; information technology; public affairs and communication; finance and tax; and risk, underwriting and compliance (EOWA 2012).

(2013) argues that HRM in these firms should be studied separately from large established organisations.

It follows that employment practices in small firms are more informal than in large organisations, especially in start-up firms where time and resources are limited (Hargis and Bradley 2011). With the requirement to hire specialist skills but also control costs, SHRM strategies such as selective hiring and offering employment conditions such as training and job security are either not feasible or not suitable. For example, informal networking is often preferred to formal recruitment strategies (Leung 2003), whilst employment security could have a negative impact on entrepreneurial firms that rely on a flow of employees into and out of the firm to generate ideas (Krenn 2013). In other words, what works well in large organisations does not necessarily work well in small organisations.

A major difference between small and large organisations is the degree of subjectivity in decision making. Baron, Hannan, Hsu and Kocak (2007) differentiate between the 'bureaucratic logic' of large organisations and the 'affiliative logic' of small organisations where 'fitting in' is crucial. In small firms decisions are often driven by the values of the owner or manager, with research indicating the founder's 'employment blueprint' drives HRM priorities and practices including the degree of formality surrounding HRM as the firm grows.

Whilst some researchers take a negative view of what appears to be unrestricted managerial prerogative in some firms, describing small business as 'bleak house' in terms of HRM, others emphasise that many small businesses offer alternative attractions to those of large organisations (Bacon et al. 1996). For example, Ram (2000) emphasises how the interdependencies between employers and employees in small firms enable the informal accommodation of employee needs. Indeed, Australian research indicates workers in smaller firms have lower work-life interference than those in larger firms (Skinner et al. 2012) which may be related to this informal accommodation. In small businesses communications are more direct, people have to work more flexibly, the impact of each employee's impact on organisational performance is clearer and implementing change is simpler (Bacon et al. 1996). So whilst there is greater subjectivity in small firms, flexibility, transparency and authenticity can be very attractive to employees. In this context it cannot always be assumed that the 'objectivity' of the meritocracy, viewed with scepticism by many, is superior to the subjectivity of small firms in terms of gender equity outcomes.

2.3 Gender and productivity

In Australia gender equity policies have been introduced into a wide range of private and public sector organisations over the past twenty years. Increasingly over that time, gender equality has been positioned as more than simply a moral cause that promotes fairness and equity, with more direct appeals to those with primarily an economic and business focus (Conway 2012). At the national policy level, this has long been the case with Pocock et al. (2013: 608) observing 'the most successful arguments in favour of work-family reform in Australia have focused in the main upon the economic consequences'. Recent trends have been to frame the debate in terms of the ageing population and looming skills shortage (Goldman Sachs 2009) and the benefits of increasing the workforce participation of women in highly skilled jobs where Australia can reap the benefits of women's increasingly higher levels of education (Ernst and Young 2013).

At the level of individual organisations, however, the 'business case' to provide gender equitable employment arrangements traditionally has been more equivocal (Conway 2012). It has focused variously on risk management to avoid potential discrimination claims, the advantages of attracting and retaining talented female employees and the productivity benefits of contented employees (Johnston and Teicher 2010). More recently there has been greater emphasis on the bottom line for firms. Conway observes a shift in the tone of Government communications which now emphasise improving 'the productivity and competitiveness of Australian business through the advancement of gender equality in employment and the workplace' (Conway 2012).

There is also increasing recognition of the desire for professional women to work part-time and the costs to organisations when these women leave. An Australian report estimates that these part-time workers deliver an extra week and a half of productive work per year simply by using their time wisely (Ernst and Young 2013). Meanwhile feminist academics are beginning to argue the 'business case' for gender equity, highlighting the economic costs of 'the flexibility stigma' when professional workers, both women and men, leave organisations (Cech and Blair-Loy 2014). This emerging productivity discourse is more directly linked to profits than previous vague notions of retaining 'contented' workers.

Whilst this debate begins to question the notion that more time spent at work equals greater productivity (output per hour), the focus on time and motion is reminiscent of Taylorism with the potential to further intensify the work of professional part-time women (McDonald et al. 2009; Tomlinson and Durbin 2010). The double-edged sword of being 'good value' may place further pressure on these women who identify strongly with management expectations, notions of productivity, merit and 'deservedness'. It is also noteworthy that the focus of this debate is on the productivity of part-time professionals, not managers. Whilst these groups often overlap, the ability of managers to access workplace flexibility is more difficult. Hence when the productivity debate does not include managers specifically, the likely assumption is that the productivity benefits of part-time work relate to 'others'. Indeed the 'selling points' seem to be different for employers (greater employee productivity) and employees (greater work-life balance). These messages may reinforce the 'separateness' of managers. In other words, a debate focused on productivity without due attention to gender equity at senior levels will not address the long hours that are routinely associated with management work and continue to send a poor work-life balance message to aspiring managers and others.

There is growing interest amongst gender and work scholars in a 'dual agenda' approach that seeks to improve both gender equity and organisational productivity (Rapoport et al. 2002; Bailyn 2011; Meyerson and Kolb 2000). A key finding from applied research projects using this approach is that business improvement and productivity are indeed central concerns for both employers and employees, and that gender equality is a necessary but not sufficient message when initiating such change. Bailyn (2011) observes that some changes are easier to implement than others. She distinguishes between change implemented through a 'work-family' lens and change implemented through a 'gender' lens. Applying a work-family lens identifies aspects of work that make life difficult for employees due to organisational expectations of 'ideal workers' with no other responsibilities outside work. By contrast, a gender lens tends to reveal gendered conceptions of competence and commitment, and of 'ideal work', for example emphasising the technical aspects of work over the relational aspects. Bailyn observes most successful change efforts involve a work-family lens and effectively integrate the occupational and domestic domains, ensure flexibility applies equally to men and women and take into account the needs of the work team. This reflects the increasing desire for many men to be involved in family life and recognition of the work-life interference experienced by both women and men (Skinner and Pocock 2011). Despite the on-going time squeeze, and slow take up of family-friendly work practices by men and ambitious women, in some ways this is the 'low hanging' fruit in the quest for improved gender equity at work because at least it is a 'visible' problem (Acker 1990; 2012). Projects applying a gender lens are more difficult to implement. For example, changing 'masculine' position descriptions questions deeply institutionalised work practices and entrenched views about what competencies are required for work and who has those competencies (Bailyn 2011). This includes deeply held, gendered notions of 'merit' (Cech and Blair-Loy 2010) and unconscious gender biases (Reskin and Beilby 2005).

In light of the overriding concern of all parties with productivity, researchers have found keeping 'gender on the agenda' is their most formidable task in organisational projects. Some describe being specifically asked not to talk about gender equity because it is considered too provocative (Meyerson and Kolb 2000; Bailyn 2011). One strategy used by researchers has been to use 'work-family' as a proxy for gender equity because it encompasses men's needs and is not immediately associated with legal issues such as sexual harassment or pay equity which are considered more controversial and confronting to management (Bailyn and Rappoport 2003). However, others warn against temptations to dilute, disguise or otherwise hide gender concerns in the pursuit of dual agenda goals or the productivity agenda more generally (Meyerson and Kolb 2000; Ely and Meyerson 2000a; Eveline and Bacchi 2009).

The desire to be productive is strong and particularly so for ambitious professionals and managers. This attitude is linked to the widespread perception that gender equity initiatives undermine productivity. In relation to their own careers, managers and potential managers often see gender equity 'initiatives' as either irrelevant (Hipp and Stuth 2013), damaging, or inaccessible (Liff and Ward 2001; Skinner and Pocock 2011). Johnston and Teicher (2010) argue that in Australia, twenty years of formal gender equity initiatives at the national and organisational level have failed to deliver equity for professional and managerial women, and a new paradigm is needed.

2.4 Chapter summary

This review of the gender and work literature sets out the challenges for women seeking to be 'equal parts mother and professional' (Lovejoy and Stone 2012). In the societal context of separate spheres and the organisational context of gendered management practices and ideal worker norms, that challenge can only be met with substantial change in both the home and the workplace. The lack of genuine choice for working parents of either sex is obscured by the 'buy in' of professionals and managers' to gendered notions of merit and deservedness leading to a work devotion schema that sees managers working excessive hours and part-time professional women engaging in work intensification without complaint. In either case, issues of work-life pressure are largely accepted as individual responsibility and the choices individuals are forced to make are viewed as their preference thereby absolving both organisations and households of any obligation to change the status quo. A 'dual agenda' approach that seeks improvements in both gender equity and productivity offers a potential way forward but will only be effective if it addresses the work practices of managers themselves.

3. Literature review: Gender and biotechnology

In this chapter I compare the relatively recent research on careers in commercial biotechnology with research on traditional science careers. First I introduce the field of biotechnology and two very different forms of organisation within it: networked biotech firms and hierarchical academic science organisations. I review how work is organised and skills valued in these two environments. Two contrasting themes emerge. Commercial biotech is characterised by interdependence and collaboration both between individuals and between organisations, whilst academic science is built on a culture of competition and independent scientific achievement. Whilst the intensification of science-industry relationships has led to changing career paths and management practices in science, such change is limited by the opportunity and propensity for researchers to work across industry and academia. There is evidence internationally that women fare better in the networked biotech firms of the New Economy due to increased flexibility, teamwork and career mobility, although this is tempered by recent studies suggesting gender bias at the more senior levels. By contrast, common barriers to women's career advancement are exacerbated for women working in academic science. This is largely due to the incompatibility of the highly structured scientific career path with women's family commitments and the individualistic 'priority reward system' that undervalues a range of team-oriented contributions. I review the (in)effectiveness of gender equity policies aimed at addressing this disadvantage because they fail to consider the gendered organisational logic inherent in this system. I conclude the chapter by situating this study in the emerging body of empirical work examining new career opportunities for women in commercial biotech.

3.1 The field of biotechnology

Biotechnology is an important New Economy[3] industry, its beginnings rooted in a series of breakthroughs in molecular biology during the 1970s. It encompasses several different research technologies or methods and several sectors or fields of application, including agricultural, industrial, environmental and medical biotechnology. In this thesis I am concerned with human health or medical biotechnology which draws on different scientific capabilities and operates in a different regulatory climate to other forms of biotechnology (Powell et al. 2005: 1148). Medical biotechnology reflects the shift from older tools of drug discovery based on organic chemistry to novel methods of molecular biology and genetics (Powell, Packalen and Whittington 2012). As such, it is grounded in the discipline of biology. However as the field evolves, there is increasing recognition of its multi-disciplinary nature, particularly the convergence between biological and chemical processes in the development of medicines (Gilding and Pickering 2011). Hence, whilst researchers working in this field most often have high level qualifications in biology, a range of other science qualifications are also well-represented, particularly chemistry, and also health-related disciplines such as medicine, pharmacy and pharmacology.

Biotechnology is a high stakes endeavour, both socially for its transformative potential and economically due to its time and capital intensiveness. The cost of developing a new blockbuster drug is estimated at over US$1billion (Di Masi and Grabowski 2007). However, it is the network form of organisation that characterises this field that has sparked intense interest from sociologists. Powell et al. (2005: 1141) observe that biotechnology is 'not a separate industrial sector with well-defined boundaries' preferring the term 'field' to capture the diversity of organisations involved in bringing new medicines to market. Collaboration is necessary because the wide-ranging skills required are not readily assembled in the one organisation (Powell et al. 1996), resulting in a 'lattice-like' field that includes universities, public research organisations,

[3] The 'New Economy', a phrase coined in a 1983 Time magazine article, refers to the transition from heavy industry to a new technology based economy, with 'boundless opportunities' ranging from microelectronics through to genetic engineering (Alexander, Bolt and Zagorin 1983).

venture capital firms, large multi-national pharmaceutical corporations and biotech firms (Powell et al. 2005: 1141). In this study I focus on two types of biotech organisation within the field: biotech firms; and universities and public research organisations (which, in combination, I refer to as academic biotech – see chapter four).

3.2 Biotech firms and careers

Biotech firms are known for their entrepreneurialism and cutting-edge technology. In the Australian context, they are understood to be small R&D intensive firms which take innovative technologies from early to later stage development. They obtain most of their ideas from public research organisations, their early-stage support from government agencies and venture capital, and their later-stage support from big pharma (Gilding and Pickering 2011). Firms draw on the intellectual capital and tacit knowledge of a 'heterogeneous community of experts' (Casper and Murray 2005) with expertise in basic research, applied research, clinical testing, manufacturing and regulatory processes (Powell et al. 1996; Powell 2001). Employees with expertise in the founding technology often come from an academic research environment, whilst employees with experience in the highly regulated and complex drug development and commercialisation process are likely to come from large pharma or other biotech firms. Casper and Murray (2005: 68) observe that it is virtually impossible to develop this applied knowledge within a pure academic research setting, but rather it is 'knowledge learned through experience in moving drug candidates from preclinical experiments into multiyear drug development pipelines'.

Powell (1990) considers the network form of organisation suitable for this type of highly skilled workforce whose 'commodity' is 'know-how' and not easily measured. Networks reflect a 'logic of organising that is built around project-based work and team organisation; flatter, more horizontal organisations that rely on long-term interdependent relations with external parties; and extensive efforts to leverage capabilities across a wide range of activities' (Powell 2001: 68). In this environment, jobs are increasingly constituted as projects and mobile knowledge workers provide fast access to information, flexibility and responsiveness (Powell 1990). These mobile workers may retain their personal autonomy but they also depend on the organisation for access to a variety of resources to apply their knowledge in context. Hence there are limits to the extent of their independence (Kelly et al. 2011). Such interdependency is a key feature of biotech, with reputation and reliability critical for both firms and individuals.

In biotech, competence in managing relationships is critical both to firms' and individuals' performance (Powell et al. 2005; Smith-Doerr 2005). Individuals and firms may compete on one project but collaborate on another in 'shifting rival alliances' (Smith-Doerr and Powell 2005:386). Therefore competition cannot be at the expense of on-going relationships. For individuals, their reputation for co-operation may be equal to, or even more important than their technical expertise as purposive activity often becomes 'entangled' with friendship and trust (Smith-Doerr and Powell 2005: 379). At the same time, potential investors and the business press evaluate firms' potential on the networks of the management team, particularly the market affiliations of managers (Higgins and Gulati 2003; Smith-Doerr and Powell 2005).

Biotech is distinguished by its pronounced geographic clustering. In the US, for example, more than fifty percent of biotech companies are found in three locales (San Francisco Bay Area; Boston, Massachusetts; and North San Diego County in La Jolla California). Powell et al. (2011: 70) observe that high rates of formation and dissolution of firms, together with the presence of public research organisations, facilitate labour market mobility in these localities. The authors highlight that personal scientific relationships and business ties are instrumental in forging these communities. In the Australian biotech hub of Melbourne, Gilding (2008:1143) finds the 'tyranny of distance' promotes intensified regionalism alongside precocious internationalism'. Internationalism is driven by the need to access expertise and resources that are not available locally, whilst regionalism is promoted through strong support from local public research organisations and access to local venture capital. Given the interdependence of local biotech organisations and the unique characteristics of each geographic cluster, it makes sense to treat each on as an entity that has become institutionalised (Powell, Packalen and Whittington 2012: 435).

Whilst the network form is integral to all biotech firms, their business models can vary widely. Business models focus on the firm's 'value proposition' or the value created for users of a particular product or technology (Magretta 2002). This includes consideration of the market segment, cost structure and profit potential of the product, thereby linking the 'technical domain' to the 'economic domain' (Chesbrough and Rosenbloom 2002). An important aspect of the business model is deciding which value chain activities the firm will and will not do (Magretta 2002). For example, small firms seek to conserve resources and not undertake activities that established firms can do better, such as manufacturing or large clinical trials (Ernst and Young 2011: 14). Thus internal decisions are made regarding the competencies a firm develops in-house, the competencies it chooses to source through partners, and which competencies it might contract from the market (Gottinger and Umali 2008).

The choice of business model can shape career outcomes. Powell and Sandholtz (2012) differentiate between science-centred and commerce-centred biotech firms. Science-centred firms often locate on a campus-like setting near a university and provide a work environment resembling academia. They allow staff the freedom to publish and contribute to public science and usually have a founder who retains a university position. By contrast, commerce-centred firms have a founder with a prior business track record and involve an experienced senior health care executive in the management of the firm, usually as CEO. In these firms, managers take the lead, driving business strategy and product choice. An academic ethos, including publishing, is not encouraged. Career-wise, research-centred firms allow researchers to retain academic links and the potential to move back into academic science whilst commerce-centred firms provide a fusion of science and business leading to a more commercially-oriented career path. It follows that the local mix of research and commerce-centred firms is likely to influence the degree to which researchers can move in and out of the academic research environment.

Notwithstanding these different career pathways, the complexity of biotech requires most managers to demonstrate versatility to attain senior management roles. Kelly et al. (2011) distinguish between 'technical generalists' who acquire knowledge of new scientific disciplines and are often found working in project management roles on cross-disciplinary projects; and 'expert generalists' who are more senior, having built on a range of specialist, technical and general experiences and who draw on external networks as 'boundary spanners' but do not always manage staff directly. There is a strong demand for specialist personnel who can move beyond science to span the technical and economic domains (Chesbrough and Rosenbloom 2002). Kang and Snell (2009) observe that when firms recruit for generalists they design broad and multidimensional jobs and recruit on the basis of an individual's potential and openness to learn new skills, whereas specialist jobs are narrower and recruitment is based on current technical skills. Career-wise, this variety of specialist and generalist roles and opportunity to move between the two differentiates commercial biotech from traditional academic science.

A further biotech business model is the 'virtual' firm that operates on a skeleton staff of entrepreneurs, outsourcing much of its research and development on a 'fee for service' arrangement (Nicol, Liddicoat and Critchley 2013). This model is not new, for example, Genentech, one of the largest and most successful US biotech firms began its existence as a virtual firm (Powell and Sandholtz 2012). However, there has been a dramatic rise in virtual models over recent years (Ernst and Young 2011). Firms adopt this model both to optimise capital and mitigate the high firm failure rate in biotech. In career terms, the project management skills needed to manage 'virtual' operations have been identified as a crucial area of expertise. Biotech CEOs have been described as 'orchestra conductors more than drivers' requiring strong project management, research and clinical oversight and the ability to work across different time zones and personnel orientations (Ernst and Young 2011: 14).

Business skills may be critical and the daily activities a far cry from traditional science management, but commercial biotech management also require a strong understanding of and passion for break-through science. For this, managers draw on their early training, gained in the very different world of traditional academic science.

3.3 Academic biotech, hierarchy and bureaucracy

The basic science that underpins biotechnology takes place in large hierarchical institutions including universities and research institutes. These are generally professional bureaucracies with a formal but decentralised organisational structure and relatively thin top and middle management layers (Mintzberg 1980). As a rule, academics working in these organisations have a high degree of autonomy, although Roth and Sonnert (2011) observe that research organisations differ in the extent to which they adhere to the bureaucratic model in terms of internal management and control mechanisms. In most of these institutions, research is organised according to the Principal Investigator (PI) model[4]. Projects are conducted in groups, with researchers and technicians reporting to the PI who is ultimately responsible for project outcomes (Roth and Sonnert 2011). PIs are the ‘managers’ or ‘leaders’ in academic science, the centrality of their role reflected in the convention of identifying the research group by their name (Garforth and Kerr 2010).

The dominance of the PI model has been linked to the reliance of science institutions on external grant funding awarded to individuals to pay for facilities, equipment and personnel (Etzkowitz and Ranga 2011; Fox 2000). In these circumstances the relative freedom enjoyed by PIs within the organisation is accompanied by an on-going responsibility to renew funding. Researchers highlight the paradox of low internal accountability within research institutions coupled with increasing levels of accountability to external funding agencies (Cunningham et al. 2014). Scientists face constant pressure to obtain grants to fund their research and to continually produce publications in order to obtain further grants. Grant funding is also tied to job tenure for many scientists. Short-term grant-funded employment is increasingly the norm in Australia and internationally, with far-reaching career consequences for individual

[4] In Australian science, PIs are more commonly referred to as Chief Investigators (CIs). I use these terms interchangeably in this thesis depending on the national or international context or source quoted.

scientists and project outcomes (Rees 2011; Bennett 2011; Cunningham et al. 2014; Garforth and Kerr 2010; ACOLA 2012; APESMA 2010; ADoHA 2013). A recent study finds that 88 percent of female and 82 percent of male academics working in research-intensive jobs in Australian universities are on fixed term appointments, with insecurity most pronounced in the research-heavy science disciplines (Peetz, Strachan and Troup 2014).

Australian biotechnology researchers receive funding primarily from two national bodies, the National Health and Medical Research Council (NHMRC) and the Australian Research Council (ARC) through its discipline group 'BEM' (biological sciences, biotechnology, environmental, medical and health sciences). Researchers also receive grants from other smaller funding bodies and not-for-profit organisations. Of the estimated 23,000 researchers in medical and health research in Australia, of which around 65 percent hold PhDs, the NHMRC estimates it directly supported the salaries of over 8,500 through grants in 2010, with the number of researchers supported by NHMRC funding having grown at 13 percent per annum over the previous seven years (ADoHA 2013).

Funding science through competitive grants is an international phenomenon. It is rooted in the priority-based reward system which sociologist Robert Merton described in the 1950s as setting up a contest, or race, for scientific discoveries (Merton 1957). In this system, scientists publish their findings as quickly as possible to add to the public stock of knowledge and receive credit for the intellectual priority of their scientific discoveries. The system benefits society both by hastening discoveries and by hastening the public disclosure of those discoveries (Dasgupta and David 1994). The fundamentals of this system remain salient in contemporary science, where grants serve two primary functions: they are a mechanism for allocating resources to the 'best and brightest' scientists, thereby fuelling 'the race'; and they are a means of demonstrating accountability to the public. Grant funding is required to perform the research, and if that research is successful, there is a greater likelihood of future grants. In this way, success in research generates further success, with those achieving scientific repute through their research achievements likely to accrue greater recognition and to be awarded more resources than their lesser known colleagues. This is known as the 'Matthew effect' after Matthew 25:29[5](Merton 1968). Taken together, the 'race for discovery' and grants system drive a highly competitive research culture with a focus on quantifiable outputs, perpetuated by, and advantaging those who have achieved 'success in the system'.

In terms of public accountability, individuals and small research teams in receipt of grants are regularly subject to audit and evaluated on their contribution to the economy. The workload created by the grant cycle is therefore the subject of much complaint amongst scientists whose distaste for 'red tape' is well documented (Roth and Sonnert 2011). The increasing competition for funding in combination with the low levels of administrative support typically provided by research institutions means that PIs spend significant time administering the research process, reducing the time available for research leadership, which is the original basis of the award (Cunningham et al. 2014). In surveys, Australian researchers consistently complain about the demands of administration, paperwork, filing of returns, and submitting lengthy applications full of 'unimportant detail'. They highlight the negative productivity effects of these accountability measures and call for more trust (ACOLA 2012). Although biotech firms also have administration and paperwork, this is expected as part of the fusion of science and business, with staff recruited for this purpose. By contrast, in academia this work is done by researchers. The contrast between increasingly bureaucratic systems of accountability in academia and the collegiality and networking in New Economy firms has been noted (Walby 2011).

Demonstrating scientific excellence is arguably the biggest challenge for researchers seeking career advancement, with a hierarchical ordering of contributions determining 'what counts' for this (North-Samardzic and Gregson 2011). In nearly all countries publications and peer reviews are the main criteria for advancement (Cervantes 2006). Universities and public sector research bodies seek researchers with national or international reputations in their field who can attract external research funding and

[5] 'Unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath'

increase the standing of the organisation (ACG 2010a). A record of successful grant funding, research impact, publications, and student supervision are essential criteria and together form a strong reinforcing feedback loop in the demonstration of research excellence (O'Brien and Hapgood 2012; Goulden, Mason and Frasch 2011; Fox and Colatrella 2006; Bennett 2011).

This hierarchy of scientific contributions works to the disadvantage of women who spend less time on research than men. Whilst the relationship between time and outputs in research is not necessarily mechanical, this time difference is substantial. US research, for example, indicates men working in academic science, technology, engineering and mathematics (STEM) spend around 42 percent of their time on research compared to women's 27 percent, whilst STEM women spend more time on mentoring and service work such as serving on committees (Misra, Lundquist, Holmes and Agiomavritis 2011). Teaching and mentoring are considered integral to the system of science as the stability of teaching enables the more risky endeavour of research; they are interconnected, yet one is subordinated to the other in the rewards system (Dasgupta and David 1994). Indeed, teaching is not considered at all in measures of scientific excellence in some countries (Cervantes 2006). The communal everyday work of keeping a laboratory running is also disproportionately done by women. Garforth and Kerr (2010: 16) observe 'masculine work' in science is associated with outputs, reputation, publications, individual excellence and linearity whilst 'feminine work' is characterised as collective, materially oriented, ongoing and supportive. Whilst the former is highly valued and rewarded, the latter is largely 'invisible' in the formal rewards system and unrecognised by national funding bodies. They argue that in order to gain organisational recognition and career progression, scientists are required to disassociate themselves from the community that makes it possible.

Internationally, across all areas of science fewer women than men apply for grants (Bennett 2011; Bailyn 2008; Goulden et al. 2011) and women with children are less likely to apply for grants than men with children, women without children, or single women (Goulden et al. 2011). In Australian medical science, whilst overall fewer women researchers apply for grants than men, the ratio of women to men applicants varies according to the type of fellowship and stage of career. For example, NHMRC data consistently show more women than men apply for NHMRC early career fellowships, but substantially more men than women apply for higher level research fellowships and as CIs on project grants. Application rates for the years 2006-2012 illustrate this trend, with women representing between 56 and 65 percent of early career fellowship applications, reducing to between 32 and 34 percent of research fellowship applications over that period (NHMRC 2013a). In 2013, women were awarded around one third of funded research NHMRC fellowships (NHMRC 2013b). Similarly, in each of the ARC funding rounds from 2009 to 2013 women constituted between 26 and 28 percent of participants on submitted proposals (all proposals, not only biotech related) (ARC 2014a). Both NHMRC and ARC data show women's overall funding success rate is similar to men's, although this varies depending on the type of grant and fluctuates from year to year. Hence it is not their success rate, but the low number of applications that results in women's under-representation at the senior levels of academic science. Research suggests many women are also reluctant to apply for senior academic positions more generally within Australian universities (Chesterman, Ross-Smith and Peters 2005). Together, these trends suggest efforts to improve gender equity should pay attention to the factors that deter women from seeking advancement, including reticence about their capacities and ambivalence about the choices on offer (Chesterman et al. 2005).

The lower rate of grant applications from women is often linked to their higher rates of part-time work, career-breaks and short term appointments (O'Brien and Hapgood 2012; Bennett 2011; Etkowitz and Ranga 2011). First, many women academics with family responsibilities seek to maintain work life balance, avoiding the high workload that comes with the award of a grant or higher promotion to roles they perceive as not 'doable' in reasonable hours (North-Samardzic and Gregson 2011; Doherty and Manfredi 2006: Chesterman et al. 2005). Second, many women are discouraged from applying because they expect to be unsuccessful under the existing criteria. Researchers argue the method of assessing productivity, particularly the use of metrics in the form of publication and citation rates, disadvantages women who have worked part-time or taken career breaks (O'Brien and Hapgood 2012; Symonds, Gemmell, Braisher, Gorringe and Elgar 2006). O'Brien and Hapgood (2012) maintain women are disadvantaged by the assumption that research output is linear with time. In particular they observe there is a 'lag' in research output in the early stages of a research career. Unless they generate research above a critical threshold before they take leave or reduce their hours, women find it difficult to catch up. In these circumstances, they often are judged 'research inactive' and uncompetitive for grants. A common outcome is for women to take up teaching positions that are more compatible with part-time hours to avoid the demoralisation that comes from working hard in a system in which they are unlikely to ever succeed. In competitive academic science, this effectively signals the end of their research careers. Such 'withdrawal' from research is reminiscent of Merton's (1957: 655) reference to 'retreatism' when scientists 'abandon the esteemed cultural goal of originality', and confine themselves to some other role in science, such as teaching or administration. This Mertonian observation is still highly relevant today.

Despite the apparent disadvantages to women, the criteria and processes by which scientific productivity are judged in academic science are highly institutionalised and therefore difficult to change. Researchers observe that many scientists, including women, are quick to maintain that the processes in science are neutral and merit-driven and that its inherent 'objectivity' means that science cannot be gender biased (Rees 2011; Valian 2008). Bennett (2011) ventures that in the face of the quantitative evidence this attitude could be described a 'false consciousness'. Nevertheless, the competitive dynamics created by the priority reward system are thought to drive excellence and the peer review processes associated with promotion and funding are generally accepted as fair, if not perfect (Powell, Owen-Smith and Smith-Doerr 2011).

This broad consensus can be traced back to the 'ethos of science', a set of universal rules or norms that govern the production of science and are internalised by scientists as their 'scientific conscience' (Merton 1973 [1942]). Whilst contemporary scientists may question some or all of these norms, strong socialisation ensures both attitudinal and institutional change is slow (Lam 2010). The ethos of science, therefore, remains integral to a wide range of science management practices. Merton articulates four sets of institutional imperatives: ‘universalism’, ‘communism’, ‘disinterestedness’ and ‘organised scepticism’. The first element, universalism, underpins scientists’ commitment to objectivity whereby scientific claims are judged according to pre-established impersonal criteria and without regard to the personal or social attributes of the scientist. The second element, communism, holds the substantive findings of science are a product of social collaboration and should be assigned to the community. The principle of communism recognises the essentially cooperative quality of scientific achievement, driving the commitment to, and prioritisation of publications which are the ‘products’ of scientific endeavour. The third element, disinterestedness, relates, not to a scientists’ motivation, such as a passion for science or humanitarianism, but to the institutional control over scientists’ personal motives, whatever they may be. The norm of disinterestedness is enforced through ‘exacting scrutiny of fellow experts’ to maintain the integrity of scientific claims (Merton 1973 [1942]: 276). This occurs through the fourth element, organised scepticism, which is interrelated with the other elements of the scientific ethos, and manifest in the peer review system in science.

Merton claims these imperatives are binding on scientists, not only because they are procedurally efficient, but because scientists believe they are ‘right’ and ‘good’ (Merton 1973 [1942]: 270). However, these scientific norms have very specific career and gender equity impacts. First, scientists’ strong commitment to universalism often comes with the assumption that gender-free equates to ‘fair’. This can lead to a lack of attention to, and undervaluing of the ‘inputs’ necessary to achieve original claims or the societal factors that impact differentially on women’s and men’s ability to succeed within the system of science (Acker 1990). Second, a narrow interpretation of the principle of communism and rigid prioritisation of publications above all other scientific contributions, disadvantages women who publish less than men. Third, the ‘rigorous policing’ of disinterestedness, as Merton (1957: 651) claims ‘to a degree perhaps unparalleled in any other field of human activity’, can stifle the progress of anyone deemed to be following an unconventional path. For example, Powell et al. (2011) describe how the peer-review system is inherently conservative, with the allocation of resources based on successful track records tending to reinforce the position of incumbent investigators. This ‘Matthew effect’ is often at the expense of novel, interdisciplinary research proposals that can be more difficult to evaluate due to their ‘newness’ and considered more ‘risky’ in a highly competitive funding system. Researchers observe those who have followed an unconventional path, younger ‘unproven’ investigators and women are those more likely to present such proposals (Valian 2008; Powell et al. 2011). The link between morality and the technical systems that maintain science is a formidable barrier to creating a more inclusive system.

3.3.1 Gender inequality in academic science

The under-representation of women in senior levels of science is well-documented across all OECD countries including Australia (Bell 2009, 2010; Cervantes 2006). Described in terms of a ‘leaky pipeline’, women progressively leave academic science in the post-doctoral phase of their careers with relatively few women reaching senior and leadership roles In Australia, women constitute only seven percent of fellows in the learned Academy of Science and only eight percent of research managers in CSIRO, the country’s largest public research organisation (Bell 2009). Although aggregate data on women’s seniority in biotechnology-specific fields are not gathered systematically, the leaky pipeline is clearly evident in individual medical research institutes. For example, in 2009 at the Walter and Eliza Hall Institute (WEHI), a large medical research institute in Melbourne, women comprised approximately 60 percent of undergraduate and PhD students and around half of post-doctoral scientists, but only 27 percent of laboratory heads (lab heads), none of the 10 division heads, and only one of 16 professors (Bell 2009: 52). Elsewhere in Australia, the Garvan Institute of Medical Research reported in 2011 that 10 of its 29 group leaders were women and the Queensland Institute of Medical Research reported that women constituted 62 percent of their staff but only 38 percent of their senior research fellows (FASTS 2011).

Bell (2010) argues that the persistent vertical segregation in science has fallen off the equity and productivity agendas in Australia, partly because the problem has been masked by women’s improved educational outcomes. Women now outnumber men in university enrolments, however higher education is characterised by high levels of horizontal segregation. Women are under-represented in STEM fields overall[6], and within STEM, tend to be concentrated in fields such as biology, health, agriculture or pharmaceuticals, with low representation in physics, computing and engineering (Bell 2009; Cervantes 2006). In Australia, women have comprised the majority of PhD graduates in the biological sciences in each year at least since 2001[7]. This is consistent with world-wide trends where women comprise more than 60 percent of life science graduates in many OECD countries (Cervantes 2006). Yet high numbers of women entering a particular field does not guarantee advancement. The picture of vertical segregation in Australian medical research institutes is all the more concerning given women's congregation in the life sciences, and clearly points to retention as the most important gender equity problem.

A consistent theme in academic science, demonstrated through large surveys and studies over decades, is the difficulty faced by women in combining family and work (Rosser 2004; Heilbronner 2013). Heilbronner (2013) finds that whilst factors such as isolation and a lack of mentoring have diminished as barriers to women in SET, balancing work with family continues to be their most significant challenge. It is also the main reason they leave science careers. Women's 'choices' to leave academic science, or take a reduced role in it, are shaped by their perceptions of the options available to them in combining motherhood and a science career (Bennett 2011). Studies indicate the presence of children disadvantages women, but not men, in science (Xie and Shauman 2003). Women in SET have children later and have higher rates of non-motherhood than graduates from other disciplines (Blackwell and Glover 2008); women who leave science to have children are less likely to return than women

---

[6] Whilst female participation in professional fields has grown substantially in Australia since the 1970s, reaching 53.4% in 2008, women comprised only 22.3% of professionals within the field of Design, Engineering Science and Transport in 2008 (Bell 2009). This field includes such occupations as scientists, engineers, architects, pharmacists and medical practitioners.

[7] Biological sciences has only been measured as its own 'narrow field of study' since 2001, and was previously included in the Life and General Sciences category where women comprised over 40% of PhD graduates from 1997 to 2000 (DEST/DEEWR Higher Education Student Statistics reported in Bell 2009, pp. 87-88).

working in other sectors (Walby 2011); and among tenured academic scientists, more men than women have children and more women than men report having fewer children than they want (Mason and Goulden 2002, 2004). Consistent with these trends, a recent survey of Australian women working in SET careers shows over 70 percent of those with children believe their carer responsibilities had affected their career progression, whilst 50 percent of all women reported their career had affected their planning for parenthood including whether or not to have children, the timing of children and the number of children (APESMA 2010).

The work-family challenge for women starts with the ‘front-loading’ of academic science careers. Although there may be slight differences across countries and academic institutions, academic scientists are required to demonstrate their productivity through a post doc period before they are granted tenure or funding to establish their own lab. This transition typically occurs during women’s childbearing years, this incompatibility of career and family timing having progressively worsened (ADoHA 2013; Goulden et al. 2011). In Australia, the average post-doctoral career phase has extended from 1-2 years in 1980 to more than 10 years in 2010 (ADoHA 2013) As a result researchers now are often in their late 30s to early 40s before they have the opportunity to set up their own lab to share the research load.

The post-doctoral period is traditionally the most competitive time in a science career, with a lack of job security and often the requirement to relocate geographically, either to take up a prestigious position or due to a lack of local research opportunities (ACOLA 2012). Women who are planning a family or who already have children during this period can struggle with the financial and geographic insecurity associated with a series of short term positions and also find it difficult to put in the hours required to outcompete their colleagues (Adamo 2013; Goulden et al. 2011). Research indicates women scientists with children are less geographically mobile than women scientists without children or men scientists, whilst men scientists have high rates of mobility when their children are young. This is largely because women are more likely to be primary carers, but is further complicated because women scientists are more likely to be married to other full time workers (especially other scientists), thereby facing both dual-career and geographic mobility constraints (Xie and Shauman 2003; Preston 2004)

Under intense pressure to publish, there is a strong perception that taking maternity leave during this period damages a researcher's career prospects. A recent Australian survey finds 80 percent of female scientists whose employment is conditional upon grant funding are concerned about the negative effects of an extended break on their long term career and over72 percent believe dedication in their workplace is equated with long hours (APESMA 2010). On a personal level PIs may wish to support women's requests for family leave or modified duties, but in practice the inflexibility of funding to accommodate maternity leave, especially in relation to the duration of research grants, means such leave has a negative impact on the research project and puts them in a difficult position (ADoHA 2013; Goulden et al. 2011). Moreover, a recent survey indicates 37 percent of Australian women scientists are concerned that if they do take family leave they will be penalised when they try to re-enter the workforce (ACOLA 2012). There is a strong perception that taking a break is particularly problematic in SET compared to other occupations because progress and change is endemic, particularly to pure science where skills and knowledge are considered quickly out of date. Therefore the length of a woman's break is a significant factor in their ease and level of re-entry, with temporary exits often becoming permanent (Preston 2004; Ellis 2003; Bell 2010). The options for women appear very limited when 'only non-breaking careers are publicised as successful examples' (Mavriplis, Heller, Beil, Dam, Yassinskaya, Shaw and Sorensen 2010: 145).

In Australia, Government bodies such as the ARC and NHMRC have changed their grant funding rules to account for family and caring responsibilities. In 2010, the NHMRC released a statement clarifying its career disruption considerations as including pregnancy and childbirth, major illness and carer responsibilities (NHMRC 2010). Also in 2010, the ARC formally changed its focus from an individual's 'track record' to 'research opportunity and performance evidence' (ROPE) (ARC 2014b). Grant applications now require a record of career opportunities relative to opportunity, with allowance for teaching responsibilities and 'career interruptions' such as child-rearing and parental leave. Hence assessors are now required to make qualitative judgements and no longer rely solely on metrics. The ARC also allows additional time for early career researchers to qualify for grants normally limited to within five years of a PhD, due to such career interruptions. The implementation of these changes, however, has proven problematic with researchers questioning 'how many papers is a baby worth?' In a recent Australian survey, Klocker and Drozdzewski (2012) find many academic researchers consider career interruptions to be 'unquantifiable'. Attitudes to this issue vary widely, with some respondents urging more attention to quality than quantity; some objecting to the implication that parenting responsibilities actually impact on performance at all; and some estimating a number of publications and accepting the constraints of a metrics-based system. This issue seems far from resolved in Australian academic science, with the ARC recently issuing further clarification on the operation of ROPE (ARC 2014b). Comparable initiatives implemented overseas have experienced similar teething problems (Bennett 2011). Preston (2004) observes such policies are often ineffectual because women don't believe that taking leave will be viewed neutrally in practice. She finds that instead women either put off having children or take minimal leave and return to work to compete as if they were childless. This is consistent with findings from other qualitative studies of gender and the scientific workplace that senior women are less likely than un-promoted women to have let child-caring responsibilities touch their working lives through career breaks or reduced working hours (Blackwell and Glover 2008).

The consistent portrayal of the post doc period as the time when scientists put in the 'longest' hours, gives the impression that the pressure eases off after that. However, scientists at senior levels continue to work long hours, experience job insecurity and face significant on-going pressure to secure funding to continue research. There is little evidence of a reduction in work pace at any stage of an academic science career that would be a 'window of opportunity' to focus on family commitments (ADoHA 2013; Goulden et al. 2011). This combination of long hours and job insecurity is a problem in Australian academia generally, but is more pronounced in science. Overall, around 51 percent of Australian academics work more than 50 hours per week and 52 percent would prefer to work fewer hours, whilst 70 percent of women and 60 percent of men consider their workload to be an impediment to balancing their work and family lives. Adding to this work pressure, 44 percent of all academics (including teaching and research staff) are employed on fixed term contracts (Strachan et al. 2012), but within the ranks of science, medical and health academics where there is a higher proportion of research-only staff, this percentage is substantially higher at over 80 percent (Peetz et al 2014). Under these circumstances, many women scientists are compelled to reduce their work hours or take a career break at some stage due to motherhood, often experiencing guilt and stress when they do so, and feeling they are not doing 'a good enough job' even when they are working harder than they ever have (Mavriplis et al. 2010: 145-6).

International research suggests the proportion of scientific researchers working part-time is low compared to other occupations although overall there is little data available on scientists' employment arrangements (Hart and Roberts 2011; Schacherl 2006). In Australia, professional association data indicate around 81 percent of scientists work full-time although this is an average across industry and academia and includes both research and other science and technology occupations (APESMA 2007). This is a high rate of full-time work compared with the average of around 70 percent full-time employment across all sectors (ABS 2010b). Of the relatively few scientists working part-time, it is notable that women are four times more likely to be working part-time than men. Around 16.5 percent of female scientists work part-time which is very low compared to the average of 43 percent of women working part-time across all sectors (APESMA 2007; ABS 2012).

These data highlight both the traditional career structure in science and the positioning of part-time work as a deviation from the norm taken up primarily by women. A recent submission to the Australian Academy of Science, prepared by a representative group of medical researchers working in Australian research institutes and universities, acknowledges the varied opinions of individuals committed to gender equity on 'whether working part-time is a sustainable approach in an inherently competitive workforce' (Dunstone and Williamson 2013: 2). Describing it as a 'controversial issue', the paper expressly avoids further discussion of part-time work, focusing instead on what the authors consider 'practical steps' to promote gender equity in Australian medical science. The implication is that part-time work is 'not practical'. Whilst many research institutes promote themselves as 'family-friendly' by offering part-time work, especially on women's initial return from maternity leave, this is often portrayed as a 'transition' back to full-time work, rather than on-going part-time work (FASTS 2011). This raises the question of whether such an option encourages women to truncate their maternity leave and return to the 'race for discovery' sooner, and if so, whether such a policy can be considered 'family friendly'? O'Brien and Hapgood (2012) observe there is 'plenty of encouragement' and career support for women to return to full-time work after maternity leave but few role models for those who continue working part-time. This reflects the economic focus of the debate on gender in science whereby women are considered an under-utilised resource (Marginson, Tytler, Freeman and Roberts 2013). In this context, full-time work, not part-time work is equated with increased productivity. Moreover, full-time work is associated with long hours, not standard hours. Hence scientists faced with long hours may opt for part-time work in order to pare these back to somewhere near standard full-time hours, rather than a genuine desire to work part-time. This problem of 'choice' between polar extremes is largely ignored in productivity reports or gender equity initiatives.

Attitudes to part-time work in medical research can be gauged by the rate of application for part-time fellowships, a relatively recent gender equity initiative in Australia. Of the 1128 personal fellowship applications during the 2013 NHMRC funding round, 94 were applications for part-time fellowships. However, of those 94, only 5 applications were in the largest broad research area (BRA) of funding, basic science, whilst the vast majority of applications were in the clinical medicine and science BRA where many clinicians combine part-time research with professional clinical work (hence often continuing to work full-time)(NHMRC 2013b). This suggests even when the opportunity is available researchers are sceptical about the feasibility of part-time work in basic science.

Working time policies are arguably the most important yet least effective gender equity initiatives in science. Female scientists rank flexible working arrangements and work-life balance as the number one priority that needs addressing in science, ahead of equal pay and career development (APESMA 2010). This seems incongruous given academic environments are known for their flexible work hours and arguably offer the most generous maternity leave benefits in the country. In Australian academic science, however, efforts to ensure a family-friendly workplace are patchy and even though extensive leave and other supporting policies are often in place many female scientists report the workplace culture affects their ability to access them (APESMA 2010). In this context, some of the more progressive Australian research institutes have introduced initiatives to complement leave and working hours policies, such as childcare subsidies, financial support for female scientists to employ a research technician to continue their work whilst they are on maternity leave, family-friendly meeting times and assistance with travel to attend conferences (NHMRC 2014; FASTS 2011; Dunstone and Williamson 2013). Most of these initiatives are designed to minimise the impact of taking a (short) career break with the emphasis heavily weighted to assisting women maintain career momentum and maximising their availability for work. Initiatives supporting re-entry into the scientific workforce after longer periods of leave are less common although a handful of organisations have introduced these (NHMRC 2014). Noticeably absent from organisational initiatives is the creation of part-time positions (as opposed to the right to request them) or efforts to address work overload or reduce long hours. This is despite workload/work pressure consistently being identified as the strongest predictor of work-life conflict and a block to the uptake of work-family policies (Strachan et al. 2012; Skinner and Pocock 2008; Allan et al. 2007; Waters and Bardoel 2006).

Many Australian research organisations also encourage women to advance their careers by providing female-only research fellowships, targeted leadership training, development and mentoring programs, and ensuring female representation on key committees and conference programs (FASTS 2011; NHMRC 2014). It has been argued that such development programs reflect a ‘woman as deficient’ approach to equality (Ely and Meyerson 2000b; Liff and Ward 2001; Rosser 2004). Others question their effectiveness given the low levels of senior women in many SET organisations even when such programs are well-established (Herman and Lewis 2012). These programs reach only a relatively small number of women and whilst they may benefit the individuals who participate in them, they do little to change the systemic factors that create an uneven playing field for women in the first place (Meyerson and Kolb 2000).

Gender equity policies in science tend to focus on the (necessary) 'short agenda' of reducing women's disadvantage in formal recruitment and promotion procedures but neglect the 'longer agenda' of more systemic change that involves changing job requirements, job structures and terms on which jobs are offered (Cockburn 1989; Rees 2001). Liff and Ward (2001: 33) observe short agenda initiatives that 'help' women compete can make women look inadequate and, in some circumstances, possibly as receiving an unfair advantage, thereby undermining notions of merit. At the same time, they argue, such approaches 'fail to expose the current organisation of the workplace as built around, and hence favouring, male needs and ways of working'. This disadvantages both women and men who wish to combine high-level scientific research and care. Researchers are increasingly calling for change to the institutionalised practices in science that cause both individual and group disadvantage, and potentially have a negative impact on productivity. Bailyn (2004) for example, observes that burnout, mid-career crises and dead wood in academia are all unintended consequences of early career pressures whilst Valian (2005:208) points out that if we continue to emphasise and reward always being on the job, we will never find out whether leading a balanced life leads to equally good or better scientific work.

3.4 Opportunities and tensions at the boundary

The intertwining of academic and commercial research networks has provided a range of new career opportunities for scientists. In the field of biotechnology, researchers point to changes in academia, such as the increase in project-based work involving multi-disciplinary collaborative teams, tighter alignment to tangible research goals, and increased involvement in commercialisation by academic researchers (Jong 2008;

Whittington 2011; Owen-Smith and Powell 2004). Meanwhile in the commercial sector biotech firms invest heavily in R&D, make contributions to public science and allow their scientists to publish and participate in the scientific community (Powell et al. 1996; Smith-Doerr 2005). Such changes to the structure of scientific careers are driven by the movement of researchers between academia and industry (Smith-Doerr 2004, 2005; Powell and Sandholtz 2012). Movement can occur organically or in a more structured way. Powell and Sandholtz (2012: 386) describe the organic change that has occurred in US biotech, facilitated by high-profile scientists who move back and forth as consultants, advisors and founders of university spin-off firms. They refer to these scientists as 'amphibious creatures'. Meanwhile, large technology-based firms with a network R&D model promote new career opportunities through more formalised human resource ties with academia. Lam (2005) describes how firms extend their internal labour markets through 'linked scientists' who bridge the interface between science and business. In-house researchers connect the firm's R&D projects through their relationships with 'entrepreneurial professors', post-doctoral fellows working on industrial collaborative projects and doctoral students co-supervised by academic and industrial partners. Governments also facilitate collaboration and career mobility through national research priorities, targeted funding, programs and incentives (see Marginson et al. 2013).

The success of the network R&D model and the new career opportunities it presents depends to a large degree on how scientists respond to competing social and institutional pressures. Scientists' propensity to be mobile or even to collaborate across sectors will depend on their perceptions of the career opportunities available and also their own career aspirations and attitudes. In a study of UK academic scientists, Lam (2010) finds attitudes to university-industry ties range from a traditionalist commitment to the pursuit of basic research to an entrepreneurial merging of science and commerce. However, within this range she finds the majority of scientists adopt a 'hybrid' orientation, sharing a belief in the importance of science-business collaboration whilst at the same time maintaining their commitment to a scientific ethos that cherishes autonomy and dedication to knowledge, a product of long years of graduate training and socialisation. This can lead to collaborative tensions between industrial and academic scientists, particularly around the ownership of research results, work norms and project timeframes (Lam 2005) as well as internal tensions for scientists grappling with changes to their professional role identity (Lam 2010). Smith-Doerr (2004, 2005) observes the 'narratives' scientists develop to legitimise their commercial biotech work when academic jobs are the default legitimate career option. This narrative emphasises the opportunity to do 'good science' outside of academia. This is facilitated through better access to resources in the face of declining university funding as well as association with top researchers who make the move into biotech firms. The 'asset of newness' is also highlighted, portrayed in terms of the 'excitement' of collaborating with talented scientists from a range of disciplines towards a common goal. Biotech scientists differentiate this team approach from the individualised promotion-driven academic environment.

Institutional barriers can undermine collaboration and career opportunities across sectors. Many academic scientists are conscious that taking an entrepreneurial path could jeopardize their academic careers. They complain of a 'cultural resistance' within universities toward entrepreneurial activities (Lam 2010; ACOLA 2012). Australian scientists observe that industry experience is not well-regarded in university circles, an attitude reinforced by a system that prioritises a strong publication record in determining appointments, promotions and grant applications. In a recent survey, almost 50 percent of scientists complained there is no system to allow moves between sectors. This is consistent with Australia's low OECD ranking in terms of collaboration between business, higher education and government research institutions (ACOLA 2012; OCS 2014; Marginson et al. 2013). In medical science, McKeon (ADoHA 2013) notes the strong emphasis on track record assessment can discourage researchers from engaging in research translation, resulting in a disconnect between evidence creation and translation into improved health outcomes. This lack of researcher mobility between sectors is increasingly highlighted as a major barrier to scientific productivity and international competitiveness. In response, there are calls to formally recognise industry experience in the academic career path and to include commercialisation and other industry-relevant skills in research training programs to equip graduates for lateral career moves (OCS 2014; ADoHA 2013; ACG 2010a).

These recommendations are driven primarily by a productivity agenda, but any change that eases the rigidity of the academic career path is also likely to improve gender equity. Currently, when women 'leak from the pipeline' little is known about their destination; most often they are simply portrayed as 'lost to science' (Bell 2009; Etzkowitz and Ranga 2011; Bennett 2011). This reflects both the expectation of career continuity and the hierarchical ordering of contributions in elite academic science. By taking a career break or opting for technical rather than managerial careers to contain their work hours or pressure, women are assumed to be permanently 'lost' (Bennett 2011). More recently, however, the relevance of the pipeline model with its emphasis on a linear academic progression has been questioned. There is increasing recognition that many women leave linear academic careers only to 'reappear' later in science occupations that are more compatible with family life, for example in health informatics, science media or technology transfer (Bennett 2011; Etzkowitz, Gupta and Kemelgor 2010; Etzkowitz and Ranga 2011). These are relatively new roles in emerging sectors of the knowledge economy, providing women the opportunity to continue high-level science careers through a complex mix of linear and non-linear trajectories. Changes to how researchers are recognised in academia are likely to contribute to a more inclusive environment for both women and men who have followed these or other non-linear pathways for family or other reasons.

Irrespective of efforts to break down institutional barriers between academia and industry, individual scientists are not necessarily easily transplanted. Scientists gravitate to the types of work and environments that suit their vocational identity (Holland 1996). Their availability to local biotech firms, for example, is impacted by the types of jobs, employment practices and job security offered by competing institutions such as local universities (Casper and Murray 2003). Those accustomed to long-term employment in large bureaucracies may not have the entrepreneurial skills or social capital required to thrive in commercial biotech or other industry roles. Nor might they be attracted or suited to constantly changing projects where skills are ill-defined and a premium is placed on flexibility (Sennett 2006; Lam 2005). According to Sennett (2006: 115), getting deeply involved in any one problem is considered dysfunctional in the

New Economy. He laments the loss of ‘craftsmanship’, the concept of learning to do just one thing really well. In science, craftsmanship is analogous to building a track record, a career path well-suited to those who prefer mastering a particular domain of knowledge to ‘moving from problem to problem, subject to subject’.

Whilst career opportunities in the New Economy are often presented in a positive light as capital rich and providing personal autonomy (Leadbeater 1999), Powell (2001:68) describes our understanding of the social ramifications of new organisational forms as ‘murky’. He acknowledges there are potential costs to individuals when attachment and loyalty are replaced by flexibility and constant change. However, for women scientists with family responsibilities, unable to meet the time-based criteria required for ‘craftsmanship’ in science, the New Economy may present exciting new opportunities.

3.5 Women in commercial biotech

An increasing number of studies are focusing on women’s careers in New Economy fields such as biotechnology. There is a view that firms evolving outside established institutional routines present an opportunity for change in the gendered division of work. However, studies show mixed results for women. Whilst career prospects look better for women in biotech firms than in academia (Smith-Doerr 2004; Eaton and Bailyn 1999), there are signs of stratification in commercial biotech management, with women less well represented in the most senior or prestigious roles (Ding et al. 2010; McCook 2013; Smith-Doerr, Kemekliene, Teutonico, Lange, Villa-Komaroff, Matthiessen-Guyader and Murray 2011).

In a large study US biotech study, Smith-Doerr (2004) finds many of the problems encountered by women in academia are less evident in the network form of organisation. Drawing on career data for more than 3,000 life science PhD graduates, she finds women are eight times more likely to hold a management position in a biotech firm than in other types of life science organisations, such as university departments and large pharma. Smith-Doerr argues her finding is not simply because more leadership positions exist in biotech firms because, in her US sample, there are proportionally fewer leaders in biotech firms compared to the hierarchical organisations. Based on her fieldwork and interviews with industry participants, she concludes this positive outcome for women is due to the more flexible style of working in biotech firms. She argues that when work is organised around collaborative project teams, and inter and intra-organisational connections underpin success, women's contributions to the team and overall research outcomes are more visible, leading to recognition and career advancement. In other words, what is often 'invisible work' in academia is not only more visible in commercial biotech, but it is also rewarded.

Smith-Doerr uses the 'umbrella term' of flexibility to cover a range of features of commercial biotech that benefit women. Other researchers have also observed these features. Consider, for example, flexibility in recruitment and promotion. Biotech firms often lack bureaucratic HR processes, with recruitment organised by line managers rather than HR personnel (Finegold and Frenkel 2006). As bureaucratic processes have been shown to protect women from discrimination (Reskin and Bielby 2005; Roth and Sonnert 2011; Baron et al. 2007), this could be construed as a disadvantage. However, Smith-Doerr (2004) finds informality can be advantageous to women. She maintains that being part of a network is a form of self-regulation that is more effective than formal recruitment policies. There are two main reasons for this. First, biotech firms' extensive networks of external collaboration expose women to different career opportunities allowing them to maneuver around discriminatory situations and the lack of recognition they often experience under the PI model. Second, she describes how promotion opportunities are more accessible compared to the rigidly defined roles in large organisations. Titles are fluid and progression fast into positions of responsibility for those who are 'gung-ho' and have the skills (2004: 119). Eaton and Bailyn (1999) find a surprisingly high number of promotion opportunities for both women and men in biotech firms. They claim the informal hiring approach provides 'opportunities for growth and movement up a shifting hierarchy of job titles and responsibility', often due to vacancies left by departing managers (1999: 167). Whilst Sennett (2006:4) argues this 'new meritocracy' that 'celebrates potential ability rather than past achievement' alienates those who have dedicated their working lives to craftsmanship, high achieving women scientists may be the new ‘winners’ when career advancement no longer rests on continuity and track records (Acker 1990).

A further benefit of flexibility in biotech firms is the ability to manage family or other non-work responsibilities. Eaton and Bailyn (1999) find that scientists working in biotech choose to work in ‘insecure’ firms as long as they can develop their skills, integrate their home and work lives, and maintain and expand their professional networks. Smith-Doerr (2004) also emphasises how the flexible team-based organisation of work provides coverage for women researchers when they take family leave. She asserts that, in contrast to the more individualistic ‘guarding your turf’ type of culture in academia, when a woman working for a biotech firm takes family leave the project continues through contributions from the broader team. Whilst the female scientist may come back to work on a different project, her contribution to the previous project has not been lost and her career momentum has been maintained.

Despite these improved gender equity outcomes compared to traditional science, women nevertheless hold fewer management roles and, recent US research suggests, lower status management roles than men in commercial biotech (Smith-Doerr 2004; Smith-Doerr et al. 2011; McCook 2013). This situation persists even though women make up the majority of PhD graduates in the discipline of biology. Women are significantly less likely to start biotech businesses and receive less funding for start-ups when they do launch (McCook 2013). They are also significantly less likely than men to join biotech firms through a firm’s scientific advisory board (SAB) usually because ‘they are not invited’ (Ding et al. 2010). Moreover, if they are invited, preliminary findings suggest women are more likely to be offered SAB memberships for small start-ups with limited financial backing rather than high profile companies. This appears reminiscent of the ‘glass cliff’ theory where women are more likely to be offered roles in precarious firms (Ryan and Haslam 2005) or the closely related gender queues theory where women are offered roles that men do not want (Reskin and Roos 1990). Ridgeway (2011: 175) suggests initial gains by women in this sector, due to the gender neutrality of biology and the flexibility in how work is organised, may be offset by implicit performance expectations that favour men for positions of substantial authority. A more fine-grained analysis of the type of management positions held by women in biotech firms is therefore required to understand the extent of progress for women in this sector.

The more flexible organisation of work suggests that part-time and other non-standard employment arrangements may be more feasible in commercial biotech than in traditional academic science. However little is known about specific firm-level employment practices or particular roles that may be suitable for flexible working. Whittington (2011), for example, observes that little is known about the distribution of positions and resources by sex in commercial biotech and whether this distribution is impacted by motherhood. The literature on occupations and employment arrangements for scientists working outside academia is generally limited (Gidlof Regnier 2006) and the few case studies in the literature tend to focus on large multinational companies with hierarchical structures that are more like academia than small biotech firms (Herman and Lewis 2012; Lewis and Humbert 2010). Understanding more about firm-level management practices will provide insight into the mechanisms of women's advancement in commercial biotech.

In Australia little is known about the destination of STEM graduates outside of academic science or the attractiveness of flexible and less linear career options (Bell 2009; Marginson et al. 2013). The limited industry data available indicates women are under-represented in science management generally (Bell 2009). However, the biennial Australian Equal Opportunity in the Workplace (EOWA) Leadership Census shows there is a higher percentage of women in management in the pharmaceutical/biotechnology sector than in any other sector. Whilst this augers well for women's career opportunities in commercial biotech, this census only covers management positions in the top 200 firms listed on the Australian Securities Exchange (ASX). It therefore includes very few biotech firms because most are too small to make the top 200. (For example, the 2010 EOWA census reports women holding 20 percent of key management positions, but in fact, this 20 percent represents only 3 women).

In this study I seek to fill this gap in our knowledge about women in commercial biotech in Australia. A key question is whether the small sample in the EOWA census is indicative of women doing well in the broader sector (including the smaller firms that make up most of the sector). Another is whether the trends identified by Smith-Doerr in the US are repeated in the Australian context. I seek to answer these questions by comparing management outcomes for women in biotech firms and hierarchical academic biotech. However, I use a different methodology to Smith-Doerr who was able to access a large national database of life-science careers not available in Australia. Instead I have gathered data direct from firms, enabling a comparison of the particular types of biotech management jobs undertaken by women and men and the employment conditions under which they work. I also explore the perceptions of managers working in commercial and academic biotech of the decision-making processes that determine who gets to be a manager, and how productivity is assessed and rewarded. I am interested to know how closely the Australian experience resembles the international research findings discussed in this and the previous chapter, and where it might be different.

In the next chapter I detail my methodology for doing this.

4. Methodology

In this chapter I begin with a brief overview of biotech in Victoria before discussing my approach to this research. I situate myself as a researcher and an ‘insider’ in the field, explaining my choice of a mixed methods research strategy and the philosophies and theories that underpin it. I then discuss the technical aspects of, first the quantitative, and then the qualitative, data collection and analysis. The chapter concludes with some observations about the practices of triangulation and data integration.

4.1 Victorian biotechnology

This research is based in the State of Victoria, Australia, the stronghold of Australian biotech. Australia has a strong academic history, evidenced through the publication and citation records of Australian scientists as well as funding success through the US National Institutes of Health (NIH) foreign grants program (Herpin, Karuso and Foley 2005). Victoria has the largest concentration of human health biotech organisations in Australia, with particular strengths in the medical field, especially in oncology, neurosciences, regenerative medicine (including stem cells) and infectious diseases (VDoIIRD 2011). Most of this activity takes place in Melbourne, the state’s capital, where the Government strategy has been to develop ‘medical precincts’ to foster collaboration between biotech firms, universities, hospitals and service providers and provide ‘incubator’ space for fledgling biotech firms. The state hosts 13 major publicly funded medical research institutes, 10 teaching hospitals conducting significant research, and 9 universities. It is estimated that more than 6,000 people work in Victorian-based biotechnology companies (including non-human health) with about 2,270 employed in research and development. Of the 150 or so biotech companies, more than 75 percent are focused in the area of human health (ACG 2010b; VDoIIRD 2011).

Most Australian biotech companies are involved in R&D and early stage development rather than production, sales and marketing (ACG 2010b). In Victoria, firms have typically established close to where their technologies were invented in one of Melbourne’s publicly funded research organisations (PROs), with, founding PROs often extending support to firms beyond R&D collaboration. In particular, the difficulty in accessing venture capital has resulted in a relatively inclusive regional cluster, where local institutions provide risk capital to firms and where firms take cautionary patent approaches due to costs, license early and are often forced into an early public listing (Gilding 2008; Herpin et al. 2005). This makes it a ‘high risk’ sector where firms have a small product pipeline and ‘survival of the fittest’ is the rule (Herpin et al. 2005).

The profile of Victorian biotech firms, therefore, is one of small, early-discovery, seed-stage companies working to validate their technologies to attract downstream investment and partnerships. The overwhelming majority of biotech firms’ collaborations are directed towards research or commercialisation, many with their founding organisations and most dealing with the early stages of commercialisation such as licensing arrangements, development funds and management assistance (Gilding 2008). In this uncertain environment, it is estimated that over 50 percent of Australian biotech firms have adopted a virtual model or are ‘moving in that direction’ (Nicol et al. 2013).

Whilst there is a strong supply of academic researchers in relevant biology and chemistry disciplines (see chapter two), there is a shortage of skills in a small number of key roles for the commercial biotech sector. These include directors of clinical trials; people able to design (rather than run) clinical trials; people skilled in strategic regulatory affairs; and those with scientific skills augmented by a strong commercial understanding (ACG 2010b: 64). These particular roles require years of on-the-job experience, often but not always gained in large pharma, and the lack of candidates reflects the developing nature of the Victorian biotech industry. The small size of the Victorian biotech industry and indeed the small size of the firms within in it, are limiting factors for the attraction of qualified experienced staff to the sector.

The advancement of women in the Victorian commercial biotech sector, therefore, should be read in the context of a small industry comprised of mainly small, precarious firms and a shortage of elite professional workers able to work across both science and commerce, often as project managers in virtual firm settings.

4.2 Reflexivity, worldviews and theory

4.2.1. Situating the researcher

Hesse-Biber and Leavy (2011: 120) describe reflexivity as the process through which researchers recognise, examine, and understand how their own social background and assumptions can intervene in the research process. Reflexivity in relation to social location and emotional responses has long been a concern of sociologists, but there are multiple other ways to exercise reflexivity in research. Alvesson and Karreman (2007) emphasise the importance of theoretical reflexivity, encouraging researchers to extend their 'theoretical repertoire' and to challenge the assumptions of their original framework. Meanwhile Mauthner and Doucet (2003) highlight the interpersonal and institutional contexts of research, as well as the ontological and epistemological assumptions embedded within data analysis methods. Reflexivity, therefore, can get complicated. But despite the effort involved, I believe mixed methods researchers have a particular obligation to explain their epistemological assumptions due to the varied methods they apply to their research.

I will start by addressing certain subjectivities associated with my career and family life. In particular: I am an insider; I am a woman; I have a husband and children; and I have an agenda to advance the cause of equal opportunity for women in the workplace. I should point out that the very process of undertaking this research reinforced this 'agenda'. When I commenced this study, I did not identify as a feminist; now I do.

I have worked in the field of biotechnology for the past fourteen years and in scientific research more generally for over twenty-five years. I have worked in research institutes, universities and biotech firms, all of the types of organisations examined in this study. Yet my role has not been as a natural scientist, but as a human resources (HR) practitioner. Frequently combining work and study, including this PhD project, my subject matter has not been the science, but the scientists themselves, along with the organisations in which they work. In each of these forms of organisation I have worked closely with biotech managers, many of them female, and many with children. I identify with them on a professional and personal level.

My current and ex-colleagues across the sector were very supportive of my project. They introduced me to potential interviewees and recommended my study to other organisations, which smoothed the way to get questionnaires completed. This was a great advantage. The disadvantages were the *quid pro quo* involved at times, favours to be returned, as well as combining part time work and study so that I could maintain insider status. I am sure that being able to say I was currently working in the sector helped me get a foot in the door.

Towards the end of the study I stopped working to concentrate full time on my thesis. At that stage I faced a different dilemma. Having encountered so much goodwill, would my findings be enough of a 'reward' for those who participated? I did not want to disappoint them. Fine et al. (2003) urge researchers to consider their social responsibilities in deciding how to represent their research, about what to 'say aloud'. As a responsible researcher I should not be writing only for and with friends, but in ways to reshape 'common sense' thinking about gender dynamics in biotech. I reminded myself that my colleagues are researchers themselves, in search of the 'truth' and, sadly, always prepared for disappointing news! Nevertheless, the pressure of expectation was something to be reflexive about. I did not undertake this research as a public relations exercise for women in biotech.

I am also a wife and mother. I am now fifty years old, have four children, the eldest twenty-four, the youngest six. I share parenting and household responsibilities with my husband. We run a fairly egalitarian household; everyone contributes, including the children. My husband is a nurse. He came to this profession after our first child was born, and one consideration was that the hours suited family life. For my husband, family life is the highest priority. There have been times when either or both of us have worked part-time to fit around the family. When I was working for a research institute I took twelve months maternity leave for each of the first three children, but for the fourth, I was working for a biotech firm – that time I returned to work after two months to 'protect' my job.

Apart from regular reflective moments, researchers need to guard against imposing their own expectations and ideas on their product. One strategy I used was to take some time to read the interview transcripts 'on my own terms' (Mauthner and Doucet 2003). In this separate reading of the narratives, I listened for how I responded emotionally and intellectually to that person and recorded my thoughts. For example, how did I respond to the 'burden' of female managers who returned to work two weeks after giving birth to 'protect their jobs' (sounds familiar) or to male managers with stay at home wives (not my husband's lot). I paid attention to issues of both choice and constraint when portraying these managers whose priorities might differ from my own. According to Mauthner and Doucet (2003:410) 'failure to name these emotions and responses might lead them to become expressed in other ways such as how we write about that person'. I used my notes as an on-going reference to cross-check where my assumptions and views could affect my interpretation of the interviewee's words.

The above assumes there is some chance of moving toward a more 'objective' position in relation to the data. I believe reflexivity and transparency are important, but I also believe our ability to be objective is limited, and that in the social sciences all 'facts' are based on interpretation, albeit to a greater or lesser extent. I explore this further in the section below.

4.2.2. Worldviews and mixed methods

My research reflects an appreciation of critical realist philosophy. Critical realists believe 'Capital T Truth is what will be the final opinion, perhaps at the end of history, whilst Lowercase t truths (the instrumental, partial, and provisional truths) are what one obtains and lives by in the meantime' (Johnson and Onwuegbuzie 2004:18). This philosophy situates the research within an open societal system leaving room for alternative explanations than that which can be observed (positivist empirical approach) and that which is an interpretation (constructionist approach). Critical realists have a particular orientation towards methodological pragmatism including mixed methods, because it rejects 'the either-or choices from the constructivism-positivism debate' (Johnson and Onwuegbuzie 2004). Methodological pragmatists value both objective and subjective knowledge, placing the research question as the main focus. Such an approach accepts that different, even conflicting theories and perspectives can be useful, combined with observations and experience, to gain an understanding of people and the world.

According to Denzin and Lincoln (2003:8), 'the combination of multiple methodological practices, empirical materials, perspectives, and observers in a single study is best understood … as a strategy that adds rigor, breadth, complexity, richness, and depth to any inquiry'. In this study I have used a variety of questions, methods and data sources. The major findings derive from two main sources: quantitative data gathered through questionnaires about biotech managers and their jobs; and qualitative data from in-depth interviews with managers. Whilst the questionnaires were administered to organisations, the interviews were held with biotech managers themselves, thereby providing different perspectives on some overlapping subject matter. A mixed methods approach provided the opportunity to simultaneously address a range of confirmatory and exploratory questions (Teddlie and Tashakkori 2009). Essentially the questionnaire was used ***test whether*** women were more likely to be managers in firms than in research institutes, and whether those management positions involved similar responsibilities and conditions of employment. Although a questionnaire cannot be considered completely 'values-free' as it requires both the selection and interpretation of questions, I considered this the best way to gather reliable, generalisable data and to identify patterns and relationships. Meanwhile, the interviews were used to ***explore*** 'how' and 'why' scientists ended up in management positions and differences between the career experiences of men and women. These quantitative and qualitative data are augmented by my own observations from working in the biotechnology sector; primary sources such as position descriptions and organisation charts; interviews with key informants who provided their professional views; and information from company websites.

I take a constructionist view of the qualitative data gathered through my interviews, mindful of 'the socially constructed nature of reality, the intimate relationship between the researcher and what is studied, and the situational constraints that shape inquiry' (Denzin and Lincoln 2003: 13). Distinguishing between the real and the true, constructionists acknowledge that what is 'real' for one interviewee may not be 'real' for another interviewee describing the same event. They further argue the researcher does not report the interviewees' reality but a rendering of it (Charmaz 2003). Nevertheless, qualitative data fulfils the pragmatist criterion of usefulness because it enables development of hypotheses and concepts that offer explanation and understanding. In this study, I argue the Thomas theorem applies: 'if men define situations as real, they are real in their consequences' (Thomas and Thomas 1928:572, cited in Merton 1995:380). In particular, the strength of the perception held by both women and men that to succeed in the race for discovery requires a level of dedication that leaves little time for family has very real consequences for women in academic biotech management.

A fundamental goal of mixed methods research is to yield 'meta-inferences', that is to produce knowledge that cannot be produced using a qualitative or quantitative study independently. Fielding (2012) captured the three main benefits I hoped to gain from mixing methods: illustration; convergent validation; and analytic density. Fielding claims that whilst illustration is not very profound, it serves the purpose of bringing dry statistical data 'alive'. Convergent validation refers to agreement between findings arrived at through different methods, thus allowing stronger inferences. Analytic density is considered an alternative to validity, recognising that findings from different methods do not necessarily increase validity or objectivity, as each finding must be ‘understood in its own terms’. Instead the use of mixed methods, or ‘triangulation’ can extend the scope and depth of understanding (Flick 1992; Fielding 2012).

Good social research must involve a rigorous methodology that withstands scrutiny from a sceptical audience. As a methodological bilingualist (Teddlie and Tashakkori 2009), therefore, I applied the appropriate quality standards to each research strand separately as data was collected and analysed. For example, the quantitative data was analysed and presented with due attention to the normal standards of statistical validity within the post-positivist tradition, whilst the qualitative research was analysed and presented with attention to the standards of authenticity and credibility in the constructionist tradition. In this way, the complexity associated with integrating the data at the interpretation stage was reduced by having first clarified the ontological and epistemological underpinnings of each research strand.

Researchers have noted similarities between critical theory and aspects of feminist theory in organisational analysis. For example, both approaches situate researchers, not as passive observers, but as active participants in the research. Researchers move beyond simply mapping organisational practices and recording organisational members’ interpretations of their experiences; they seek to expose, challenge and remove forms of oppression (Alvesson & Willmott 2012; Sayer 1999). Based on the work of French philosopher Jacques Ranciere, Huault, Perret and Spicer (2014) advocate a moderate form of critical analysis focused on a ‘reconfiguration of the sensible’. They argue that whilst existing claims for emancipation in organisational life are explained ‘through theories of macro-emancipation (which focus on larger social structural challenges) or micro-emancipation (which focus on everyday challenges)’, reconfiguring the sensible provides a link between individual and collective struggles. This middle path sidesteps the criticism of macro-emancipation as elitist and overbearing and of micro-emancipation as insignificant and banal. According to Huault et al. (2014: 36):

> Struggles for emancipation at work are prompted by the desire to *assert one’s equality* in the face of experiences of inequality manifest at work. This takes place through the

creation of dissensus in and beyond the organisation, which is expressed in the *reconfiguration of what is considered to be sensible* (or not) within the organisation. [Italics from original text]

According to the authors, dissent takes many forms and can include leaving the organisation. I view the exit of women from academic science as an act of emancipation calling for a reconfiguration of the sensible in that sector.
Huault et al. (2014:44) suggest that, rather than focusing on doing critical management studies, (that is, identifying inequality in organisations) researchers should engage in a study of 'the critiques of management undertaken by those who engage with management on a daily basis'. In other words, researchers should pay attention to who is dissenting and what they are dissenting from. I have done this through my interviews with biotech managers, seeking their opinions of management practices in biotech workplaces and the impact on their working lives. However, 'simply recognising and documenting inequalities does not equate with emancipatory progress.' A more positive approach is required that provides the 'necessary hope required for emancipatory change' (Huault et al. 2014: 26). This aligns with the view of feminist researchers calling for research that moves beyond the documentation of gender inequality to understanding gender-related change. Martin (2012: 224) suggests such an approach is likely to be 'more helpful than observing familiar inequalities endlessly reproduce themselves in new forms'. My approach in this study, therefore, is to provide 'hope' for reconfiguring the sensible in academic biotech by revealing gender-related change in the commercial biotech sector.

Notwithstanding my feminist standpoint, I recognise the need for a broader critical perspective. Whilst feminists may focus on the shared frustrations of women in bureaucracies (Ferguson 1984) critical theorists argue that drawing attention to what is most acute for female workers may obscure what are common concerns and grievances among many employees, irrespective of gender (Alvesson & Willmott 2012: 110). Indeed I explore how men are also negatively impacted by institutional practices in biotech, either in the same way or in different ways to women.

Although there is no singular concept of a 'feminist methodology' (Harding 1987), certain approaches are favoured by feminist researchers. I used two of these. First, I used gender as a variable in the quantitative research, investigating how management positions, job responsibilities and salaries are horizontally and vertically distributed between men and women. Harding refers to this as feminist empiricism. Second, I encouraged women's voices in my interviews. Feminist methodology has been described as 'gentle', emphasising the importance of trust between the researcher and subject and allowing 'emotions to surface, doubts to be expressed and relationships with subjects to grow' (Charmaz 2003: 272). I found myself collaborating with women in conversation and sharing my own experiences and observations as a woman working in the biotech sector, rather than separating myself as an interviewer.

Given the highly educated, articulate group of female managers in this study, it may seem incongruous that I needed to 'encourage their voices'. Yet, I did get the impression that some insights were shared only because we were 'women in conversation'. One very ambitious and business-focused female CEO [pseudonym Nerida] shared her feelings about pregnancy at work:

> I felt like a fertile, overtly sexual being in front of men. I felt like a pregnant woman, and it almost felt like I was a fraud … being a professional in this space with this big round belly and there I was speaking at some kind of authoritative level to a group of people.

I could identify with her experience. In the ensuing discussion, 'emotions surfaced and doubts were expressed' as together we explored the issue of what would be reasonable concessions to make for pregnant women in the workplace. How would such concessions compare to those we make for others dealing with, say, the distractions and trauma of a divorce or a terminally ill family member:

> [Nerida]: I'd put them all in the same category. I would make sure there are back up systems in place. But I'd judge me harder than I would if I was going through a divorce

> or something else … as my [own] boss I would be more compassionate to the divorce and to the critically ill than I would be to me as a pregnant woman.
>
> [Researcher]: Do you think that's reasonable?
>
> [Nerida]: [Pause] No … yet it's really interesting that as I think about it now … I'm only challenging it now, where I don't normally challenge why I'm motivated … but no, it's not reasonable at all.
>
> [Researcher]: I really understand what you're saying and probably have been very similar.
>
> [Nerida]: Have you? [Laughing]
>
> [Researcher]: Yes but I probably haven't articulated it either.

This was a case of two women exploring their sense of identity together. Whilst I doubt such a connection would have been made with a male researcher, I am equally sceptical that the men I spoke to were as frank with me as they might have been with a male interviewer. There were times when I felt the male managers were guarded about issues of gender. Whilst quite a few males had observed instances of gender discrimination (against women), they all seemed scrupulously clean when it came to their own management practices. One manager, who had been described to me as a 'sexist pig' by a female CEO who had once reported to him, was adamant that when recruiting it never enters his mind if they're male or female, not even for a second. I made a note to self that the art of interpretation requires a healthy dose of scepticism.

Through critical analysis over the course of the project, I became more conscious of the feminist agenda than I ever had been. I found the women's and men's stories differed; that I was studying something much more complex than the effect of organisational form on biotech management careers, and that many of the extant theories of gender and work were, in fact, being played out before my eyes in the Victorian biotechnology sector.

4.3 Quantitative data collection and analysis

The purpose of the questionnaire was to gather data about total staff employed by biotech organisations as well as the specific jobs and employment arrangements of the managers within them. The ‘quantitative sample’ therefore, comprised the organisations themselves (n=30), as well as the managers for whom they provided data (n=401).

The questionnaire comprised two Excel spreadsheets. The first spreadsheet requested basic demographic information about the organisation, including overall scientific and non-scientific staff numbers, gender composition; and employment terms. In addition, for academic biotech, the number of research students was requested. The second spread-sheet gathered more specific information about the biotech managers working in the organisation, including their job title, job scope, employment status, qualifications and gender.

The challenge in gathering information about the biotech managers was to identify and describe variables that were relevant across different forms of organisation. Clarity was also important. For example, in a question asking how many staff were supervised by managers, I had to specify that contractors and consultants were included as ‘staff’ (for firms) and also differentiate between the supervision of staff and students (for research institutes).

I sought feedback on the draft questionnaire from two firm managers and one research institute manager through an initial pilot study. They confirmed the content validity of the questionnaire. In their view, the data I sought was a reasonable representation of the managers’ responsibilities, although I did make some minor changes to the categories on their advice and removed some ambiguities. I also decided to use separate versions of the questionnaire for firms and research institutes. Essentially the same data was gathered from each type of organisation, but the format was tailored so that less explanatory detail was required. The two versions of the questionnaire are included in appendices 4.1 and 4.2.

4.3.1 Sampling organisations

Organisations were eligible if they were headquartered in Victoria and undertaking human biotechnology research as at 30th June 2010. Some of the firms, due to their network structure, conducted research activities interstate, internationally or both. These organisations were still eligible for the study provided key management personnel were located in Victoria.

I applied an inclusive definition of 'biotechnology organisation' for the study. Placing a premium on industry relevance, I included organisations that used synthetic (chemical) scientific sources and methods in their research as well as those that applied biological sources, systems or processes. This inclusion of non-biological science acknowledges the increasing convergence of scientific disciplines in the field of biotechnology (Gilding and Pickering 2011). In my questionnaire, I defined biotech organisation as follows:

1. The biotechnology organisation must be dedicated (more than 50 percent of activity) to research and/or development in the area of human therapeutics, preventatives or diagnostics; and
2. The organisation may be a stand-alone company or research institute, or a division of a larger organisation, the biotechnology department of a university, research institute, or pharmaceutical company.[8]

Using this definition, I estimated that a total of 48 Victorian firms, 13 research institutes and 8 university departments were eligible for the study[9].

My estimate of the Victorian biotech population derives from a number of sources. For firms, I drew on a database compiled by my colleagues Michael Gilding and Vikki

[8] In this case data was not collected for the whole university, research institute or pharmaceutical company, only the relevant department.

[9] The only eligible large Australian (bio)pharmaceutical company, CSL, declined to participate. CSL has more than 10,000 employees worldwide, and would have been included in my study as an example of 'large pharma' rather than as a biotech firm, given its size (Gilding and Pickering 2011). I did, however, interview four managers who had previously worked at CSL and was able to develop an understanding of the organisation through that avenue, along with other 'large pharma' firms in which interviewees had worked.

Bunton for their longitudinal study of the Australian biotech industry (Gilding 2008). Gilding and Bunton used the peak Australian biotech industry body, Ausbiotech's directory of members, university websites (for details of spin-off companies) and other specialist biotech media to develop a comprehensive database of firms from 2003 to 2014. For research institutes, I referred to the list of biotech-related institutes eligible for NHMRC funding body and added the CSIRO which is a Government statutory authority that conducts biotech research but is not on the NHMRC list. For the university population, I reviewed the websites of all nine Victorian universities. Of these, eight separate university departments or institutes were identified as undertaking significant research in human biotechnology according to my eligibility criteria. Table 4.1 shows that 30 organisations responded to my questionnaire, representing 43 percent of the total study population. The research institutes are the most highly represented with 69 percent of the population in my sample; the firms next highest with 40 percent represented and the university departments the least represented at 25 percent.

As indicated in the table, I have grouped together the two university departments with the nine research institutes. I have done this for ease of statistical comparison with firms but I do run separate analyses when there is reason to differentiate them (for example when comparing certain employment conditions). This combination is justified by the fact that university departments and research institutes share many organisational characteristics including an academic culture and student supervision, hierarchical structure and reliance on Government grant funding. Although there are some differences in terms of autonomy, as the university departments are part of a larger institution, I do not believe these differences have a major impact on the issues relating to biotech managers that I cover in this study. For the remainder of this paper, I refer to the combined group as 'academic biotech' unless otherwise stated.

Table 4.1: Participating organisations (returned questionnaires)

Organisation type	Victorian population	Questionnaires sent	Questionnaires returned	Questionnaires returned (academic groups combined)
Firms	48	25	19	19
Research institutes	13	11	9	
University departments	8	7	2	**(11)**
Total	69	42	30	30

I contacted all organisations by phone before sending questionnaires, starting with my own network and seeking referrals wherever possible. Apart from co-operation from some of my own personal contacts and the general problem of people being too busy to complete questionnaires, I suggest the response rate for each of the organisation types reflects two main factors: first, their level of interest or assessment of 'what was in it for them'; and second, their organisational form. On the first factor, I found the firms and research institutes were more interested than the universities. My primary contacts in the research institutes were administrative people who were able to co-ordinate completion of the questionnaires. Most worked in HR and were very keen to discuss the policies and programs they had set in place to promote equal opportunity, including childcare facilities, flexible hours and special research fellowships for women. By contrast, only one of my firm contacts worked in HR, as that is not usually a position that exists in small firms. There was no mention of special programs to promote equal opportunity, although there was a high degree of enthusiasm for my study. This seemed to be related to the view that women were doing well in firms and that this would be a good news story for biotech. In essence, the motivating factor for participation, for both research institutes and firms, was the public relations opportunity, but they had different stories to tell.

After the introductory phone call I emailed the questionnaire, information and consent documents to organisations that had either agreed to participate, or were at least prepared to receive the documentation (refer appendices 4.3, 4.4 and 4.5). In all cases, the questionnaire was addressed to a senior person in the organisation who would have the authority to release the potentially confidential information I was seeking. In firms, this was usually the CEO, CFO or Company Secretary; in research institutes and universities, usually the head of HR, finance or another senior manager. As an incentive to participate, organisations were offered a short summary report with the aggregated, de-identified questionnaire results. Eventually, 42 organisations accepted questionnaires, and of these, 30 were returned.

The second factor, organisational form, impacted primarily on the response rate for the firms and university departments. Five of the biotech firms in the population advised they did not have any qualifying managers at all, so were not sent questionnaires. Others were ‘virtual firms’, run by one manager or through a venture capital company, with only a mobile phone number as a contact. Quite often these firms were un-contactable, and it was unclear if indeed they were still functioning. Hence the representativeness of my firms sample may be higher than it appears because the overall population is probably smaller.

I found it much more difficult to access data from universities than either research institutes or firms, due to their size and decentralised structures. I had to deal with individual departments as there were no central records with the kind of data I sought. The individualistic culture of universities meant that information often resided with particular individuals, usually either the Head of Department or her/his staff. These people were generally too busy to piece together bits of information to answer my questionnaire. Data on budgets was particularly difficult to obtain as it related to grants awarded to individuals across the whole department, each person holding their own details. Supervisory responsibility also seemed unclear – I was advised that completing the questionnaire would involve asking each manager who they supervised, what their budget was and most other factors about which I was enquiring. I gave up on chasing universities because of the time and complexity involved. Whilst seven university departments agreed to provide data, only two actually followed through and returned their questionnaires. This difficulty in accessing information was the first sign of the differences in culture that I was to find in my interviews, that is, the contrast between the tight administrative control and 'united front' of firms and the generally lower priority, 'do it yourself' administration in academia.

The academic organisations ranged in size, although they were all large compared to the biotech firms. The median number of staff in this group was 190, the smallest with 100 staff and the largest with 639 staff. Unlike the firms, they did not have different business models or 'market' sizes that might confound the statistical analyses. They were all well-established, traditionally hierarchical in structure and generally representative of the academic sector more broadly.

Throughout this study I refer to firms as 'commercial biotech' or 'firms' or more generally as the 'commercial sector'. There were more 'within group' differences between the firms than between academic organisations. In terms of staff numbers, the firms were generally small. The median number of staff was nine, the smallest firm with only one staff member, and the largest with 78 staff. However, for biotech firms, the number of staff is not necessarily the best indicator of 'size' or management accountability. A more relevant measure is 'market size' due to variability in outsourcing activities which can impact on the number of in-house staff but may or may not reflect the number of products in development or a manager's responsibility for the performance of external contractors or partnerships, or accountability to investors. I therefore differentiated firms by market size to explore the effect on the type and scope of jobs undertaken by managers and any differences in their employment arrangements.

To calculate market size, I used a method that incorporates revenue and assets as well as staff numbers, developed by Gilding and Bunton (forthcoming) [10]. Their size criteria

---

[10] Gilding and Bunton draw their criteria from the international database MintGlobal, published by Bureau Van dijk Electronic Publishing. The monetary categories are converted from USD to AUD at the Australian Reserve Bank exchange rate at 30th June 2010. Although MintGlobal criteria only requires one of these classification criteria to be met, the Gilding-Bunton method requires two to be met, along similar lines to the Australian Securities and Investments Commission (ASIC) sizing protocol. The ASIC sizing protocol is not used as it has only two categories, large and small, so therefore does not provide the same level of differentiation between firms as the three MintGlobal categories. The Australian Bureau of Statistics also uses size criteria but refers to staff numbers only.

are listed in Table 4.2, with organisations required to satisfy at least two of these to be classified as small, medium or large. Data was gathered from the annual reports of listed companies and from documents listed on the ASIC website for unlisted companies. Where unlisted companies were not required to lodge a financial report with ASIC due to their small size, they were classified as small.

Table 4.2: MintGlobal company size classification criteria as at 30th June 2010

Criteria		Organisation Size	
	Large	Medium	Small
Operating Revenue	>=AUD $15.3M	>=AUD $1.5M	Less than AUD $1.5M
Total Assets	>=AUD $30.7M	>=AUD $3.1M	Less than AUD $3.1M
Employees	>=150	>=15	Less than 15

As well as data relating to size, I obtained details of the companies' research strategies, business models, public listing status (ASX listing), age, and head office location. Most of this additional information was straightforward to gather from websites, although some judgement was required in categorising the firms' scientific strategies and business models. Where the category of business model was not clearly evident, I sought confirmation from a professorial level scientific researcher with experience in the biotech field.[11]

This additional information about firms was used for two purposes. First, it was used to confirm the representativeness of the sample within the wider Victorian firm population. Second, it provided context for the analysis of the management data. For example, it allowed me to run statistical tests on, say, the relationship between company size and the gender of managers, or company business model and the salaries of managers.

These criteria were not used because they do not capture the extent of outsourced commercial activity or value of intellectual property assets in firms.

[11] The expert mentioned is the researcher's PhD supervisor who has over 50 years' experience in scientific research and is on the Board of Australia's premier research organisation, the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

Table 4.3 compares my sample of 19 firms with the total population of Victorian biotech firms[12]. This shows that overall my sample is highly representative of the population. It has a slightly higher percentage of medium and large firms, and fewer small firms than the broader Victorian biotech population, but this is not a substantial difference. The firms in my study are slightly younger than the population sample, and more of them have their own head office, although there is not a substantial difference in either of these factors. The levels of ASX-listing in my sample are also very similar to the population.

Table 4.3: Comparison of sample and overall population of biotech firms

Sample/Population	Mean Age of firm (years)	ASX-listed (%)	Own Head Office (%)	Firm Size (%) Small	Medium	Large
Study Sample (n=19)	9	9 (47)	14 (74)	13 (68)	4 (21)	2 (11)
Study Population (n=48)	10.5	22 (46)	32 (67)	38 (79)	6 (13)	4 (8)

4.3.2 The Managers

The questionnaires from the 19 firms provided data on 86 managers, whilst the questionnaires from the 11 research institutes provided data on 315 managers. In defining a 'biotech manager' for this study, I wanted to capture the full range of management roles across different types of organisations, in order to contrast and compare. This included both leadership and management, terms which are used interchangeably in the workplace. Such blurring reflects the overlap and interdependency between management and leadership functions; managers are required to lead and leaders are required to manage (Kotter 1990). Definitions of leadership vary widely, often focusing on vision, inspiration, relational influence and

[12] Size data for the remaining Victorian firms was accessed from the Gilding-Bunton database.

empowerment, whereas management is most often referred to in terms of organisational functions such as planning, organising, leading and controlling organisational resources (Toor 2011; Kotter 1990; Kotterman 2006; Simonet and Tett 2012). My approach is consistent with that of Smith-Doerr (2004) in her biotech study. She did not provide a singular definition of manager**,** referring variously to 'leadership of a laboratory group', 'directing scientific projects or 'managing the firm in some capacity', and 'supervising her own lab'.

As I used a questionnaire to gather information, I needed to define biotech manager for data collection purposes. In doing so, I recognised that in small networked biotech firms, 'leading and controlling resources' can extend beyond the immediate organisation and may involve the management of contracts rather than people. It also may involve part-time or contract employment. Accordingly, I defined biotech manager as follows:

1. The biotech manager must work at least one day per week as a direct, indirect or contracted staff member, reporting to the participating biotech organisation, in a role for which a science or medical and health science qualification is a prerequisite;
2. The biotech manager is eligible for the survey if they:
    a. directly supervise at least one person in the organisation; or
    b. directly manage at least one outsourced provider of contract or clinical research services; or
    c. manage anyone in the position of a) or b); or
    d. are members of the senior management team of the organisation.

Although I am mindful that firms and academic organisations may not have reported all of their eligible management positions, I am confident that any omissions were kept to a minimum. In follow up calls to organisational representatives, I usually 'talked them through' the eligibility criteria. For firms, I stressed that managers with responsibility for managing outsourced contracts should be included even if they did not have direct people supervisory responsibilities. I wanted to ensure I captured some kind of measurement of the 'relationship management' that this activity represents.

This was a well understood concept within firms and from the completed questionnaires I could see that managers were included on this basis.

In the academic organisations, there was a fairly consistent view that management positions were associated with staff supervision and began at the project leader or lab head level (with some variation in titles across research institutes and universities). There was very little formal 'supervisory' activity below lab head, and management of 'outsourced' contracts tended not to be relevant in academic biotech. Although interviews with managers often emphasised scientific thought leadership over management in the academic sector, in this study I have focused heavily on the management and supervisory activities of scientists. Whilst my experience as an HR practitioner has perhaps influenced this direction, there is also a practical rationale. Medical research occurs in laboratories staffed by people. Thought leadership and management, therefore, are not mutually exclusive but complementary. I designed this study with the knowledge that despite some academic managers' abrogation of, or resistance toward management responsibilities, thought leadership rarely comes without the need also to manage the scientific contribution of others. Indeed, my findings suggest that differences in how academic and commercial biotech managers 'manage' provide key insights into the different outcomes for women across these two sectors.

4.3.3 Comparing 'apples and oranges' – the job factors

The purpose of the questionnaire was to enable an assessment, not only of the representativeness of women and men in management across different forms of organisation, but also to shed light on the nature and scope of those positions. It is difficult to compare the responsibilities of, say, the CEO of a five-person publicly listed biotech firm with the director of a research institute with five hundred staff. This is complicated by the extensive contracted services managed through firms that can belie their 'size' whilst other firms may be more akin to a research 'project' within a research institute.

My method for comparing 'apples and oranges' is based loosely on an analytical job evaluation method developed in the 1920s, commonly referred to as a point or point-factor system. This system is still in common use today, although usually within large organisations, and usually for the purposes of setting pay rates ([Benge 1926] in Ingster 2008). Research has shown point factor systems to be a very reliable form of job evaluation (Heneman 2003).

Job evaluation involves the preparation of a detailed job description which is assessed against a number of written standards, known as 'factors'. The factors are weighted according to their value to the organisation, with points assigned to indicate the degree to which a job possesses each factor, and the total point score determining the overall 'level' or value of the job (Chicha 2007; Lawler 1986; Heneman 2003; Beatty and Beatty 1984). The four most commonly used job evaluation factors are variants of qualifications, effort, responsibility, and working conditions (Remick 1984). These factors are generally considered 'essential and sufficient for evaluating all the tasks performed in an organisation, regardless of which economic sector the enterprise belongs to' (Chicha 2007).

I collected data based on these factors. Given the questionnaires were to be completed by organisational representatives, and not the managers themselves, information about job factors could only be gathered at a relatively high level of detail. Therefore, an a priori approach was taken, where I specified in advance which job factors I considered common to all biotech management positions, to enable comparison on common dimensions. This factor selection was subjective although not arbitrary (Pierson, Koziara, and Johannesson 1984). The initial reference point was my personal experience working in the biotech sector and the management position descriptions I had available to me from both firms and research institutes. As previously mentioned, I also sought feedback through an initial pilot study. The final questionnaire included the following five job factors to represent the latent construct of 'job responsibility':

1. Number of staff reporting direct to manager;

2. Overall number of staff (and contractors) reporting through to manager (and for research institute and university managers, the number of research students supervised);
3. Size of budget managed;
4. Number of contracts managed; and
5. Membership of the most senior management team.

In addition, information was gathered on the highest level of scientific qualification. Qualification details were used as a proxy for 'knowledge and skills'. The minimum qualification for eligibility was a science degree but most managers were more highly qualified with over 98 percent of research institute managers and 69 percent of firm managers holding PhDs[13]. I did not collect information about working conditions or effort through the questionnaire, preferring to explore these issues in depth through the interview process.

Claims of gender inequities embedded in economic institutions, and particularly the issue of 'comparable worth' have led to extensive reviews of job evaluation schemes (Remick 1981; Acker 1989). Links have been established between wage discrimination and traditional job evaluation schemes, although most reviewers recognise that job evaluation in and of itself is a value-free technique and that 'values are added when factors are chosen, weights assigned, and jobs evaluated' (Pierson et al. 1984:136). In particular, reviews have found that the sub-factors used for job evaluation appear to be oriented to predominantly 'male' jobs, and that sub-factors associated with predominantly female occupations have been overlooked. As a result, despite the ideological basis of 'equal pay for equal work', women continue to be underpaid when they perform comparable work (Treiman and Hartman 1981; Remick 1981; Figart 2000; Chicha 2007). I maintained an awareness of these criticisms of job evaluation during the design of the questionnaire, analyses and interpretation of the data collected, as described below.

[13] Or medical doctor qualifications, including MBBS or MVet or combined PhD/MBBS/MVet

Supervision and contract management

If we consider ‘manager’ in traditional terms, data on the two job factors related to ‘number of direct reports’ and ‘overall staff reports’ could give an immediate impression that managers in large bureaucracies have the greatest responsibility. Lawler has emphasised the hierarchy-reinforcing nature of traditional job evaluation, where large numbers of points are typically assigned to factors involving level of responsibility, and responsibility has been equated with number of reporting relationships (Lawler 1986). Meanwhile, ‘organising’ has not been equated with supervision. This distinction between organising and supervising has traditionally advantaged men in job evaluation (Burton 1988; Chicha 2007) and reflects the values of society as a whole, not just employers. Supervisors traditionally earn more than those they supervise (Remick 1984).

These aspects of job evaluation are at odds with knowledge and high-technology work, where the last thing that is needed is a rigid hierarchical structure (Lawler 1986). To counter this, I included ‘contract management’ as a job factor in the questionnaire. In small firms, where much of the research and development work is contracted externally, ‘supervision’ is more likely to take the form of ‘organising’. I also guarded against ‘double-counting’ supervision by avoiding the aggregation of similar job factors, such as ‘direct’ and ‘overall’ supervisory responsibilities (Burton 1988).
The differences between traditional and ‘new economy’ management were reflected in the questionnaire responses. For the 315 research institute managers, contract management data was provided for only 153 (49 percent). This missing data was revealing. On further investigation, I found that even those research institutes that had reported on this factor had misinterpreted my definition, which stated ‘responsibility for managing activities outsourced to external parties, specifically science-related consulting, contract or clinical research services’.

In retrospect I realise that, to avoid confusion, it would have been better not to have included that factor on the research institute questionnaires. Contracts managed in firms differ from contracts managed within research institutes, where they generally involve managing grants that support work being done ‘in-house’. So essentially, in firms ‘managing contracts’ was a de-facto for managing *extra* staff, whilst in research institutes it was essentially an administrative function involving writing applications, reporting against milestones and managing *existing* staff. This questionnaire response meant I could only compare this factor between women and men within firms, where data was provided for 51 of the 86 managers (59 percent).

Budget

Budget is another factor that has been associated with higher job evaluation scores, and traditionally to the career advantage of men (Treiman and Hartmann 1981; Acker 1989). I collected data on managers’ annual operating budgets for the 2010 financial year. I was interested to explore the relationship between budget and contract management for firm managers and budget and research grants in academic biotech. There was also missing data on this job factor. For research institutes, budget size was reported for 159 of 315 managers (50 percent) and for firms 60 of 86 managers (70 percent). Those completing questionnaires in both organisation types reported this data was difficult to access from their finance departments, either due to confidentiality concerns, lack of clarity around budgets or simply because the finance staff were too busy to help. I had anticipated some of these problems, so provided set categories (budget ranges) against which organisations could report, rather than asking for specific budget amounts. I took guidance from my pilot study participants on what those ranges should be. Despite some of the problems gathering data for this job factor, enough information was provided to undertake some useful analyses.

Membership of most senior management team

The final job factor included in the questionnaire, membership of the senior management team, simply required a ‘yes’ or ‘no’ answer. There was virtually no missing data on this job factor. I have used these data with caution given that in some small firms every manager is on the management team. Nevertheless this is useful information to assess the relative influence of women and men within organisation types although not for comparison across organisation types.

Salary and employment conditions

In addition to job factors, I also gathered data on managers' salaries, their contracted hours, tenure, and type of employment contract. This data enabled me to run analyses on which job factors or combinations of factors are best rewarded in each of the organisation types, and to compare how men and women are rewarded within and across organisations. I could also examine which types of roles tended to be part-time or full-time, and the job security associated with the various roles.

I provided set salary ranges against which organisations could report. Like budget data, salary data tends to be highly confidential information that organisations may be reluctant to share and in my practical experience the response rate is likely to be higher if ranges are provided. I set the ranges to correspond with publicly available salary scale of the University of Melbourne, but also added higher level categories to cater for some very highly paid firm executive managers. Most research institutes base their salaries on university scales, whilst in my experience firms tend to rely on benchmark data from the local biotech sector, but also take university salaries into account in this process. Therefore, the university salary scales were likely to be a relevant basis for my categories. I structured the salary ranges to be continuous to ensure all salary levels could be accommodated, however I did not set even salary ranges for two reasons; firstly because the university salary scales for different classifications are not even, and secondly, because the higher salary ranges had to cater for very wide differences in the salaries of some biotech managers (according to salaries reported in firm annual reports). Organisations responded well to this question, with salary data reported for 239 of the 315 research institute managers (76 percent) and 84 of the 86 firm managers (98 percent).

4.3.4 Quantitative analysis

In quantitative research, tests of statistical significance are used to provide reasonable certainty that relations between variables did not happen by chance. For this purpose, I used the statistical computer program SPSS. I have presented descriptive statistics for most of the data captured through the questionnaires. In addition, I conducted inferential statistical tests to identify differences between groups and to identify associations or relationships between variables.

Because the data I collected through the questionnaires covered managers from a range of seniority levels, and from very different organisation sizes and types, virtually all of the management data was skewed (not normally distributed) and therefore did not meet the assumptions for parametric tests. Accordingly, I used primarily non-parametric tests such as chi-square, Mann-Whitney U, and Spearman rho to analyse the data. For the same reason, I have presented most descriptive statistics using the median and interquartile range rather than the mean and standard deviation which are used to describe normally distributed data (Morgan, Leech, Gloeckner and Barrett 2011).

The post-positivist view recognises the impact of the researcher in interpretation of quantitative data and it has been suggested that the best way to combat bias is to provide enough evidence for the reader to make inferences that are similar to the investigators. Such evidence includes reporting the size of correlations and effect sizes, and ensuring the intensity of inferences is credible in relation to these (Teddlie and Takkashori 2009: 299-300). I have endeavoured to provide such 'evidence' throughout my analysis.

4.4 Qualitative data collection and analysis

4.4.1 Sampling managers

Whilst sampling for the quantitative research focused on achieving representativeness in the population and gathering breadth of information, interview participants were selected for their potential to generate rich data on the varied career paths of biotech managers. By examining their stories, I wanted to make analytic generalisations about ‘fit’ (or otherwise) with existing theories, whilst also allowing new themes or theories to emerge from the empirical material.

I used multiple purposive sampling techniques to select the managers (Teddlie and Tashakkori 2009), applying the same qualifying definition of ‘biotech manager’ as for the questionnaire. Based on my experience with the questionnaire, I expected the best way to reach potential interviewees would be to start with my own network. Therefore I asked managers I knew to provide me with the names of other managers who might provide insights for my study. This ‘snowballing’ sampling technique (Coleman 1958-59) provided me with an informal sampling frame from which I could select my interviewees. I categorised the managers in my sampling frame by gender, the types of organisations they had worked in, and the types of roles they held (as indicated by my initial contact and publicly available information from the internet). This exercise gave me an early indication of the range of different biotech managers I could interview.

My goal was to select a ‘maximum variation’ sample reflecting the diversity of roles in the sector, in order to hear different perspectives and achieve balance (Teddlie and Takkoshori 2009; Rubin and Rubin 2012). I started with a few managers who had been enthusiastically recommended as likely to be interested in my study. Following those few, in order to maximise diversity, I contacted participants sequentially. The snowballing process continued as each interviewee suggested new managers whom I could add to my sampling frame. This expanding list gave me greater choice as I proceeded through the sampling process.

In total, I held in-depth interviews with 26 biotech managers, 20 of whom held or had recently held roles as biotech firm managers, and 11 of whom held or had recently held roles as research institute/university managers. Five of the managers had worked as managers in both firms and research institutes, with three of these holding firm and academic roles concurrently. These five managers have been included in both sub-sets. It should also be noted that although I treat the sample of interviewees as quite separate to the quantitative data for analyses, 19 of the 26 managers I interviewed were also included in the quantitative data as they worked for organisations that participated in that part of the study.

To complement the formal interviews I also had informal conversations[14] with ten professional informants, including three HR managers, six other biotech managers, and a venture capitalist who all provided important insights and background information. These individuals provided additional context and clarification, and I have integrated the information they provided throughout the findings chapters, but without giving them 'names' as I did not explore their personal career stories, only their general views about the sector.

The formal sample includes 17 female and 9 male managers. I provide a career profile on each individual at the beginning of chapters six (for firm managers) and seven (for academic managers) and therefore only a general overview here. I favoured interviewees with cross-organisational experience so they could provide a comparative view. Most managers had held roles in more than one biotech organisation, often a mix of research institute and firm, and quite a few had held positions in large pharmaceutical companies. Although I did not collect quantitative data from 'large pharma' organisations, I was able to gain insights into that work environment from eleven of the managers interviewed. Table 4.4 shows that nineteen of the twenty-six managers were able to compare their work experiences across different types of biotech organisations. Only three of the managers were able to compare working in research institutes and 'large pharma', which was the least common combination.

[14] Informal conversations included initial discussions seeking advice from biotech managers about the feasibility and potential interest in my study, seeking referrals to other managers and organisations and seeking advice about the sector generally. These interviews were not recorded but written notes were taken. Information from these meetings is not included in the thematic analysis of interview data but is used more generally to provide context.

Table 4.4: Organisational experience of interviewees

Organisational Experience	Women	Men	Total
Research institutes only	4	1	5
Firms only	1	1	2
Large pharma only	0	0	0
Both research institutes and firms	4	4	8
Both research institutes and large pharma	0	0	0
Both firms and large pharma	6	2	8
All three of research institutes, firms and large pharma	2	1	3
Total	17	9	26

All interviewees had line management responsibilities. Of the 26 interviewees, 13 (8 women and 5 men) had held the 'top job' either as CEO of a firm, director of a research institute or head of a university school. Of the 20 firm managers, 15 were 'C-suite' managers. I define 'C-suite' as either a CEO or COO, or a director/vice president who is also a member of the most senior management team. Of the 11 academic managers, three held executive roles at the level of director, deputy director and head of school, whilst a further six held senior management roles including division head, centre director, head of department, and business development executive roles. The remaining interviewees held middle management roles. The interviews did not produce the systematic kind of information that would allow a comparison of interviewees' levels of seniority, especially across different types of organisation. I don't presume that all of 'top jobs' were of similar 'status', nor even that those managers who had not held the top roles had lesser roles. For example, some 'deputy directors' or 'vice presidents' may have more responsibility than some CEOs –

understanding the scope of these different roles across organisations was one of the aims of my study.

All but four of the managers had children, although one of the four was pregnant and another planning a family. Generally I preferred to interview managers with children as I wanted to explore how this impacted on their careers. However, I did not stipulate this when I rang managers, because I did not want to appear uninterested in their career if they told me they did not have children – because, in fact, I still was interested in their career! Work-life balance is equally important for those without children, and I wondered if people without children managed this better. One of the managers I interviewed actually stressed the importance of considering the needs of employees without children – she had a gay woman reporting to her who was very involved in hockey. She acknowledged this commitment as valid and important, commenting that companies tend to accept family commitments but can be less understanding about other legitimate personal goals.

In a relatively small sector, it's difficult to avoid interviewing people from the same social circle. As an insider, this is complicated by actually knowing, or knowing of, many of the potential interviewees. Where possible I avoided interviewing managers I knew personally but, in the end, I did interview four managers with whom I had worked previously. I included these managers because I knew they all had extensive experience, and were able to compare across organisations. It is difficult to surmise what impact this prior relationship had on the interviews. Each of them shared some very frank opinions with me that I do not think would have occurred if they felt guarded or uncomfortable. Because I worked with them in a consulting capacity issues of power and influence in the interview (from either side) are likely to have been less than if it had been a line management relationship.

After I had completed about three-quarters of the interviews, I realised that the men's stories were sounding very similar to each other, whilst the women's stories involved common threads but more diverse career paths and family complications. I had reached 'saturation point' with the men, but needed more rich data from the women.

For the remainder of the interviews, therefore, my purposive sampling resembled the ‘theoretical sampling’ approach that underpins the grounded theory methodology associated with Glaser and Strauss (1967). According to grounded theory methodology, participants are chosen specifically for their potential to add to emerging ‘grounded’ theories identified by the researcher early in the research process. Perhaps in contradiction to the intent of the original method, I adopted ‘late stage’ theoretical sampling. This aligns with the approach recommended by Kathy Charmaz (2003) to conduct theoretical sampling later in order that relevant data and analytic directions emerge without being forced. As a result of this sampling approach I interviewed more female than male managers.

4.4.2 The interviews

Of the 26 interviews, 13 were held in cafés and 13 in offices or meeting rooms, with two of those offices based in CEO’s homes. The cafés meant plenty of annoying cappuccino machines to negotiate during transcription. I was aware of this noise problem early, but it seemed less formal to meet in a café, where I could more easily develop rapport, and hopefully glimpse the managers’ ‘shoes off’ self without distractions from the office. Also, at least I could buy them a coffee as a thank-you. Essentially, I was just grateful for their time, so let the managers choose where they preferred to meet.

The interviews were semi-structured. They covered the managers’ career histories, work environments, family responsibilities, and their thoughts about the attractiveness/prestige of their chosen biotech roles. An indicative list of questions is attached at appendix 4.6, although these were used as a guide only, and not every question was asked in every interview.

My approach to the interviews integrated deductive and inductive logic. The literature was used with caution to help frame the main questions (Rubin and Rubin 2012), yet I also remained flexible to other topics. Although I had an interest in ‘testing hypotheses' derived from existing social theories, I was just as keen to develop new theoretical perspectives. I therefore allowed the interviewees to guide the data collection and introduce topics they deemed meaningful, rather than talk about subjects of little interest to them (Charmaz 2003).

I asked open-ended questions like, 'Can you walk me through your career?' With the literature in mind, I then probed for particular details at various points in their story. How did you get the job? How was the company doing? What was the work environment like? Often I did not need to ask, the managers simply volunteered this information as a natural progression of the conversation. These very general questions enabled me to explore certain feminist and organisational theories and concepts. For example, asking managers how they got their job could provide information about the comparative advantages of networking or formal application processes for women (Reskin and McBrier 2000; Smith-Doerr 2004) or asking how the company was doing could provide insight into the 'glass cliff' phenomenon (Ryan and Haslam 2005).

Assurances of confidentiality and de-identification of interview data were given and have been strictly followed. The biotech sector in Victoria is relatively small and managers within it could be identified depending on the information revealed. To protect their identities I have used pseudonyms in the findings chapters, and given serious consideration to the balance between providing context and revealing identifying information. A Consent Information Statement including a statement of confidentiality was issued to all interviewees (appendix 4.7), and consent was obtained in writing via an Informed Consent form (appendix 4.8), in accordance with the ethics approval granted by Swinburne University of Technology (appendix 4.9).

4.4.3 Qualitative analysis

I took comprehensive notes during the interviews, which were also audio-digitally recorded. I reviewed my notes between interviews, familiarising myself with any emerging themes, but stopping short of deliberately introducing them in the next conversation. Instead I wanted to see if those same themes emerged naturally.

I was very conscious of my insider status as I conducted the interviews. In particular I was concerned about being ‘overly intuitive’. Often during the managers’ career stories I could relate their experiences to those of other biotech managers I knew or situations I had observed. Whilst I captured these thoughts in a diary for later reference, I did not want to allow ‘potential themes’ that I recognised early, or which might play to my preconceived ideas, to drive the course of the interviews to come. For this reason, I did not transcribe the interviews until after the last one was completed. Putting some distance between the personal connection developed during the conversation and the transcription and analysis also made it easier to focus on the actual words spoken and ‘make the familiar strange’ (Glaser and Strauss 1967; Corbin and Strauss 1990). When I compared my hand-written interview notes to the transcriptions I noticed how my note-taking had been influenced by the managers’ professional persona. For example, one CEO looked and sounded confident in her large, comfortably furnished city office. She laughed a lot. So it was revealing later to read several references to her vulnerability in the transcript:

> I never believed anyone who said anything good about me anyway … She [a recruiter who offered her a management role] would have asked five other people [before me] and they would have said no.

Interestingly I had not included a reference to this passage in my notes. I don’t know why, but suspect that I was busy engaging in conversation, or maybe I did not want to appear to be taking notes about vulnerabilities. There were other similar examples where I was surprised at what I ‘heard’ in the data later.

Given my preconceptions of the sector and many of the personalities within it, I listened carefully to the transcripts to minimise missing important themes. Initially I coded in three ways. First I applied ‘open’ qualitative codes to key comments and observations. Second, I applied codes that represented my personal responses from listening 'on my own terms' (Mauthner and Doucet 2003). Finally, I also coded for relevance to existing theories that I was aware of at that time, both for consistencies and inconsistencies, or 'breakdowns', in understanding (Alvesson and Karreman 2007). Following the initial coding process, I then organised the codes into broader categories for further investigation, re-checking the literature to expand my theoretical repertoire when necessary. Whenever I discovered an emerging theme, I looked for possibilities of integrating the quantitative findings to complement and balance these interview narratives. I explore these themes more fully in the chapters that follow.

I used NVivo 10 qualitative software for data storage, coding, and to assist with theme development. I only used the software for the qualitative data, having used SPSS to manage the quantitative data. The NVivo software helped me manage the large amount of empirical material emanating from the interviews and made it easy to replay passages of audio when required. It was a tool for analysis, searching for terms and grouping information, but the job of interpretation was mine.

4.5 Integration and inferences

In a content analysis of mixed methods articles, Bryman (2006) finds that often the findings from mixed methods studies are not integrated at all, but presented as two distinct components. In these circumstances one method often assumes primacy over the other(s). One of the reasons for this is likely to be the difficulty associated with integrating data from different research strands. In particular, when there are contradictory findings that reflect epistemological differences, these can usually only be resolved conceptually, not empirically (Fielding 2012).

My general approach was to analyse the qualitative and quantitative data separately, then integrate them in the interpretation phase of the research project. This was not a linear process; in fact it was messy. The questions explored through the two research strands were complementary but not always suitable for integration. In many cases I used them for illustration, to provide a 'rich picture'. Sometimes the qualitative illustrated the quantitative, and vice versa; I endeavoured not to privilege one set of data over the other but to place dissonant data 'in conversation with one another' (Hesse-Biber 2012: 140). For example, there is a view in commercial biotech that women are doing well in firms, and this view was often held by the women I interviewed. It was part of the reason why some of them participated; they wanted the good news story to be told. On the face of it, the quantitative data supported this 'success' story – women were more highly represented in firm management than in academic biotech management. Yet tales of 'basket case' companies and exhaustion raised questions about the extent of this 'success'. Here were two versions of a story that needed to be placed 'in conversation'.

One particular exercise in integration led to developing a 'typology of managers'. This typology became a useful way to analyse data and present the findings as I discuss below.

4.5.1 A typology of biotech managers

During the interviews, I heard numerous comments to the effect of 'women tend to congregate in development jobs, especially clinical and regulatory affairs' or 'women are good at project management and multi-tasking'. This qualitative information suggested there may be job segregation within the overall occupation of biotech manager. It led me to consider how I could triangulate this finding with the quantitative data.

I had requested manager titles in the questionnaire, initially to see if they would indicate different 'levels' of management. There was such a diversity of titles in firms that this attempt proved fruitless. However, as it eventuated, the manager titles, particularly in firms, gave a strong indication of what a manager actually does. For example, 'vice president development and regulatory affairs' indicated a manager whose primary function was to manage the development program for a product(s), and was clearly a different role to 'research director' which involved managing laboratory-based research. The academic managers' titles were more generic, with 'project leader' and 'laboratory head' the most common. Whilst these titles were not rich with description, this was telling in itself. Most of the managers in these organisations were, in fact, concerned with the direct management of laboratory-based research.

Combined with the information from interviews, manager profiles on company websites, position descriptions, and my own general knowledge of the field, I was able to use this title information to develop a typology of managers. I established the following categories: *'research', 'development',* and *'corporate'* managers. I coded managers into these categories primarily by referring to their titles, but occasionally after clarification from the organisation reporting the role. There were only a few 'generic' titles reported by firms, such as 'project manager' that required clarification. This was an example of how different types of data could be integrated to show convergent validation, as well as increased analytic density and understanding. I used a typology originating from the qualitative data for the statistical analysis of the quantitative data. The statistical analyses, did, in fact, show that women congregated in development roles within firms, as suggested in the interviews. I was also then able to test for the impact of this segregation. I could compare job factors between, say, managers working in development and research roles, for example, 'number of contracts managed by men and women working in development positions in firms'. I could also compare manager job factors between research institute and firm managers, limiting that comparison to just managers working in, say, research management positions, for example 'salaries earned by female research managers in research institutes compared to female research managers in firms'. This typology also provided a useful framework for differentiating the qualitative sample. The type of management roles they held provided important context to the managers' narratives.

4.6 Chapter summary

In this chapter I have located my study in the Victorian biotech sector and located myself as a researcher within that. I have explained my worldviews and alignment with critical theorists who see themselves as active participants in the research. The change I seek is a 'reconfiguration of the sensible' in relation to women's place in the management of science, using biotech as an exemplar. I have explained that I value both objective and subjective knowledge in developing a deeper understanding of people and the world. I have explained my data collection and analyses methods, my questionnaire data comprising the quantitative part of this study and my interviews comprising the qualitative part. I have also explained how a mixed methods approach has enabled me to integrate different research strands to provide a rich picture of biotech management.

The next three chapters form part two of this thesis where I present my findings.

5. Managers of what?

In this chapter I present the key finding that women scientists in biotech firms are more likely (over 3.5 times in my sample) to be managers than women scientists in academic biotech. I draw on my quantitative data to demonstrate this is due to two main factors. First, there are relatively more management jobs available in the commercial sector than in the academic sector. Second, relative to men, a higher proportion of women scientists reach management in firms than in academic biotech. To understand what drives these factors requires an examination of both the management jobs and the managers themselves.

I present this chapter in four sections. In section 5.1 I present the main statistical finding that frames this thesis. In section 5.2 I focus on the commercial sector. I describe how firms adopt different business models that lead to a wide variety of corporate, development and research management roles. I also demonstrate how the network form of organisation and relatively small size of most Victorian biotech firms determines how management work gets done, including the use of outsourcing and employment of part-time managers. In section 5.3 I focus on the academic biotech sector. I discuss how research institutes provide an abundance of specialist research management jobs but limited opportunities outside that core function. In contrast to the variety offered by firms, these jobs are differentiated, not by function, but by increasingly higher expectations of personal research achievement, management of in-house teams and science administration. In section 5.4, I compare salaries and rewards across the two sectors. I find that both women and men working in firms earn significantly more than their academic counterparts, demonstrating that it pays to 'take off the white coat' in biotech.

5.1 Being a manager

In this section four key quantitative findings that underpin this thesis are presented. First, the ratio between women and men managers is similar in both the commercial and academic biotech sectors. Second, the ratio of women scientists in academic biotech is greater than in firms. Third, there are relatively more management opportunities in firms than in academic biotech. Fourth, relative to men within each sector, women are more likely to be managers in firms than in academic biotech.

Table 5.5 shows the gender distribution of managers in my sample. Of the 86 managers in firms, 24 (28 percent) were women and of the 315 managers in academic biotech 90 (29 percent) were women. I make two observations about these data. First, the ratio of women to men managers was relatively low in both sectors. These data reflect worldwide trends of vertical segregation in the corporate world and in academic science. Interestingly, both sectors had a lower percentage of female managers than the Australian average of 34 percent across all sectors (ABS 2010a). Whilst this is consistent with public perceptions of women's under-representation in the management of academic science it is at odds with the apparent ubiquity of women managers in the commercial sector.

Table 5.5: Managers within organisation types by gender

Organisation Type	Women (%)	Men (%)	Totals
Firm	24 (28)	62 (72)	86
Academic biotech	90 (29)	225 (71)	315
Totals	114 (28)	287 (72)	401

The second observation from Table 5.5 is that the representation of women in management appears relatively even *across* these two sectors. However, I argue this high-level comparison belies important gender dynamics within each of the sectors. Aggregate level data can obscure horizontal segregation and structural characteristics that impact on the management opportunities within occupations. That is the case with these data so I therefore provide context below.

The gender distribution of scientific staff in my sample is shown in Table 5.6. Of the 204 scientists working in firms, 96 (47 percent) are women and of the 2189 scientists working in academic biotech, 1348 (62 percent) are women. A chi-square test shows the relationship between gender and type of biotech organisation is statistically significant (x^2 =16.445, *df*=1, N=2393, *p*=.000), with women over-represented in academic biotech compared to commercial biotech.

This gender profile in the academic sector reflects the worldwide horizontal segregation of science where women are over-represented in biology compared to other SET disciplines. With a more even gender balance, the science workforce in the commercial sector likely reflects the additional work experiences of these scientists that is less biology or female-dominated. This workforce demographic provides further context to the management data provided in Table 5.5. With a scientific workforce of 62 percent women, one might reasonably expect a high representation of women in management in the academic sector. However, that is not the case.

Table 5.6: Scientific staff within organisation types by gender

Organisation Type	Women (%)	Men (%)	Totals
Firms	96 (47)	108 (53)	204
Academic biotech	1348 (62)	841 (38)	2189
Totals	1444 (60)	949 (40)	2393*

*Includes all scientific staff, both managerial and non-managerial. This does not include non-scientific staff such as administrative staff or students

Further context to the comparison of managers across sectors is provided in Table 5.7. These data show that overall there is a higher proportion of managers in firms than in academic biotech. In academic biotech, 14 percent of scientists are managers whilst in firms 42 percent of scientists are managers, three times as many. This relationship between the proportion of managers and type of organisation is statistically significant

(x^2 =103.142, df=1, N=2393, p=.000) and illustrates how biotech firms are essentially 'management firms'.

Table 5.7: Science qualified managers within firms and academic biotech

Managerial status of scientists	Firms (%)	Academic biotech (%)	Totals
Scientists who are managers	86 (42)	315 (14)	401
Scientists who are not managers	118 (58)	1874 (86)	1992
Totals	204 (100)	2189 (100)	2393

Given this thesis is concerned primarily with the management opportunities available to women, I show the same analysis for women only in Table 5.8. These data show a similar trend. Of the 96 women scientists working in firms 24 (25 percent) are managers whilst of the 1348 women scientists in academic biotech 90 (7 percent) are managers. So, percentage-wise, 3.5 times as many women are managers in firms as in academic biotech, slightly more than the 3 times multiplier for men and women combined. A chi-square test showed this relationship between women managers and organisation type was also statistically significant (x^2 =41.380, df=1, N=1444, p=.000).

Table 5.8: Science qualified managers (women) within firms and academic biotech

Managerial status of female scientists	Firms (%)	Academic biotech (%)	Totals
Scientists who are managers	24 (25)	90 (7)	114
Scientists who are not managers	72 (75)	1258 (93)	1330
Totals	96 (100)	1348 (100)	1444

This analysis goes some way to explaining the popular impression that women are 'doing well' in commercial biotech. Proportionally there are many more women managers in firms than in academic biotech. But on its own, this does not provide evidence that commercial biotech is a more egalitarian sector than academic biotech because the difference is mainly (although not entirely) accounted for by the different ratio of management opportunities available. Rather, this finding highlights differing management structures across the two sectors.

One further analysis of the data is therefore required to capture the gender dynamics within these two sectors. Table 5.9 shows that in firms, 57 percent of the men scientists are managers compared to 25 percent of the women scientists, a little over twice as many. By comparison, in academic biotech 27 percent of the men scientists are managers compared to 7 percent of the women scientists, almost four times as many. These data show a distinctly more egalitarian outcome for women in firms.

Table 5.9: Managers within organisation types by gender

Is the scientist a manager?		Women (%)	Men (%)	Totals (%)
Firms				
	Yes	24 (25)	62 (57)	86 (42)
	No	72 (75)	46 (43)	118 (58)
	Totals	96 (47)	108 (53)	204 (100)
Academic biotech				
	Yes	90 (7)	225 (27)	315 (14)
	No	1258 (93)	616 (73)	1874 (86)
	Totals	1348 (62)	841(38)	2189 (100)

In sum, these analyses show that, compared to men, there are relatively more women scientists working in academic biotech than in firms. However, these women are less likely than women in firms to be working as managers because, first, there are relatively fewer management opportunities available, and second, those opportunities are more often taken up by men. Having established these quantitative findings, I now seek to understand why and how this situation has come about. I begin with an examination of firms and the jobs they offer.

5.2 Strategy, structure and management jobs in firms

The strategies of biotech firms provide context for what firm managers actually do. For the Victorian firms in this study, the emphasis on drug development and the tendency to be 'commerce-centred' (Powell and Sandholtz 2012) were major influences on the type of management jobs available. Two strong themes emerged during the interviews that were directly linked to these strategies: the requirement for managers to 'cross the domains' from science into business; and the wide variety of management jobs available. I argue throughout this chapter that these two factors contribute to the relatively high representation of women in management in this sector.

5.2.1. Firm strategies and business models

I have grouped the 19 firms participating in this study according to their principal business model, adapting predefined categories of medical biotechnology business models based on previous research in this field. Willemstein et al. (2007) identified five types of business model: service firm; platform firm; hybrid firm; and early and advanced stage drug developers. I have categorised the Victorian firms according to three of the five business models: platform; early stage; and advanced stage. Where they had more than one product, I categorised the firms according to their most advanced stage of development. Firms with a service business model were not eligible for this study as they are not 'research driven'. Firms with a hybrid business model (a combination of any of the business models) were included but for the purposes of this study I have categorised them as having 'early stage' business models. All of the firms, including those with a hybrid business model have been categorised with regard to their 'expected main revenue generating activities in the future' (Willemstein et al. 2007: 221). These expectations are indicated in firms' annual reports or on their websites. For the ‘hybrid’ firms it was clear that any contract research or application of their technologies outside human therapeutics (for example, veterinary or cosmetic) were secondary to their drug development activities, and often used to fund their drug development programs. Moreover, all of the hybrid firms employed drug development managers.

Platform firms offer an ‘enabling’ technology that can be used in the drug discovery and development process. Gottinger and Umali (2008) refer to these firms as providing ‘tools for the process’ (for example, bioinformatics, combinatorial chemistry, high through-put screening), (2008: 584). Platform firms profit from out-licensing their technology to other biotechnology or pharmaceutical companies rather than pursuing their own therapeutics.

By contrast, early and advanced stage drug developers are ‘product firms’. Their aim is to develop a human therapeutic, (or for this study, it could also be a diagnostic or preventative therapy) for the market. Their place in the value chain is determined by how far they intend to take their product through the development process, for example whether they intend to out-license their technology after, say, phase 2 clinical trials, or to take their product right through to registration as a new drug. In this study, I have adopted the two models for product firms as described by Willemstein et al. (2007). I have assumed that all firms who describe their activities as ‘developing a product’ intend to progress at least to phase 1 or 2 clinical trials, and therefore grouped them as early stage firms, even if they have not yet commenced clinical trials. Where firms have already progressed to phase 3 clinical trials, I have grouped them as advanced stage firms, noting this evolution ‘does not represent a true shift in business model’ but is a significant ‘step up’ from the relatively small scale phase 1 and 2 clinical trials (Willemstein et al. 2007: 223).

Table 5.10: Biotech activities by firm business model

Business Model	Functional Area	Typical Activities
Platform	Discovery	Laboratory-based research into technologies that contribute to the development of new biomedical interventions
Early stage development	Discovery	Identify lead compound or molecule; genomic based research
		Early safety tests • Toxicology • Pharmacokinetics
		Lead optimisation
	Preclinical	Formulation strategy
		Drug delivery strategy
		Scale-up and manufacturing of clinical trial material (Good Manufacturing Process)
		Safety tests • In vitro (laboratory) • In vivo (animal)
		Prepare and file regulatory documents • Investigational new drug (IND) • Institutional review board (IRB) documents
		Quality assurance
	Clinical	Phase 1 clinical trials (small group of people to evaluate safety)
		Phase 2 clinical trials (larger group of people to evaluate efficacy and safety)
Advanced stage development	Clinical	Phase 3 clinical trials (large group of patients on multiple sites to study efficacy and monitor side effects)
		Prepare and file regulatory documents (e.g. new drug application (NDA)
		Product labelling
		Phase 4 trials (on-going monitoring of effectiveness and side effects over longer period after product is marketed)
	Manufacturing	Transition from small-scale to large-scale production

Sources: Steinmetz and Spack 2009; www.innovation.org; www.australianclinicaltrials.gov.au/node/5; position descriptions provided by biotech firms; interviews

At 30th June 2010, the firms in my study operated across various stages of discovery and development, including phases 1, 2 and 3 clinical trials[15]. Fifteen firms were early stage, whilst two were advanced stage firms and two were platform firms. An overview of the R&D activities associated with each business model is provided in Table 5.10. These activities have been adapted from descriptions of the drug development process in the literature, augmented by information gathered through interviews with managers working in different functions. The list is not intended to be exhaustive, but to provide some insight into the specialist knowledge that managers in biotech firms are likely to require.

A firm's business model determines, not only which type of managers they engage, but at what point. For example, a firm might engage managers or consultants with clinical expertise at various stages before or during the early clinical phase to assist with clinical trial planning and compilation of the investigational new drug (IND) submission. Therefore, depending on timing there can be plenty of improvisation before specialists come on board. One CEO I interviewed commented:

> It was learning from ground zero … [my VP Clinical Development] is much more from the 'reg' side and the chemistry and toxicology, it was all analytical, a black box for her. But certainly I learnt from my interactions with her, and then from the people we brought around the program … some US agents and other consultants … somehow we learnt.

5.2.2. What firm managers do

In firms, a manager's full job title usually provides a good indication of what he or she does. Whilst the title prefixes (for exampe 'VP' or 'Director') are not a reliable guide to the scope or level of a manager's responsibility as these are not consistent across firms, full job titles in commercial biotech are usually quite descriptive, for example, 'VP Clinical Development' or 'Director Business Development'. As described in chapter

[15] Since my data capture date, there have been many changes in the fortunes of these companies, with some ceasing operations, others subject to mergers or takeovers and some reaching stage 3 clinical trials or bringing products to market.

four, I have therefore used titles and other sources to categorise my sample managers by their primary function as either ***corporate, development*** or ***research*** managers.

Corporate managers include the Chief Executive Officer (CEO) as well as other managers who work in non-lab roles directing a range of activities across the science and economic domains. These may include Chief Operating Officers (COOs), Business Development (BD) Managers and Intellectual Property (IP) Managers. Development managers can be involved in either non-clinical or clinical development activities, or both. These roles range from the overall direction of a development program to more specific management of: one or more clinical trials; drug formulations; biological testing; manufacturing (CMC); regulatory affairs; quality assurance; and general project management. Typical titles include VP Development and Regulatory Affairs or Drug Development Manager. Research managers are involved directly in the management of discovery or other scientific research. These may include, for example, the Chief Scientific Officer (CSO) or senior scientists leading lab-based research teams, as well as Research Information Managers and Laboratory Managers.

My interviews revealed there can be overlap between these functional areas and that managers may work in a range of these roles over the course of their careers. The differences are not always clear cut, but rather a matter of emphasis. A Chief Medical Officer, for example, could well have primarily a research focus or a development focus, depending on the stage of the firm's development program. For my quantitative sample, where the titles were not clear in indicating whether a manager's job is primarily corporate, research or development, I checked the firm's website or liaised with the person who completed the questionnaire to clarify this before categorising the manager.

Table 5.11 shows that the managers in my sample were spread evenly across the corporate, research and development functional areas, although this distribution varied by business model. There were only two each of the platform and advanced stage firms. The platform firms did not have development managers as they were not involved in clinical trials. They were also very small, providing only three managers for the study between them. Of the two advanced stage firms, one had an in-house research group, in which all 13 of the research managers worked. The other late stage firm did not have a dedicated 'in-house' research manager when the questionnaire was completed, having moved by that time to a purely development focus. Table 5.11 shows that in my sample most of the managers work in early stage firms, the majority in corporate management roles. Also, there are more development managers than research managers working in early stage firms. So this representative sample of Victorian biotech firms presents a picture of a sector dominated by early stage drug developers employing primarily corporate and development managers. It also suggests Victorian biotech firms are more commerce-centred than research-centred (Powell and Sandholtz 2012).

Table 5.11: Functional managers by firm business model

Firm business model (No.)	Corporate managers (%)	Research managers (%)	Development managers (%)	Totals(%)
Platform (2)	1 (33)	2 (67)	0 (0)	3 (100)
Early Stage (15)	22 (41)	13 (25)	18 (34)	53 (100)
Advanced Stage (2)	5 (17)	13 (43)	12 (40)	30 (100)
Totals (19)	28 (33)	28 (33)	30 (35)	86 (100)

One feature of a firm's business model that differentiates management positions is ASX-listing. A few of the managers I interviewed were keen to develop skills associated with listing, for example in ASX reporting and investor relations, and had taken on roles specifically to get this experience. Table 5.12 shows that both of the late stage firms in my sample were listed and just under half of the early stage firms were listed, whilst neither of the platform firms was listed. Two of the early stage firms were also listed on the NASDAQ (US stock exchange). So, managers have the opportunity to get ASX experience in either early or late stage firms.

Table 5.12: ASX-listing of firms by business model

ASX-listing	Business Model			Totals
	Platform	Early Stage	Advanced Stage	
Listed	0	7	2	9
Not Listed	2	8	0	10
Totals	2	15	2	19

Apart from these ASX-related activities, my interviews revealed the core responsibilities associated with each of the corporate, development or research functions were very similar across all types of business model. As a result, the managers were able to develop skills highly portable across the sector. Following is a brief description of the different roles in each functional area and the kinds of qualifications and experience required.

Corporate managers in firms

The corporate managers were generalists. Many described how their own biotech careers had started with an 'entry ticket' specialisation in a research or development function, before they transitioned into a general management role where an understanding of the science was essential but they weren't necessarily 'doing science'. As noted, this group includes 'C-suite' roles such as CEO and COO, but also BD and IP Managers. Often managers cover 'all of the above' like one COO with a chemistry PhD who described his broad-ranging responsibilities:

> I did IP, PR, IR, lawyers, contractor relationships, new business … no science … but I needed the science, especially for the BD role. I did a merger and a listing. It was all new, made it interesting.

The CEOs spoke of providing strategic oversight, but also hands on involvement in operations including corporate, research and development activities. Interaction with the Board, capital raising and overall management of the finances, negotiation of major deals and investor relations were key CEO responsibilities in firms across all business models, including shareholder responsibilities in the ASX-listed firms. The CEOs had responsibility for selling ‘the story’ sometimes to financial investors or sometimes to strategic buyers such as large pharmaceutical companies. This important function, which has been described as ‘building extremely convincing data packages’ (Ernst and Young 2011: 14) is perhaps the most strategic example of CEOs crossing the domains. As one of the managers commented, ‘I like the strategic side, thinking ahead, contingencies, anticipating, it's fascinating, a bit like playing chess.’ In many ways, the COO roles mirrored the CEO roles. In larger firms, the role was like a ‘deputy CEO’ resembling a general management position with responsibility for a range of functional areas. In small firms, there was either a COO or a CEO, not both, as they performed essentially the same role.

A common thread through all of the corporate roles was a BD component. Indeed, of the 15 ‘C-suite’ managers I interviewed, 11 had held at least one dedicated BD role at some stage previously; it seemed to be a ‘pre-requisite’ for the top job. Interestingly, however, firms reported only five dedicated BD roles in the questionnaires. This indicates the degree to which BD activities are interwoven with other corporate roles, especially CEOs. BD involves developing new partnerships, particularly through setting up out-licensing and other commercial deals. This requires a scientific understanding as the ‘product’ is intellectual property – the work involves licensing a technology rather than selling a commodity. The managers I interviewed who either were, or had been BD managers reported working closely with research managers to identify the value proposition for the technology, potential customers and collaborators. BD managers had responsibility for market analysis and competitor intelligence, and usually the initial drafting of contracts before finalising with lawyers. Some were required to submit and report on grant applications and often the BD manager was required to contribute across a number of corporate areas. One BD Director explained:

> A lot of the stuff that I do is not necessarily business development but more a broad general management role. I mean I’m managing a linkage project with a group at [a university]; I’m managing that whole project. And there are other collaborations that

> we're setting up, and because they're more based in Australia I manage all of those. Even though our research group is based in [Europe], they haven't really had anything to do with it. So it's a little bit … I haven't really thought about it, I just use some of my science stuff.

A number of the CEOs and BD managers I interviewed also had responsibility for IP, with only two firms reporting dedicated IP managers in their questionnaires. IP management involves deciding on IP strategy, managing external patent attorneys, liaising with researchers to gather technical data for the preparation of new patent applications, as well as considering the legal ramifications of publications and contracts. Often the manager with IP responsibilities had previously worked as a scientist either within the firm or elsewhere. For example, another BD Director explained how she had crossed the domains:

> I was working as a scientist in the lab. [The company] was very small at the time, incubated at [a university] and they said, "Can you look after our intellectual property portfolio?"… And I said, "I'd love to, what's IP?"

So, the corporate roles in firms both vary and overlap; they can include a range of commercial and science activities such as BD and IP, with finance also a strong theme throughout. Of the three management types, the corporate managers in my sample had responsibility for the largest budget, with a median in the range of $501K-$1M. This may explain the emphasis on business qualifications in this corporate group. The questionnaire data showed that 64 percent (18 of 28) of corporate managers in my sample held PhDs (or were medical doctors). Whilst I did not capture business qualifications in my questionnaire, it's likely that most of those corporate managers would also have some kind of business qualification. I base this assumption on the profiles of the managers I interviewed (a separate group). Of the 16 corporate managers I interviewed, around 90 percent had MBAs or other business qualifications, whilst just over half held PhDs. It seems that in corporate roles, business qualifications and industry experience rate as highly as scientific credentials.

Development managers in firms

I interviewed managers who worked, or had worked in non-clinical development jobs and clinical development jobs. The non-clinical development managers facilitated biological testing such as toxicology and pharmacokinetic studies, oversaw quality assurance procedures, and managed the contract manufacturers who supplied clinical trial materials. They interacted with laboratories and manufacturing facilities and with in-house or external research staff on drug scale-up and formulations.

By contrast, the clinical development managers focused on managing the services provided by clinical research organisations who conduct clinical trials. They were responsible for devising and implementing regulatory and product development strategies, including submission of regulatory applications with international drug authorities, and arranging and attending meetings with those authorities.

Although they differed in content, all these development roles were essentially project management roles. These managers oversaw projects, setting and monitoring project milestones, managing the budget and timelines, anticipating bottlenecks and actively managing any impediments to reaching project outcomes. Their median budget was in the range of $401-500K. This project management work requires both specialist scientific knowledge and generalist management skills, particularly relationship management. For example, CEO Matt's entry into biotech was through a development role that was not being managed well by the firm's Research Director:

> [My CEO] wanted somebody to, in his words: "sort out the [contract manufacturer] relationship" because [the Research Director] seemed to piss off [the contract manufacturer] and [the Research Director] was pissed off with [the contract manufacturer]. They were doing scale-up. That was the bottleneck in [the Research Director] being able to say yep we've got a development candidate in the [product] area so [my CEO] said, "Can you come across to [biotech firm] and sort that out?"

In the questionnaires, 54 percent (16 of 29 qualifications reported) of the development managers were PhD qualified, a lower percentage than both corporate or research managers. Of the eight development managers I interviewed, three had PhDs, three were pharmacists, and two held other science degrees. The three pharmacists all entered biotech management through clinical development roles. One CEO explained how pharmacy qualifications are useful in development jobs and more generally when crossing the domains in biotech:

> A pharmacy background is an advantage due to legislation and reg affairs and understanding of documents. There's a lot of that in drug development; that whole anal retentive thing about compliance. It also fits in with that small company thing where you need to do a lot of roles.

Because most development work is conducted through external contractors, the management scope of these roles can be 'hidden.' The managers spend most of their time at their desks, making calls and sending emails, writing and examining documents. It is less clear than in other roles how much actual 'management' of other people is involved but in many ways the contracted services managed by development managers are a 'proxy' for staff. Contracts can represent quite large groups of people employed externally to work on firms' development activities and often require high level relationship skills to coordinate a range of activities from a distance. However, with less need for face to face supervision, this type of work is more suitable for flexible work arrangements than jobs involving the management of people 'in house'.

In my quantitative sample, the development managers were responsible for more contracts than the other functional managers. The development managers managed a median of eight contracts, whilst the corporate and research managers each managed a median of two. A Mann-Whitney U test showed this difference was statistically significant with the mean rank of contracts managed by development managers significantly higher than the research managers (U=65.500, p=.032, r= -0.38), and also significantly higher than the corporate managers (U=89.000, p=.013, r= -0.41).
The number of contracts also varied according to business model. Managers working in advanced stage firms managed the most contracts with a median of 10, compared to a median of 2 in early stage firms and 1 in platform firms. So these development jobs are

larger in scope in the advanced firms where there is likely to be more products under development and a greater level of activity for any particular product where phase 3 clinical trials are underway.

Research managers in firms

The research managers directed in-house laboratory research, out-sourced research activities, or a combination of both. As the 'in-house' scientific expert, it was expected that research managers would have high level scientific qualifications, with firms reporting that around 90 percent of research managers (26 of 29) held a PhD, a much higher percentage than the corporate or development managers. Despite their scientific specialisations, however, there was also an expectation that the research managers apply their scientific knowledge broadly – they could not remain narrow in their focus. For example, one venture capitalist who had employed a number of PhDs with a chemistry background commented, 'If they don't have biology they have to be a fast learner.' They also had to view the research through a commercial lens. One CEO explained the importance of 'straddling research and business' which was different to her previous experience in a research institute:

> It's planned and structured. You need to map out market size. There is a 'disconnect' with truly disruptive discoveries which are hard to plan.

In applying a commercial approach, the research managers were also required to cross the domains. One manager stressed the commercial aspects of his research management role in a biotech firm as it prepared to list on the stock exchange:

> We were focused on what we thought would give commercial outcomes, not just exciting science … the two were often aligned. Reporting and, you know, governance and that sort of thing were pretty important. It was a time when they were going to move from being a private company to listing. You know, all those sorts of things … presenting to brokers and things, yeah … and preparing material for presentation and working with the safety guys.

An important part of a research manager's role is to produce the data for use in investor presentations and reports. This involves translating highly technical information into language suitable for investors. The research managers also play a key role in managing the firm's IP, working closely with BD managers and other corporate staff. But they generally stop short of doing BD work themselves. The median budget of the research managers in my sample was lower than the corporate or development managers in the range $201-300K. None of the research managers I interviewed had post-graduate business qualifications. So, whilst their focus was commercial, the research management roles were 'closer to the science' than the other firm management roles, and sometimes the managers were actually located within research institutes or universities, or shared between firms and research institutes.

Finally, the research managers in firms, like the corporate and development managers, are also expected to be skilled in relationship management. Anne, who had worked as a firm research manager emphasised that to be promoted into that role, you had to 'get on with people' as well as 'know what you're doing'. She recalled her own promotion:

> [My manager] was talking about putting [my colleague] and I in those management positions because he could see we both just pretty much got on with things … while there were other people who could have done it, it wouldn't have been a very harmonious thing to put them in the job.

5.2.3. Size, structure and how firm managers work

I classified my sample firms by size according the Gilding-Bunton method, using the MintGlobal/ASIC criteria described in chapter four. Thirteen firms were small, four were medium and two were large. Table 5.13 shows the size of firms by business model. It can be seen that both platform firms and most (11 of 15) early stage firms are small, whilst both of the advanced stage firms are large.

Table 5.13: Size (MintGlobal/ASIC) of firms by business model

Business Model	Size			Total
	Small	Medium	Large	
Platform	2	0	0	2
Early Stage Development	11	4	0	15
Advanced Stage Development	0	0	2	2
TOTALS	13	4	2	19

A break-down of staff numbers by business model is presented in Table 5.14. Overall, the median number of staff working in biotech firms is nine. One advanced stage firm is an outlier with 78 staff whilst all the other firms have fewer than 36 staff. The smallest firm has only one staff member managing a number of outsourced contracts. This indicates just how small these biotech firms can be. These data show that 50 percent of all firms have between 4 and 21 staff, with 50 percent of early stage firms, the largest group, having between 3 and 19 staff.

Recall from chapter four the size criteria cover a firm's revenue, assets and staff. Two observations can be made here. The first is that all the firms are small on the basis of staff numbers alone. The two advanced stage firms are rated as large for market size, but this is on the basis of revenue and assets, not staff. The second is that there is no relationship between market size and staff numbers. For example, in this sample one of the large firms has only 22 employees whereas the largest medium sized firm has 36 employees.

Table 5.14: Average staff numbers by business model

Firms	Staff Numbers				
	Total	Median	Interquartile Range	Min	Max
Platform Firms	2	10.5	n/a*	5	16
Early Stage	15	7	3 - 19	1	36
Advanced Stage	2	50	n/a*	22	78
All Firms	19	9	4 - 21	1	78

*n/a= interquartile range not available for sample size

It follows that managing in-house staff is not a major responsibility of most biotech firm managers, including many CEOs. Consistent with this, the managers in my sample supervise a median number of two staff. The research managers have the highest median of three staff, reflecting the lab-based nature of the work for some of them; the corporate managers a median of two staff which is lower than the research managers because they are more likely than the research managers to work in small firms; and the development managers a median of one, reflecting their tendency to manage contracts rather than people.

Staff numbers are driven by a firm's business model, including what functions are undertaken in-house versus outsourced. The term 'punching above their weight' is often used to describe how small biotech firms are able to deliver outcomes with a skeleton staff. They do this through outsourcing and the extensive use of consultants. Accordingly, the firms in this study ranged from virtual businesses[16] based on ownership of IP but with no head office and all functions except the CEO outsourced, to firms conducting a range of in-house laboratory and clinical activities.

[16] An alternative term could be micro business. For statistical purposes, the Australian Bureau of Statistics (ABS) defines micro businesses as small businesses with 0–4 employees, but this does not capture the scope of the outsourced activity. The term 'virtual' is commonly used to describe biotech firms as discussed in chapter three.

Outsourcing

A wide range of activities are outsourced by the firms, including experimental laboratory work which can be a labour-intensive aspect of R&D. Table 5.15 summarises the laboratory arrangements of the firms and illustrates the network structure of the sector.[17]

Table 5.15: In-house and outsourced laboratory work by firm business model

Business Model	Firms with their own lab		Firms contracting out lab work	Total
	Lab at head office	Lab located off-site		
Platform	2	0	0	2
Early Stage	3	3	9	15
Advanced Stage	1	1	0	2
Totals	6	4	9	19

These data show that most of the biotech firms were not in the business of establishing a laboratory. Of the 15 early stage firms, only 6 had their own labs, of which only 3 were collocated with their head office, the others based in rented space at a university or research institute. The 9 firms outsourcing their research engaged a mix of university departments in Australia and overseas. This work was usually directed by a Chief Scientific Officer or similar role employed directly by the firm, sometimes working part-time. So even for a labour-intensive activity like laboratory research, research managers in firms did not have high numbers of staff reporting directly to them.

[17] It should be noted this data does not capture all aspects of the firms' experimental activity, because even when firms have their own laboratory, they may use contract research organisations for some services, for example biological screening. Also, many firms have research collaborations with universities and research institutes where joint projects are conducted.

The two platform firms conducted their own laboratory work in-house, reflecting their discovery research focus. One of these firms was still located with its parent research organisation. Of the two advanced stage firms, one had established its own laboratory at its head office location, whilst the other ran its own laboratory, but from an overseas location. These two firms differed in their approach to laboratory set up, reflecting their respective 'exit 'or 'growth' strategies.[18] These different business models illustrate how the network form of organisation enables firms to grow in market size without necessarily increasing their in-house staff numbers.
Another pre-clinical activity generally outsourced by firms is the scale-up and manufacture of clinical trial materials. Of the 16 firms engaged in these activities, all *managed* the function in-house whilst all but two outsourced the physical manufacturing, which generally requires specialised facilities. Meanwhile, another preclinical activity, animal testing, was outsourced by all firms under the direction of an in-house manager.

The *management* of clinical trial programs was a central activity undertaken in-house by all of the 15 firms engaged in clinical trials. This included the design of the trials, preparation of the relevant documentation and the management of clinical research organisations that physically conducted trials in hospitals and other clinical settings. Two firms were engaged in phase 1 trials only, with the remaining 13 firms engaged in either phase 2 trials, or if they had more than one product, sometimes both phase 1 and 2 trials. The two firms conducting phase 1-only trials had 'in-sourced' specialist contractors to manage this function. These contractors had become integral to their management team.

Finally, the two advanced stage firms had conducted phase 3 clinical trials, prepared a new drug application (NDA) and entered into full scale production. One managed its own phase 3 clinical trials in a key jurisdiction, whilst partnering with a large pharmaceutical company for phase 3 trials in another jurisdiction. This firm was also beginning to build capability in sales and marketing in an overseas office. The other

[18] For example, the first-mentioned advanced stage firm later acquired additional 'assets' and grew larger, where the latter was subsequently taken over by a major international pharmaceutical company.

advanced stage firm had partnered with a global pharmaceutical company that funded and directed these activities from its overseas office. It should be noted that at least four of the 15 firms managing clinical trials also had out-licenced IP to pharmaceutical companies that were managing clinical trials for those products.

This summary of the outsourced activities of Victorian biotech firms demonstrates three things. First, Victorian biotech firms are in many ways 'management firms'. Second, the firms are organised differently depending on their particular business model, which, in turn, impacts on what it means to be a 'biotech manager'. Third, the design and management of clinical trial activities is integral to all firms except those with a platform technology. This affords both women and men varied opportunities to 'take off the white coat' and work in management roles that draw on their high-level scientific expertise.

Inter-organisational networks

For many firms in this study, organisational boundaries were blurred through extensive outsourcing and 'consultants managing consultants'. In this context, Powell (2001) suggests that rather than studying individual firms, 'it may be more relevant to regard the inter-organisational network as the basic unit of analysis' (2001: 59). Indeed, it is for this reason that I included a range of managers in this study, including consultants and contractors working as part of the internal management team, but further examination of the inter-organisational network is required to fully appreciate the scope of managers' responsibilities.

I draw on the organisation charts of two participating biotech firms to illustrate the network form of organisation in this sector. The use of contractors is demonstrated in Figure 5.1 which shows the organisational structure of one 'virtual' early stage biotech firm. This is an unlisted firm engaged across the full range of discovery, preclinical and clinical activities, including phases 1 and 2 clinical trials. Figure 5.1a shows the overall company structure, and Figure 5.1b separates out the clinical trial activities where three candidate compounds are being developed, as represented in the large boxes. This firm focuses on co-ordinating research that is undertaken externally.

What is interesting about this structure is the extensive network of consultants and contractors engaged to manage the development process, whilst there is a minimal core group of only four salaried employees (black boxes). Figure 5.1a shows the CEO John Smith reporting to the Board, and directly managing 3 in-house staff. In addition, he directly manages 14 scientific contractors, consultants or contract research organisations, 4 legal and IP consultants, and two IT service providers.

The CEO has incorporated four senior consultant/advisors (in light grey boxes) into the ‘management team’, giving them line management responsibilities on behalf of the firm. In Figure 5.1a, Ian McDowell appears twice: first on the scientific advisory team; and second, in the dual role of co-team leader of the drug discovery function (managing 3 contract research organisations). Also in Figure 5.1a, Graeme Keith is a US based team leader for toxicology and other analysis, with responsibility for compiling the IND (managing 3 consultants and 3 contract research organisations). Finally, in Figure 5.1b, the clinical contractor Phyllis Castle manages the development program for compound 3 (managing 2 clinical sites and a clinical research organisation), whilst the Chief Medical Officer Doug Jennings oversees all clinical programs. None of these managers is directly employed by the firm but they all have substantial responsibilities for the development program. This flexible structure with ‘contractors managing contractors’ can be described as ‘knowledge orchestration’ where highly skilled scientists manage an array of partners and focus expertise at critical moments (Sabatier et al. 2010).

By comparison, consider Figure 5.2 which shows the research department (Figure 5.2a) and product development department (Figure 5.2b) of an advanced stage biotech firm with extensive ‘in-house’ activities, and products in phase 1, 2 and 3 clinical trials. This firm has 85 staff working in research and product development (plus additional corporate staff including the CEO, CFO, BD and other staff who are not shown). The organisation chart does not show external contractors and consultants, but the firm does use them despite its range of in-house personnel. It uses clinical research organisations to run its clinical trials, as well as external manufacturers for scale-up and the manufacture of clinical trial material. It also has partnered with several pharmaceutical companies to manage phase 3 clinical trials. Hence, like the small firm in Figure 5.1, the 'inter-organisational network' of this firm is extensive.

Unlike the virtual firm in Figure 5.1, however, the firm shown in Figure 5.2 conducts extensive laboratory work in-house. This firm also has a number of in- house senior clinical staff to perform most of the management roles that are undertaken by consultants in the virtual firm. Although it has a product on the market, this firm does not have in-house positions associated with phase 3 clinical trials because these were conducted externally by an industry partner.

These two biotech firms have different business models, one early stage and the other advanced stage, and they also operate on a different scale, but the complexity of drug development requires specialist technical expertise whether a firm has one drug progressing through the development pipeline, or many. This often leads to small biotech firms establishing specialist departments along similar lines to larger firms, even though these may be 'departments of one'. In this way, managers working in virtual firms, sometimes part-time, gain valuable skills and experiences that are portable across the sector.

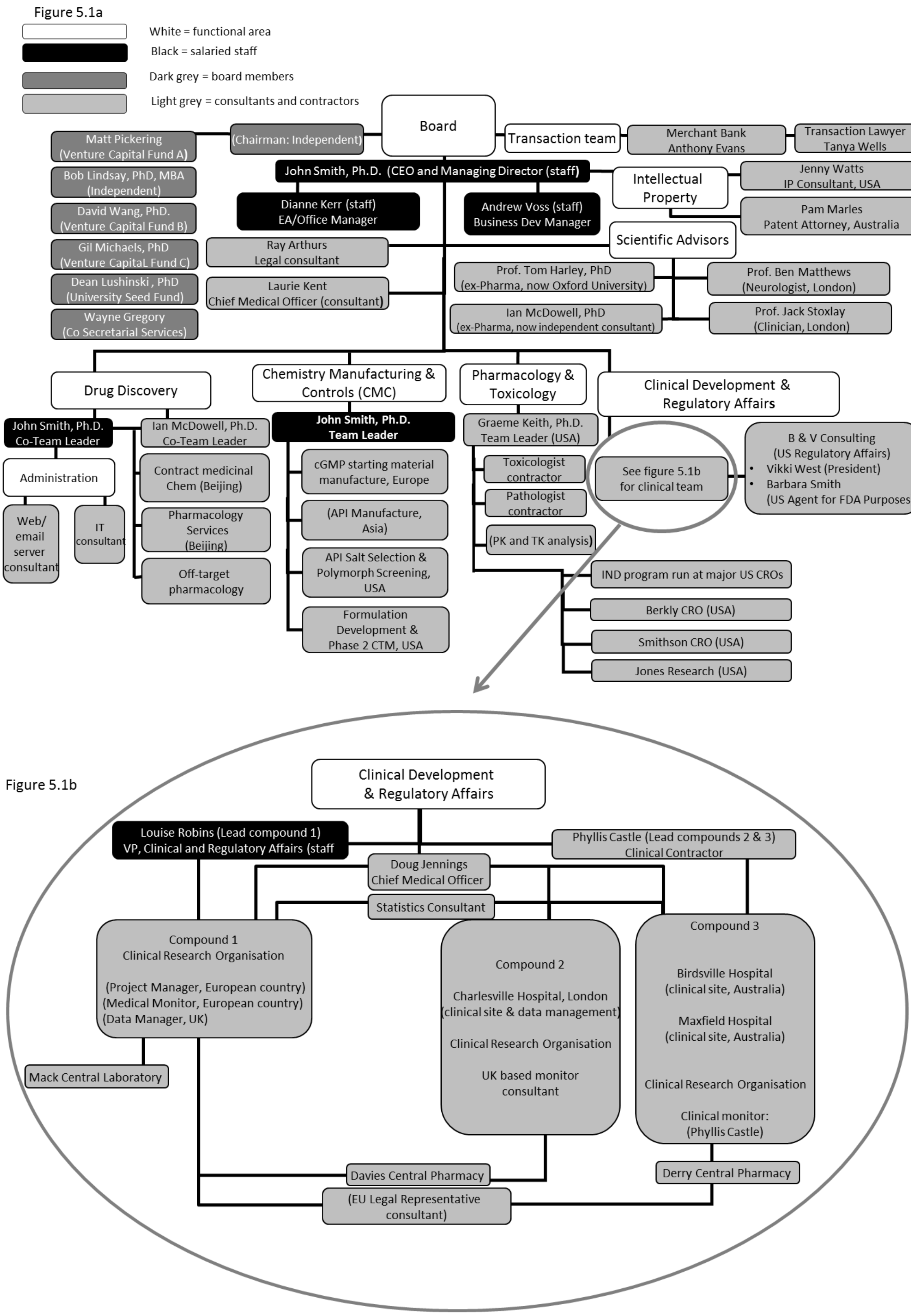

Figure 5.1: Organisation chart for virtual drug development firm (main chart shown in 5.1a and clinical team shown in 5.1b insert)[19]

[19] Figure 5.1 based on actual organisation chart of participating firm, used with permission and de-identified. Pseudonyms reflect gender on original chart.

Figure 5.2 a

Black = Corporate and Support staff (within research group)

Grey = Scientific/Technical staff

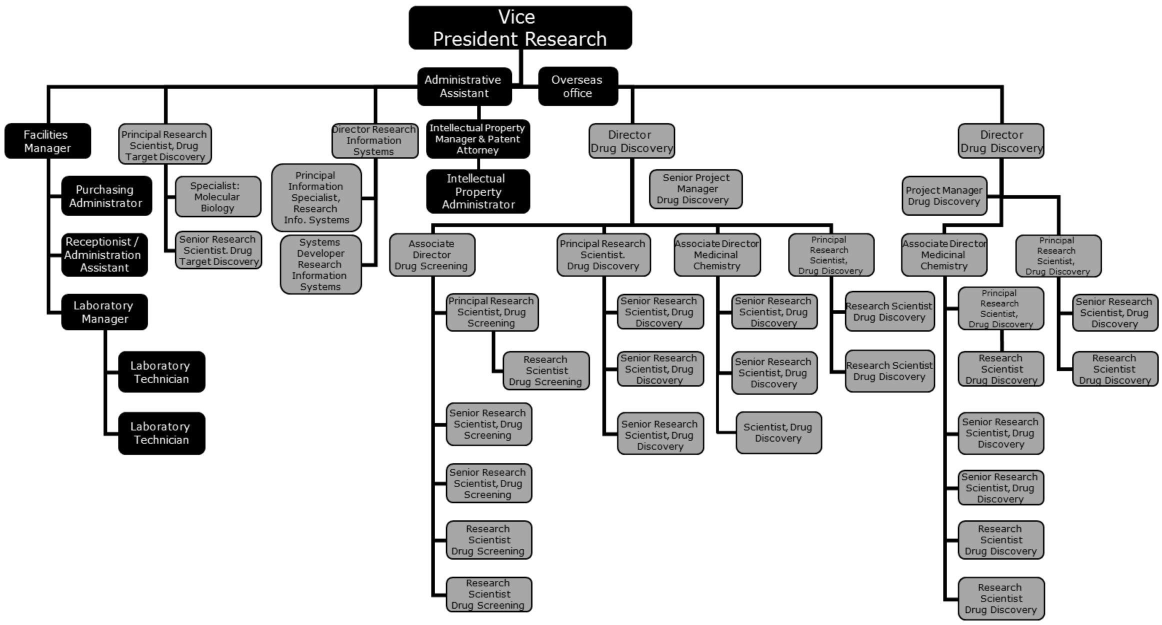

Figure 5.2b

Black = Corporate and support staff (within development group)

Grey = Development staff

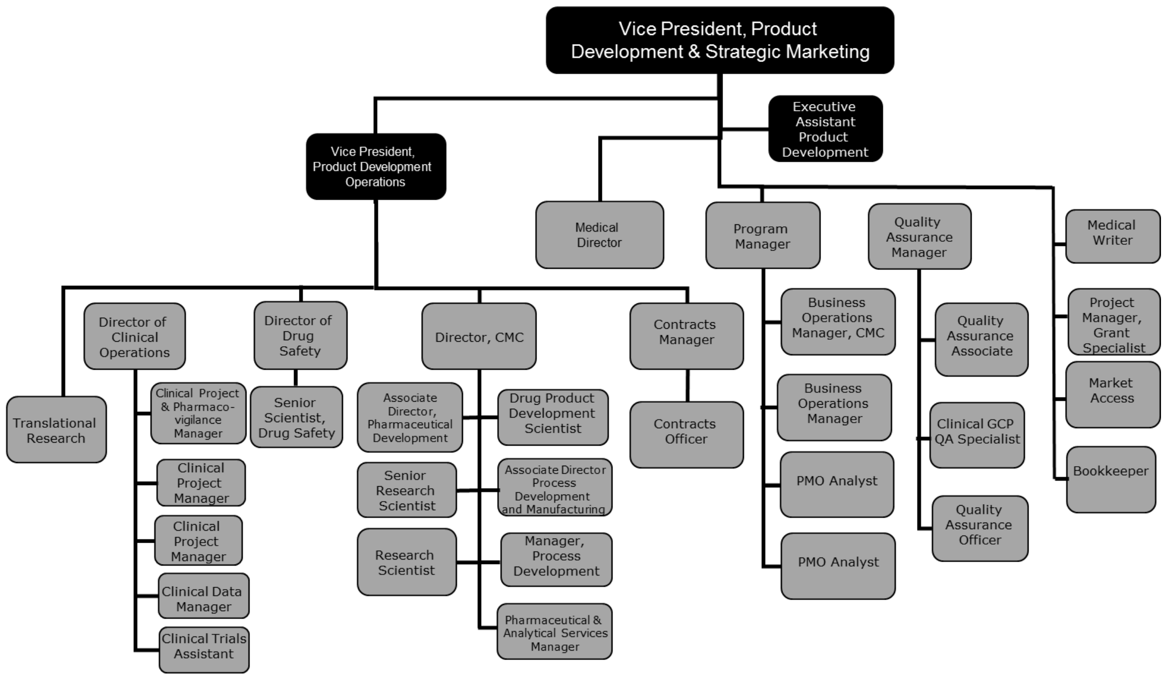

Figure 5.2: Organisation chart for advanced stage firm (research division shown in 5.2a and product development division shown in 5.2b) [20]

[20] Figure 5.2 based on actual organisation chart of participating firm, used with permission and de-identified.

Part-time management jobs in firms

A distinctive characteristic about the commercial biotech sector is that part time management jobs often work to the advantage of firms, particularly small or 'virtual' firms developing a single product. Such employer-initiated part-time work is unusual for managers in highly qualified professional roles. At this level, 'retention' part-time employment is more common where employees, most often women, request a change in hours to accommodate their family commitments. This normally results in a down-grading of their roles and their career prospects (McDonald et al. 2009; Webber and Williams 2008).

On the contrary, I interviewed two part-time CEOs whose work did not sound very different to the work of other full-time CEOs other than the scope and flexibility of it. One described his firm as 'virtual' with everything 'contracted out'. He promoted the science of the firm, organised collaborations and accessed funding, drawing on his extensive network to do so. He combined his part-time management job with Board memberships and other business ventures. Meanwhile, another part-time CEO had managed numerous small early stage firms and stressed that she did not consider her 'CEO' role equivalent to CEO roles in larger or more established firms:

> In most companies it would be me and the CSO, who would be based in the parent organisation with a team, say a university. My sweet spot is putting systems in place; finance, operations, next stage in investment … work part-time … minimise operations … actively manage … be responsive and reliable … not put the investors' money at risk.

Despite her self-effacing description, this CEO's role resembled how many others had described their roles, even though they worked for larger firms.

Overall, 22 percent of the firm managers in my quantitative sample work part-time, but more often in small firms than in large firms. Table 5.16 shows the proportion of part-time managers is very high in small firms (38 percent) then steadily decreases through medium sized firms (27 percent) to a very low proportion in large firms (3 percent). A chi-square test showed there is a significant relationship between firm size and managers' part-time status (x^2 =10.620, *df*=2, N=85, *p*=.001). So it seems as firms get larger they become more reflective of the broader workforce where part-time management work is uncommon.

Table 5.16: Managers employment status (full/part-time) by firm size

Employment status	Small firms (%)	Medium firms (%)	Large firms (%)	Total (%)
Full time	18 (62)	19 (73)	29 (97)	66 (78)
Part time	11 (38)	7 (27)	1 (3)	19 (22)
Totals	29 (100)	26 (100)	30 (100)	85* (100)

*Missing data on one manager

One indicator of the quality of part-time work is how well it compares with the attributes of full-time work (Burgess 2005). In this sense part-time biotech management can be considered high quality because it is comparable to full-time work on a number of factors. In my sample of firm managers a chi square test indicated part-time managers are more highly represented on the top management team than full-time managers (x^2=4.517, *df*=1, N=85, *p*=.028). This makes sense given part-time managers are more likely to work for small firms and also reflects the ubiquity of the 'virtual' model where managers report direct to boards. Second, in terms of job scope there is no significant difference between full-time and part-time managers in terms of the budgets or number of contracts they manage. There is, however, a significant difference in the number of staff supervised, with a Mann Whitney U test showing a higher mean rank of staff reporting to full-time managers (*U*=431.000, *p*=.031, *r*= -0.3). Whilst it is not surprising that in these very small firms there are fewer, or sometimes no staff to supervise, it is quite surprising that other responsibilities of part-time managers are not far removed from those of full-time managers. In terms of quality, this is a good sign for managers who prefer part-time work. However, it also flags a potential problem of 'overwork' where part-timers work reduced hours but with a full-time workload. I discuss this further in chapter six.

Another important finding is that working part-time in biotech management is normalised across all functional areas. Table 5.17 shows that although a higher proportion of corporate and development managers work part-time than research managers, there are managers working part-time across all the functional areas. A chi-square test showed no significant relationship between part-time work and functional area (x^2 =1.319, *df*=2, N=85, *p*=.862). This differentiates biotech management from many sectors where part-time work, often undertaken by women, is confined to support functions or less prestigious 'secondary' occupations within a profession.

Table 5.17: Managers working part-time in firms by functional area

	Corporate (%)	Research (%)	Development (%)	Totals (%)
Full time	21 (75)	23 (85)	22 (73)	66 (78)
Part time	7 (25)	4 (15)	8 (27)	19 (22)
Totals	28 (100)	27 (100)	30 (100)	85* (100)

*Missing data on one manager

To summarise, it appears that the small size and network form of organisation drive a number of flexible and part-time work options that would appear to suit the needs of many women. Importantly, these part-time options are normalised for both men and women across a range of functions. These non-standard jobs often serve as a suitable 'apprenticeship' and springboard for career advancement, with part-time jobs resembling full-time jobs and jobs in small firms resembling jobs in larger firms. Moreover, the experience gained in a firm with one business model is often transferrable to a firm with a different business model. In this way, commercial biotech differs from many other sectors where non-standard management work is either non-existent or relegated to jobs are of lesser quality, negatively impacting on future career prospects.

5.3 Strategy, structure and management jobs in academic biotech

In research institutes and the research departments of universities, organisational strategies are overwhelmingly directed toward discovery research. Whilst some of the managers I interviewed did work outside a laboratory environment, these jobs were in the minority, and even the top jobs involved directing a research program. Quite the opposite to the situation in firms, this lack of variation in the type of management jobs available in the academic sector is an overarching theme throughout this study. Ultimately these jobs are a product of the strategies of research institutes and the time-honoured social organisation of scientific research both nationally and internationally.

5.3.1. Academic biotech strategies and funding models

Research institutes' annual reports refer to their mission, vision and values and focus on the types of diseases they are researching or their fields of scientific expertise. They are not profit-driven like the biotech firms although, like firms, they do have a requirement to raise funds in order to conduct research. Therefore, in this study I refer to their 'funding models' rather than their 'business models'. Whilst the management jobs across this sector were more similar than different, it was variation in the organisations' funding model that provided some differentiation between management jobs.

Of the 11 academic organisations that responded to my questionnaire, 8 were research institutes highly reliant on funding from competitive grants. These grants were a mix of NHMRC and ARC fellowships; NHRMC project and program grants of up to five years; and other grants of various duration, including from the NHMRC and other funding bodies. Some of these grants would only last one year. In their annual reports, these institutes reported grant revenue ranging from 40 to 80 percent of their total revenue. Two institutes at the lower end of this range supplemented their grant revenue with service and clinical income, and all of the institutes were also in receipt of philanthropic funds to varying degrees. Overall, however, grants were the main source of revenue for most of them. A further research institute was funded by a combination of Government appropriations of around 60 percent and external revenue of around 40 percent both from industry and from other sources, including NHMRC, ARC and other Government grants. The remaining two organisations were units from two different universities, one a research-oriented biotech department and the other a university-based biotech institute. These university 'organisations' were primarily research-focused with the teaching responsibilities of the managers working in them generally limited to the supervision of Honours, Masters and PhD students. These students effectively formed part of the 'research group' of the managers, working alongside employed research scientists and research assistants. University research is funded by a combination of research block grants (RBG)[21] which are allocated according to performance based formula and are independent of funding for specific research projects or programs, or fellowships through the NHMRC or ARC. However, without exception the researchers I interviewed emphasised the increasing reliance on specific grant funding for research. So, all of these academic organisations were to varying degrees reliant on competitive research grants, with the independent research institutes the most reliant. I interviewed managers from organisations with each of these three types of funding model, some of them from organisations that did not complete the questionnaire, thus broadening my coverage of the sector.

The level of industry collaboration varied amongst the managers I interviewed. The managers working in the appropriation-funded research institute were most active in their industry collaboration, their institute having a requirement to raise a percentage of its funding from external sources. The managers I interviewed mentioned collaboration with other academic institutions more often than with industry. One university Department Head, for example, spoke of 'sharing grants, ideas, reagents and papers' with other universities, hospitals and service providers (for example microscopy) but he had not interacted with biotech firms, or industry more broadly. A few of the managers, however, were quite active with their industry collaborations,

[21] http://www.innovation.gov.au/research/ResearchBlockGrants/Documents/2010RBGAllocations.pdf

having consulted to biotech firms, participated on scientific advisory boards and also managed joint industry grants. So this part of the management role was a 'mixed bag' and depended to some degree on the institution and to some degree on the managers' preferences. The opportunity was certainly there for all of the managers to collaborate and undertake consulting work as part of their role if they so wished.

The academic organisations that responded to the questionnaire were all larger than the firms in terms of in-house staff numbers. Overall, the median number of staff in my sample of academic organisations is 190, the smallest with 100 staff and the largest 639 staff. For the universities and the block-funded institute I only included organisational units relevant to biotech, not the entire organisation. The two university 'units' have 103 and 232 staff, and the block-funded institute 190, not including administrative staff who are attached to the larger organisation. The noteworthy observation here is that, in terms of staff numbers the academic organisations, whether whole organisations or sub-units, are larger than all of the biotech firms, and substantially larger than all but one of them. This necessarily impacts on the level of staff 'supervision' involved in management jobs across the two sectors.

Despite the differences in size and funding models, the hierarchical organisation structures of the academic organisations were all very similar. One manager's description of her group generally applied to all: 'Basically they are hierarchical with a Division Head at the top - the Professor - and then a bunch of younger, well middle managers, younger lab heads trying to be brought along.'

In research institutes, lab heads, some very experienced, some less so depending on the institute, often would be 'principal investigators.' The less experienced lab heads would supervise, say, a post doc(s), research assistant(s) and PhD student(s), whilst the very experienced might run much larger teams. Sometimes these teams were named after the lab head, as in 'the Harvey lab'. A number of these project teams would be grouped into research programs or themes, reporting through to a Division Head or Group Leader. In turn, those heads would report through to, say, an Institute Director or a member of the executive team. In universities, it would be a lab head reporting to the Head of a Department, who would in turn report to the Head of a School or Faculty. Independent university centres or institutes would be led by a Director who would also report to the Head of a School or Faculty[22]. Quite different to the biotech firms, the academic biotech structure was hierarchical, both organisation-wide and within teams.

Although their structures were very similar, the institutes differed in the degree to which they adhered to the bureaucratic model of ‘orderly process’ (Roth and Sonnert 2011). Some institutes were relatively centralised, based on one site with all staff employed by the institute and reporting through to the Director. Others seemed to be ‘herding cats’. They comprised staff from a range of organisations including hospitals and universities as well as those directly employed by the institute. Researchers were spread across different sites and in some cases for this study I liaised with separate administrations on separate sites. Indeed, the Director of one of the more centralised institutes commented he would not lead a decentralised institute because it would be ‘frustrating’, asserting, ‘if I was going to be boss, I want to be boss’.

It was apparent that some of the individual units participating in this study were fairly autonomous in relation to their broader organisation. As I explained in chapter four, in universities, for example, which seemed the most decentralised in structure, individual managers were responsible for their own staff and budgets, making it difficult to obtain centralised data. Indeed, two of the managers I interviewed complained of the inconsistencies and unfairness resulting from this decentralisation, for example in promotion and tenure decisions and how individual professors chose to allocate their ‘personal’ research budgets. One manager who had left academic biotech for a firm explained how researchers were being treated in one university research centre:

> There were people, it’s unbelievable, they’d been there seven or eight years, never had a pay-rise [from PhD entry level]. They stayed in that environment because their boss said “oh we can’t afford to pay you, we can’t afford to give you a promotion

[22] I did not include higher level university managers in this study because that would begin to incorporate non-biotech specific groups including the Vice Chancellery which has overall responsibility for the broader university.

> because we don't have enough grant money for that". It was just complete bullshit. I don't know why nothing was done about it.

The commercial organisations seemed more consistent across the whole organisation, both in terms of internal procedures and external interactions. They were generally more 'managerial' and exerted more control over the activities of their employees. For example, one large biotech firm made the decision not to not participate in this study, with my request considered by the central administration. Unlike the universities and the block funded research institute, I was not permitted to liaise directly with the biotech R&D department. Meanwhile all of the biotech firms are too small for their decision-making to be de-centralised. Indeed the primary purpose of these firms is decision-making and keeping a tight rein over projects, costs and time. As one manager explained, 'Biotech is very tight and there's a reason for that, I mean you're trying to make money'.

5.3.2. What academic biotech managers do

For comparative purposes, I have used the same typology of managers for academic biotech as for commercial biotech, although only two types, *corporate* and *research* are applicable given that development managers do not work in the academic sector. Whilst the overwhelming majority of managers in my sample were research managers, there were two types of corporate manager. First, there were research managers who had reached a level in the academic hierarchy where their responsibility for managing a research institute, university centre, faculty or school had tipped the emphasis of their role from research into general management. I interviewed three such managers, and they described their roles in terms of research leadership and mentoring, including influence across the broader scientific community, as well as resource management. One manager asserted: 'I wanted to contribute to the culture of the organisation, influence broader things'.

However, even for these managers working at the highest levels of academic biotech management, with overall responsibility for hundreds of staff, direct involvement in research remained a part of their role. Not only was this their preference, but it was also an expectation in medical research where research credentials are a prerequisite for the top job. They did, at this stage of their careers, delegate most of the 'hands on' work. One manager described his reluctant transition:

> That was the point where I realised I probably couldn't do experiments any more. I was still involved in the science, really wholeheartedly, but not physically doing many experiments.

In this way, the corporate roles in academic biotech bore little resemblance to the corporate roles in firms where the managers had well and truly crossed into the business domain.

The second group of corporate managers in this sector were relatively few in number. These managers had moved from research into business development, industry engagement or other non-science roles, where they nevertheless needed to draw on their scientific training. I interviewed two of these managers. Their work focused on technology transfer activities involving interaction with discovery scientists and external collaborators, developing strategies and business plans to 'spin out' research, establishing strategic alliances with industry and other institutions, and managing the contractual arrangements for these. Their jobs shared many characteristics of the business development managers in firms, but there were very limited opportunities for scientists to follow this 'alternative' career path in academic biotech.

The vast majority of academic managers reported in my questionnaire, however, are research managers. Indeed, as shown in table 5.18, of the 300 management positions where titles were provided, 279 (93 percent) are research management positions compared to 21 (7 percent) corporate positions. Therefore, a more useful differentiation between managers is hierarchical level.

Table 5.18: Management level and function of academic biotech managers

Management level	Sample job titles*	Corporate	Research
Lab Head/Manager	Laboratory Head; Project Leader; Senior Lecturer; Facilities Manager	4	231
Senior Manager	Division Head; Program/Theme Leader; Department Head; Research Centre Director; Business Development Manager	3	48
Executive	Institute Director; Institute Deputy Director; Head of School or Faculty; Director of Industry Engagement	14	0
Total		21	279

*Missing title data for 15 managers

Unlike the firms, the hierarchy of management within academic biotech is easily identifiable through the conventional classification systems and titles used across these organisations. Using similar categories to Smith-Doerr (2004) in her comparison of biotech managers working in firms and large hierarchies in the US, I used the jobs titles reported in the questionnaires to categorise hierarchical management levels. I grouped the titles into the three categories of lab head, senior manager, and executive manager. In the few cases where the hierarchical level was unclear, I referred to websites, organisation charts or clarified with the person who completed the questionnaire. In table 5.18, I group the managers by corporate or research function, as well as hierarchical level, and provide a sample of titles for each level.

As can be seen from this data, corporate management is clearly associated with the top jobs in academic biotech. An important observation here is that movement out of a lab-based role in academic biotech requires managers first to attain a relatively high level of seniority in science. This contrasts with commercial biotech where managers can move out of the lab into a range of corporate and development roles at various levels. This is a potential reason why scientists, particularly women, might leave academia via the 'leaky pipeline' in search of alternative roles where they are not required to remain in the lab.

Grant applications are integral to the job

In academic biotech, the process of becoming a manager and retaining a management job is interwoven with the on-going responsibilities of the job itself. I refer here to the formal and time-consuming process of applying for research grants, which is integral to the job of many research managers, from lab head right through to the executive level. One university department head captured the general understanding with her observation that 'in science you've really got to apply, I mean you can't do your job unless you have outside grants.'

Many institutes use the funding mechanisms administered by the NHRMC, ARC and other funding bodies as a de-facto appointment process for management positions. As the HR manager from one institute advised, 'the money comes first, then the research group'. Similarly, a deputy institute director observed: 'research institutes don't promote people; it's up to them to win grants … and also increasingly at universities.' Researchers successful in their grant applications use the money to pay for salaries of staff to work on their project, equipment and consumables for the lab, and, depending on the type of grant, their own salaries.

In an environment where becoming a manager is directly linked to grant funding, it follows that the criteria for winning a grant are also the de-facto criteria for becoming a manager. Such criteria are focused on research productivity, as demonstrated by an impressive track record of publications, awards and previous grants. Consideration is given to both quantity and quality of publications as assessed through citations. One deputy director explained that whilst factors other than publications are taken into account, 'publications are so far above any other metric.' Another professor concurred: 'The first thing I look at is the publication record; I think that's probably the best indicator of success.'

The primary purpose of research grants is to allocate resources to the best researchers with the most promising research projects. Therefore, when success in obtaining a grant is used as the basis for appointing managers, very little consideration is given to the researcher's management skills. As one director of a research centre observed, being the best scientist does not mean being the best manager:

> As a general thing I would say that scientists are not very good managers I think, and often because they are good scientists, or they get good grants, they are managers of people - because they've got the money they can employ the people. But there's nothing that actually judges them to be good managers.

The time spent on preparing formal applications and research proposals is a major difference between the management jobs in firms and in institutes. In firms, managers are generally recruited or promoted into jobs that the CEO or Board want to fill. Managers or potential managers then apply for those jobs, or are 'head-hunted' into them. Whilst the managers actively maintain their personal profiles and networks, this process doesn't usually extend to convincing CEOs a job should exist. In research institutes, however, a normal part of the researcher's role is to present a case that a job actually needs to be done (or particular research needs to be undertaken). The researcher also has to prepare a convincing written case that she or he is the best one to do it, or lead a team of others to do it. Therefore, the existence of the job, or indeed the whole team, rests on the individual's scientific reputation.

In this context, 'self-promotion' is an integral part of the academic managers' work. Research managers must maintain their national and international research profile to ensure they remain competitive for external grants to fund their staff. Successful grant applications, the lifeblood of their careers, rely on impressive CVs that include a strong publications list and a history of previous grants, fellowships, invited conference presentations, awards and prizes. The quality of the researcher's CV is judged by their scientific peers participating on various grants' funding panels and other committees. The importance of self-promotion was emphasised by Clare, a senior manager who thought 'developing your CV' should be a part of a researcher's job description:

> The lab head or institute should emphasise this – the ‘eight’ criteria over which you’ll be judged over the next ‘x’ years. It changes very quickly from just doing science to having to promote yourself.

Moreover, self-promotion was also important for research managers working in the appropriation-funded institute. A recent review of the institute reported:

> One manager emphasised with us that, to succeed, people need good communication skills because they need to ‘sell’ their research proposal, their own capabilities and, for those in management roles, the capabilities of their team members.

As well as maintaining their own research profiles, academic managers, particularly at the senior levels, are required to participate in various peer review processes. The NHMRC application process, for example, makes it clear that applicants who are unable to participate in this process must provide an explanation as to why. One manager explained how these obligations take up much of her time:

> I have many more administrative responsibilities not only to do with being a [senior manager], I’ve got editorial responsibilities and people ask you to review more and more grants and sit on more and more interview committees and it’s just endless.

For the academic managers I interviewed this focus on personal research achievement and funding applications had continued throughout their careers, from lab head through to the executive level. This is a stark contrast to the appointment and promotion criteria in firms where management skills are carefully assessed and essential for advancement. This difference between the two sectors is a recurring theme throughout this thesis.

Managing research: From lab head to senior research manager

The first level of research management in academic biotech is lab head. The transition from researcher to lab head requires a researcher to establish herself or himself as an independent researcher capable of running their own lab, and, as discussed above, often requires a successful grant application which serves as the ‘entry ticket’ to management.

After securing the funding, the new manager then needs to set up their lab. One lab head described her experience in this role:

> You’re trying to build a reputation, well not just in this institute but internationally really, because everybody in here is expected to operate at a kind of international level. You also need to find students and post docs, you need to find people to come from outside in to join you, to get a critical mass to produce the goods. They have to be taught the tools for that particular investigation, they don’t come in trained in it, or even excited by it, you know, you’ve got to convince them it’s worth doing.

‘Producing the goods’ involves writing publications to disseminate research results. This major on-going activity is integral to research management jobs at every level, and there is particular pressure on principal investigators to lead this process, although the writing is often shared amongst the team. By contrast, writing publications was not integral to the jobs of firm managers I interviewed, although some of the managers did write from time to time in collaboration with universities or other partners.

As managers move from lab head to senior manager, the emphasis on ‘leading research’ becomes more pronounced. In my quantitative sample, the median number of staff supervised by academic managers was 4 compared to the median of 2 supervised by managers in firms. Although this indicates that, like the firm managers, many of the managers in research institutes managed relatively small teams, a Mann-Whitney U test showed that across all positions the mean rank of direct reports to academic managers was significantly higher than direct reports to firm managers (U=7607.500, p=.000, r= -0.29). This makes sense given the difference in size of these organisations.

As they moved through the hierarchy, the academic managers supervised more staff. In my sample, lab heads supervised a median of 3 staff; senior managers a median of

11 staff; and Executive Managers a median of 13 staff. Not surprisingly a Mann-Whitney U test showed that the number of staff supervised by senior managers was significantly higher than the number supervised by lab heads (U=1268.500, p=.000, r= -0.47) whereas the difference between the number of staff managed by senior managers and executive managers was not significant. In other words, the big jump in responsibility for managing staff occurs in the transition from lab head to senior manager. At this point the research managers in academic biotech have greater responsibility for staff but little respite in their responsibility for research. Essentially, their jobs continue to escalate in scope as they move through the hierarchy.

Although they often supervised large groups of people, the academic managers talked of research leadership rather than management, an important point of difference between them and the firm managers. Some of the senior managers also referred to themselves as mentors to the younger researchers and lab heads. When I asked one manager what she meant by leadership she replied:

> Leadership is bringing someone to the task who is talented, and having a really good big picture idea of what the project is … and then you know discussing it … and letting go and saying OK this is what I'm thinking about it, now go and see if you can find some proof.

This contrasts with the focus on 'management' in firms, where 'letting go' is the last thing that would be encouraged. In firms, tight management of project timelines and costs is an imperative, with the CEO very aware of what other managers are doing. For example, one manager compared her experience as a firm manager to her previous experience as a university researcher:

> In the university role if I had an idea for a project I could make it happen eventually. I didn't have to report much … that's completely normal in that environment to go and do your own thing. To some extent I think at [biotech firm] I am a little bit micromanaged - I think that's probably the right word for it.

As managers move up the hierarchy in academic research management, the essential elements of running a research project remain the same, but the scope of the role increases to include multiple projects and increased involvement in the administration of science both at the institute and national level. Due to these increased responsibilities, the managers I interviewed took varied approaches as to how much time they spent in the lab, although they all continued to direct the research team. One senior manager, for example, spent more time out of the lab, commenting, 'Thinking about the results and trying to figure out what can be done next … I really like that', whilst another explained:

> I'm actually in the lab, because I'm very hands on. I meet with people all the time and I interact with them all the time and look at their experiments and try and be helpful, trouble shoot, suggest new areas to go into … that's what I spend most of my day doing.

Interestingly, the managers referred to any activity that was not leading research or researchers as 'admin'. They equated management with admin, and many spoke as though it were an interference they had to endure to be able to lead the science. They tended to lump together peer review activities such as referring papers and sitting on panels with day to day lab administration – it was all just 'admin'. One manager, for example, claimed to be on 'so many committees I didn't know whether I was coming or going'. Meanwhile, almost all of them commented on the extra administrative load that came with their promotion to senior managers. One Department Head described his load:

> There's a lot more administration. I feel like I'm organising a lot of things. I've got my research lab and I look after the research, and I then I have departmental meetings and all of the Group Leaders will be there – that's the Departmental Staff Meeting. There's a number of people, including Group Leaders and teaching staff. I have to recruit new people. There's the basic stuff like approving leave. I'm the line manager for the Group Leaders, and now I have to go through all the performance review stuff. There are a lot of people, and I have to learn how to speed all this up because there's too many.

Despite the generally laissez faire approach to managing staff, there was certainly more focus on activities associated with 'people' management than, say, financial management or organising schedules and contracts. As one HR Manager commented: 'academics don't manage budgets'. In contrast to the firm managers, there seemed to be little need for the academic managers to 'cross the domains'. One manager who had worked in both the commercial and academic sectors compared the two:

> You know I never got exposure to accounts at university, to investor relations, reports, you know things that seem like simple things. They're all fundamental things that in a company you have to participate in and understand; profit and loss and everything.

The budgets of most academic managers are constituted by research grants, although other arrangements sometimes apply. The median budget reported for the managers in my sample falls within the range (\$301 – 400K), lower than the median range (\$501K- \$IM) for firm managers. A Mann-Whitney U test showed the mean rank of firm managers' budgets is significantly higher than the academic managers (U=3939.000, p=.045, r= -0.14), this difference most likely due to the high costs of drug development in firms, especially clinical trials.

One University Centre Director claimed to enjoy managing the budget but she also told me she had taught herself and that 'in the beginning it was scary … I didn't get any training, which is not unusual in a uni.' This laissez faire approach to budget management stood in stark contrast to the tight project management approach in firms and the emphasis on business qualifications.

Given most of the academic managers' distaste for this 'admin' work it was difficult to unravel whether there was an inordinate amount of it, or if they just thought that was the case. I asked one Deputy Director, who had worked across both the commercial and academic sectors for many years, which of his two roles involved the most administrative work. Interestingly, on balance, he thought it was the firm.

So, managing groups of people, sometimes large groups, is a key responsibility in academic research management, with many of the managers I interviewed reluctant to take off the white coat themselves. Even those not working in the lab did not stray far from it. In this context only five percent of the academic managers in my sample worked part-time. There were no executive managers and only one senior manager working part-time, whilst only seven percent of lab heads worked part-time. This is a stark contrast to the number of part-time managers in commercial biotech. There is a strong view amongst academic managers working part-time is not feasible in academic biotech management, as I discuss in detail in chapter seven.

5.4 Salaries and recognition

Comparing salaries across commercial firms and research institutes is like comparing apples and oranges. Not only are there major differences in the types of jobs the managers do but their salaries come from very different sources ranging from private equity in firms through to Government and philanthropic funding in research institutes. Nevertheless, salaries are most often used as an objective measure of career advancement and indeed of vertical segregation in the workforce. Therefore it is important to compare the salaries of women and men to develop an understanding of women's relative position in biotech management across the two sectors. To provide context to the salary comparison across sectors, I first examine what is valued within each sector, drawing on my quantitative data together with insights from my interviews with managers.

5.4.1. What is rewarded in firms?

As there is no standard classification system in the commercial sector, I compare salaries across functional areas to identify what is valued. Figure 5.3 shows a comparison of the salaries paid to functional managers in my quantitative sample. This graph shows the corporate managers are on average the highest paid, with a median salary range ($210-249K), and with 19 percent (5 of 27) earning over $350K. Development managers are the second highest paid, with a median salary range

($190-209K) and 10 percent (3 of 30) paid over $350K, whilst research managers are the lowest paid ($100-129K) with the highest paid manager earning between ($250-299K). Research managers tend to congregate at the lower end of the salary scale and are not represented at all at the top end. In contrast, both corporate and development managers congregate in the upper middle range and are also represented at the top end.

This ranking of salaries is well understood in commercial biotech, with one research manager observing:

> To go up in the world at [biotech firm] you have to go to 'admin'. You can only advance so far in biotech in science. You can get to VP or Director but there are less jobs in science at that level.

Development is more highly paid than research management even though it involves less direct supervisory responsibility, a traditional measure of job scope. This indicates that the relationship and organisational skills associated with project management are indeed valued in biotech firms. It is also a break from tradition because in the past the distinction between organising and supervising has advantaged men in the consideration of salary (Chicha 2007). Such skills have also been associated primarily with women and treated as 'natural' female characteristics rather than 'work' skills (Fletcher 1999).

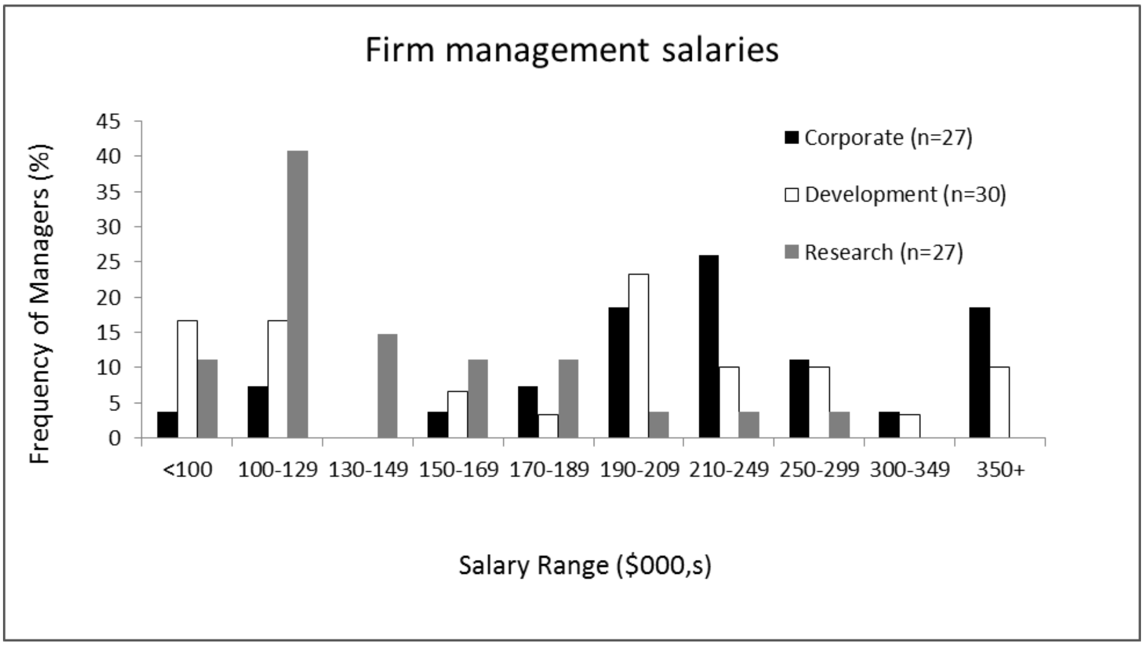

Figure 5.3: Firm manager salaries by functional area (equivalent full-time base salary plus super and bonus for year 30th June 2010)

Indeed, the centrality of development in the commercial biotech sector was further confirmed when I asked the managers what gets rewarded in firms. One COO emphasised it is ‘getting the drug approved … the closer you are to that, the critical path, the more rewarded you are’ whilst another CEO was clear in his reply:

> Progress and new development programs … it’s a reasonably easy thing to measure; hard to implement … in terms of where were you at the start of the year and where’s your program at the end of the year … in terms of the continuum. Are you closer to that next value inflexion point?

In firms, recognition and rewards extend beyond measurable results to include desirable behaviours, including ‘team’ behaviours and ‘company’ behaviours. For example, one research manager described how she had been promoted in recognition of her ‘good behaviour.’ In biotech, she saw rewards handed out to people who ‘knew what they were doing, worked hard, were committed, and got on with people.’ Interestingly, she also commented that ‘being interested and not narrow-minded’ about aspects of the company outside her own work had been noticed and rewarded.

In this sense, broader 'managerial' qualities are highly valued in commercial biotech, over and above specialist skills.

Whilst team and company performance are assessed against 'hard' measures, such as meeting particular milestones, the assessment of individual performance is more subjective, based on a combination of personal productivity and contribution to the broader effort. Team goals are prioritised over individual goals and are reliant on these communal behaviours. One research institute executive manager, who had worked extensively in both the commercial and academic sectors, commented: 'In academia everything is valued with metrics … but not in industry. I think in industry publications generally are a very low priority. Achieving the team goal, the primary goal, is what's important … whereas in academia it's very individual.'

According to my interviewees, productivity in firms means 'getting things done' and 'meeting timelines'. There is a shared understanding of what this means and often advance notice of how it will be rewarded in the form of incentive or 'at risk' salary components, including company shares, share options, or cash bonuses. Indeed, 88 percent of the managers in my quantitative sample were eligible for share based payments. Company annual reports indicate these 'at risk' elements of the managers' salary packages are linked to company milestones including how the company share price performs relative to comparable companies in the sector. In this way, contributing to the whole company is encouraged in firms rather than limiting efforts to one's immediate job.

This deliberate recognition and reward of management skills, including team behaviours, differentiates commercial biotech from academic biotech. It also affords women many career opportunities that are not available in a traditional research institute or university environment because it is very much grounded in current contributions rather than a record of achievement built up over time in the workforce that many women don't have.

5.4.2. What is rewarded in academic biotech?

In academic biotech it is self-evident that corporate managers are paid more than research managers because in the hierarchical structure corporate managers are almost always research managers who have been promoted to the executive level. Hence it is not relevant to compare salaries across functional areas in this sector.

With the exception of some executive positions, biotech managers in academia are paid in accordance with set classification levels within the institute, and those classification levels are directly linked to their personal research achievements. The HR Managers from two institutes explained how the grants system acts as a de-facto salary review process. Researchers apply to grant agencies for fellowships at a particular level, and when the grant is awarded, it includes a salary component for that level, say research, senior or principal fellow. This money is paid to the employing institute, where the decision is made as to how much the researcher is actually paid. This amount usually corresponds to the funding level provided through the grant but sometimes an institute will 'top up' the grant funding, say to match the salary scales of an affiliated university or to maintain internal pay relativities. In this way, a researcher's 'merit-based' pay is determined by a combination of peer assessment of their grant application and discretionary decision-making at their home institute. In the appropriation-funded institute in my study and in universities, salaries are set through their internal classification processes, based on similar principles including internal and sometimes external peer review.

Unlike in commercial biotech where managers are recognised and rewarded for their management responsibilities, in academic biotech 'management' is of secondary importance to leading research, as articulated by one manager:

> I participate in a lot of things and I lead a few projects and I participate in a lot of projects. But what gets recognition is leadership of an endeavour rather than participation in an endeavour.

Mal concurred that research contributions are valued above all else:

> The university wants to see research, the income is really important for a university to get the impact factor, and that's where comparisons are made. And you're talking about numbers and you're talking about rankings of universities. That's really clear.

In this context, as managers gain increasing responsibility for staff, budgets, committee participation and peer review activities, it is still their research achievement that is rewarded. This is despite the large numbers of people managed by some lab heads. This management aspect is often not recognised financially, as one HR manager explained:

> Group Leader is not a paid position; the managers are paid as scientists. The Group Leaders don't get extra pay for the administration, HR and financial management they do, but they get control over the resources.

It is unclear at what point in the academic biotech hierarchy there is an uncoupling of research and management competencies in the consideration of rewards, if indeed there is such an uncoupling. Other than those in industry engagement roles, the executive level managers I interviewed continued to lead research groups and were the recipients of Government research grants even though most of their time was spent on management activities. This suggests that whilst management skills may be considered in the allocation of rewards to these executives, their research achievements remain salient.

5.4.3. Comparing salaries across sectors

In my quantitative sample, the biotech managers in firms are more highly paid than the academic managers. The median salary range of firm managers is ($170-189K) compared to ($130-149K) for the academic managers. A Mann-Whitney U test showed this difference to be statistically significant with the mean rank of firm managers' salaries higher than the mean rank of academic managers' salaries (U=7239.500, p=.000, r=-0.22). As previously mentioned, this could be due to a range of factors not least the different funding arrangements for the two sectors.

A similar trend applies when women and men are compared separately across the sectors. Table 5.19 differentiates the salary ranges for women and men managers in my quantitative sample. These data show (in bold) the median salary range for women managers in firms is $190-209K, compared to $100-129K for women in research institutes. A Mann-Whitney U test of mean ranks also showed a statistically significant difference in salaries by gender (U=374.500, p=.000, r=-0.38). Meanwhile the median salary range for men in firms is $170-189K, compared to $130-149K for men in research institutes. A Mann-Whitney U test of the mean ranks again showed this to be significantly different (U=4332.000, p=.022, r=-0.15).[23]

What is striking about these data is that the median salary range for women managers in firms is higher than any other group, including men in firms, men in academic biotech and women in academic biotech. Given the extent of vertical segregation worldwide this is a surprising finding, and particularly so because commercial biotech is not a female dominated sector where research has shown women are more likely to attain senior positions (Jarman et al. 2012).

To further investigate this finding, I provide a break-down of salaries by functional area in Table 5.20. This shows the median salary range for corporate managers in both firms and research institutes is the same ($210-249K). It also shows the median range for research managers is actually higher in the research institutes ($130-149K) than in commercial biotech ($100-129K), although a Mann-Whitney U test demonstrated this difference is not statistically significant (U=2617.50, p=.609, r=-0.03). Overall, the relatively highly paid development managers raise the median salary range for firm managers, making commercial biotech a more highly paid sector than academic biotech. They make up around one third of the firm sample but are not represented in research institutes.

[23] It should also be noted that these comparisons not include the value of shares or share options paid to many biotech managers which would further increase the salary differences across the sectors. Virtually all of the firm managers in the sample were eligible for these as it is a very common form of payment in the commercial sector. I did not collect data on the value of shares or share options as this can vary substantially from one year to the next.

Table 5.19: Salaries across organisation types by gender. Median ranges in bold.

Salary range $000's	Firms		Academic biotech	
	Women (%)	Men (%)	Women (%)	Men (%)
<100	5 (21)	4 (7)	12 (20)	8 (5)
100-129	1 (4)	17 (28)	**27 (45)**	56 (31)
130-149	0 (-)	4 (7)	5 (8)	**28 (16)**
150-169	3 (13)	3 (5)	8 (13)	43 (24)
170-189	0 (-)	**6 (10)**	4 (7)	11 (6)
190-209	**8 (33)**	5 (8)	1 (2)	6 (3)
210-249	4 (17)	7 (12)	3 (5)	15 (8)
250-299	2 (8)	5 (8)	0 (-)	2 (1)
300-349	0 (-)	2 (3)	0 (-)	6 (3)
350+	1 (4)	7 (12)	0 (-)	4 (2)
Total reported	24 (100)	60 (100)	60 (100)	179 (100)
Missing	-	2 (-)	30 (-)	46 (-)
Total	24	62	90	225

Table 5.20: Salaries across organisation types by function

Organisation type	Median salary range $000's		
	Corporate managers	Development managers	Research managers
Firms	210-249	190-209	100-129
Academic biotech	210-249	Not applicable	130-149

This analysis leads to three preliminary conclusions that I explore further in the following chapters. First, given that women managers in firms have the highest median salary they are likely to hold a large proportion of the highly paid development jobs. Second, given that research managers have the lowest median salaries, biotech managers are likely to gain a financial advantage if they 'take off the white coat' and apply their scientific knowledge in a more generalist capacity. Third, the opportunity to work in a highly paid biotech management role is far greater in the commercial sector where around two thirds of the managers in my sample work in corporate or development roles compared to only around seven per cent of the academic managers, almost all of them at the top of the hierarchy. As previously discussed, there are few alternative career pathways for academic managers other than to work their way through the research system.

Whilst scientists make a monetary choice when they pursue a career in either commercial or academic biotech, it is important to acknowledge that individual managers may or may not rate salary highly as a subjective measure of career success. Indeed none of the academic managers I interviewed mentioned salary as a motivation for working in academia. The HR manager from one institute commented, 'they're not here for the money; they have other motivations', whilst the head of department at one university was not bothered that 'the salary is not great when you compare it to the salary of an electrician or a plumber or anything else'. By contrast several of the firm managers mentioned the attraction of salary in their decision to work in that sector.

Notwithstanding these different career values, an important finding from these salary data is that far from being disadvantaged by leaving the prestigious academic sector, women working in the commercial biotech sector are not only more likely to be managers, they are also likely to be better paid. This is certainly not a case of women being 'ghettoised' in a lower paid occupation so they can access more family friendly working arrangements.

5.5 Chapter Summary

In this chapter I have shown that due to very different forms of organisation, the management jobs in commercial and academic biotech are distinctly different. I have also shown that women are more likely to be managers in the commercial sector than in the academic sector. My analysis suggests these two outcomes are linked. I argue that the type of management work and how it is organised and rewarded in firms is more likely to suit women with family responsibilities than the management work available in academic biotech. Specifically, the range of options to move out of a traditional lab supervisory role and the normalisation of high-quality part-time work suggest commercial biotech might be an attractive option to women, whilst the opposite appears to be the case in academic biotech. Moreover, these jobs are well paid, especially the corporate and development jobs which are considered central to the business model of Victorian biotech firms which are predominantly early stage development firms with a commerce-focus. By contrast, the jobs in academic biotech are primarily of one type where research achievement is valued above all else, through to executive levels. Career progression is based on a track record in research and accompanied by an increase in job scope that limits any opportunity for part-time work. In the next two chapters I explore the interaction of these jobs with the people who work in them. I begin in chapter six with the managers in firms.

6. Women, men and commercial biotech careers

In this chapter I draw on my quantitative data and insights from interviews to examine the experiences of managers working within commercial biotech. Collectively this data suggests that commercial biotech is a 'good sector for women' through four recurring themes. First, high levels of job mobility and the use of informal networking suit many women because, along with their scientific expertise, the emphasis is on their inter-personal skills, flexible availability and reputation for 'getting the job done.' A continuous record of scientific achievement is not the criterion for advancement; the focus is on recent achievements and potential. Second, this sector offers a variety of entry points into management, including consulting roles and 'turnaround' or 'fix it' jobs that can provide a stepping stone to larger roles, and can also fit in with different life stages. Third, it is a gender neutral sector. Relationship-building and organisational skills, traditionally associated with women, are considered integral to business success. Finally, despite indications of a 'work devotion schema' and mixed views about non-standard work arrangements, the network form of organisation, characterised by project work and outsourcing has led to the normalisation of part-time work and career breaks in this sector for both women and men.

6.1 An egalitarian management culture

Recall from chapter five that women comprise 24 of the 86 managers in my sample of firm managers and have a higher median salary range than their female counterparts in academia and male managers in either sector. In this chapter I undertake further analyses to compare women and men within commercial biotech. First I use salaries as a proxy measure to compare the seniority of women and men managers in firms. Although women have a higher median salary range than men, a Mann-Whitney U test showed this difference is not statistically significant (U=717.500, p=.980, r=-0.00). This can be explained by two factors. First, the median salary ranges of women ($190-209K) and men ($170-189K) are at neighbouring intervals which can give rise to this finding. Second, the distribution of managers across the functional areas impacts on this finding. Men make up the majority of management positions and they are more highly represented in the lower paid research positions whilst there are fewer women but they congregate in the higher paid development and corporate roles. Whilst not statistically significant, these data certainly indicate that once women become managers in academic biotech they hold positions of relatively equal seniority and pay to men, an uncommon outcome for women in the commercial world.

Women are also well represented on top management teams. Due to the small size of firms, more than half of the 86 managers in my sample are members of the top team. Nevertheless this is an important job factor because it indicates level of influence in the firm and is a position that may provide access to Board members and networking opportunities across the sector. My data show that 71 percent (17 of 24) of female managers and 61 percent (38 of 62) of male managers are on the top team. Whilst a chi-square test shows this gender difference is not statistically significant (x^2 =.684, *df*=1, N=86, p=.408), this nevertheless indicates a management culture in firms that is very inclusive of women and certainly not exclusive of women.

Table 6.21 shows the scope of women's and men's management responsibilities on three factors: staff supervised; budget managed; and contracts managed. These data show that male managers supervise a median of two staff compared to female managers' responsibility for a median of one. A Mann Whitney U-test showed this difference is not statistically significant (*U*=655.500, *p*=.388, *r*=-0.09). On the second factor, the median budget managed by women and men managers is the same in the range of $501-1M. On the third factor, the median number of contracts managed by women is five compared to the median of two managed by men, although a Mann Whitney U-test demonstrated this difference is not statistically significant (*U*=242.500, *p*=.443, *r*=-0.11). Altogether, these data suggest an egalitarian culture in commercial biotech management where there are no significant differences between the responsibilities of women and men.

Table 6.21: Firm manager job factors by gender

Gender	n (missing)	Job Factor	Median	Min	Max
Women	24(0)	Staff reports	1	0*	12
	19(5)	Budget	$501-1M	Nil	>$10M
	16(8)	Contracts	5	1	14
Men	62(0)	Staff reports	2	0*	12
	41(21)	Budget	$501-1M	Nil	>$10M
	35(27)	Contracts	2	0	46

*Managers with no supervisory responsibilities were eligible for survey because they manage contracted services which were considered a 'proxy' for staff in the questionnaire

6.2 Horizontal gender segregation

Although at first I did not specifically ask about the different roles held by women and men in firms, there was a strong theme through the early interviews that women congregate in development roles, particularly clinical development and regulatory roles. This led me to dig deeper on the issue, directly quizzing the later interviewees about this, and also exploring the quantitative data for confirmation on a broader scale.

I found the interviewee observations were borne out by the questionnaire data, as presented in Table 6.22. Of the 24 female managers, 13 (54 percent) hold positions in development, compared to only 3 (13 percent) in research management and 8 (33 percent) in corporate management roles. The 62 male managers gravitate to different types of management roles, with 17 (27 percent) working in development, 25 (40 percent) working in research, and 20 (32 percent) working in corporate roles. A chi-square test showed this relationship between gender and type of manager is statistically significant (x^2 =7.668, *df*=2, N=86, p=.022).

An important observation here is that, whilst horizontal segregation within professions often sees women congregating in 'specialisms' that offer more family friendly hours those specialisms are usually lower paid. That is not the case here. Development roles are more highly paid than research roles both in firms and in academic biotech. Rather than experiencing a salary disadvantage, women are in fact advantaged by working in firm development roles. They are not 'secondary' or 'support' roles; they are core business.

Table 6.22: Functional managers by gender in commercial biotech

Gender	Corporate managers (%)	Research managers (%)	Development managers (%)
Female	8 (29)	3 (11)	13 (43)
Male	20 (71)	25 (89)	17 (57)
Totals	28 (100)	28 (100)	30 (100)

My quantitative data does not allow me to differentiate between particular types of development roles to test whether women are more likely to be in clinical rather than non-clinical management. However, I note that of the 20 firm managers I interviewed, 8 had previously been development managers (of either or both types) but had all since moved into corporate management roles ranging from CEO, COO to BD Director. I also note many of the C-suite managers had assumed overall management, or sometimes direct management of clinical development programs, even if they did not have a development background. These 'real life' career experiences demonstrate how a clinical/regulatory 'entry ticket' into biotech does not restrict a biotech manager's career to clinical development, and nor does a research or other entry ticket preclude a biotech manager from assuming responsibility for clinical development later in their career.

Even though they may or may not stay in development in the long run, the question remains as to why women are over-represented in development roles, whether clinical or non-clinical. One reason could be that despite the overall shortage of skilled clinical development managers, relative to men there is a ‘healthy’ supply of women with relevant ‘pharma’ experience which is considered an advantage in this role. Another reason may be that women are attracted to the flexible, project-based nature of this work, or the opportunity to work part-time. A third reason could be that women are better at development work because they have superior relationship and organisational skills. Each of these possibilities was suggested during the interviews, which I now analyse in more depth as I seek to understand the interaction of structure and agency in driving these positive outcomes for women in commercial biotech.

6.3 The managers – career and family

As detailed in chapter four, I held in-depth interviews with 26 biotech managers, 20 of whom held or previously held roles as biotech firm managers, and 11 of whom held or previously had held roles as research institute or university managers. Five had worked as managers in both firms and research institutes, and have been included in both subsets. The names I have given to the firm managers along with a brief profile are listed in Table 6.24. There are 13 female managers and 7 male managers.

Of the 20 firm managers, 13 were, or previously had been C-suite managers in firms. Four held executive or senior management positions in research institutes at the time of interview, of which three held or previously had held their firm manager roles concurrently with their academic roles. Twelve of the twenty interviewees held PhD qualifications and twelve held post-graduate business qualifications. Table 6.24 shows a picture of diversity and mobility, with a particularly corporate flavour as highly trained scientists ‘crossed the domains’ to become specialist managers.

6.3.1 Career

Whilst 15 of these managers commenced their careers in a lab environment, only seven completed post-doctoral fellowships. The other eight worked as bench scientists and lab assistants where they learnt early that this was not the pathway to a management career. A further three of the managers worked in hospital pharmacies

Table 6.23: Management experience of firm managers

Name	Current Position	Qualifications*	Functional Management Experience			Organisational Management Experience (in addition to firm)		
			Corp	Dev	Res	RI/Uni	Pharma	Consulting**
Anne	Lab Head (RI)	PhD			√	√		
Bron	COO	MSc, MBA	√	√			√	√
Deb	C-Suite BD	PhD, MBA	√	√				
Ellen	Cent. Dir. (Uni)	PhD			√	√		√
Helen	BD Dir. (Uni)	PhD, MBA	√		√	√		√
Janet	CEO	MSc, MBA	√	√			√	√
Jenny	CEO	MBBS, MBA	√	√			√	√
Josie	BD Manager	MSc, MBA	√				√	√
Kath	CEO	PhD	√					
Louise	C-Suite BD	PhD, MBA	√	√			√	
Nerida	CEO/COO	BSc(Hons), MBA	√	√			√	√
Rowena	CEO	BSc (Hons)	√				√	
Sarah	COO	BSc, MMktg,	√	√			√	√
Bill	CEO	BSc	√				√	√
David	Director (RI)	PhD	√		√	√		√
John	CEO	BSc/BBus, CPA	√					
Luke	Dep. Dir.(RI)	PhD	√		√	√		√
Matt	CEO	PhD	√	√				√
Neil	CEO	PhD, MBA	√				√	√
Rod	COO	PhD, MBA	√					√
Total	20		18	8	5	5	10	14

*MBBS includes medical and veterinary doctor

**Any consulting experience, including self-employed or working for a large consulting firm, or combining consulting with a full-time job (e.g. academics consulting to biotech).

and two moved directly into accounting and sales roles after they finished their science degrees. In this context, Table 6.23 shows that most of the managers gained their management experience out of the lab. Only five had direct research management experience; eight had experience directly managing a development function; whilst 18 had corporate experience in roles such as CEO, COO, with business development, marketing, sales, production and general management responsibilities featuring heavily. These 18 managers drew on their scientific training and had overall responsibility for research and development, but their careers had well and truly crossed the domains.

In terms of organisational experience, it is noteworthy that ten of the firm managers had worked as managers in large pharma at some stage in their careers. This was more common than having worked as managers in research institutes. As I discussed in chapter five, the emphasis in most Victorian biotech firms is on development activities for which pharma experience is highly regarded. My group of interviewees reflects this management emphasis.

Finally, the group also reflects the large amount of consulting work available in the sector, with 14 of the 20 managers having undertaken some form of consulting during their careers. Most of this consulting had been to biotech firms on a short-term, project basis, although two of these managers had undertaken a stint of full-time consulting work in high profile corporate (non-biotech) management consultancies. One of them, Rod, commented on how this had prepared him well for his subsequent biotech career: 'It was a great internship, I was getting the tools for management, with mergers in insurance companies and banks, but I wasn't interested because I liked science.' Most often, however, the consulting work was a normal part of the biotech career trajectory, where the managers honed their project management skills and became accustomed to mobility and flexibility.

6.3.2 Family

Of the 20 interviewees, 16 had dependent children during the time they were biotech firm managers, although many had also worked in different parts of the sector, including pharma and research institutes whilst their children were young. Despite these family commitments, all of the women and men exhibited strong work-centred lifestyle preferences (Hakim 2000). For the men this was in line with 'normal' societal gender expectations, but as C-suite managers, the women in my study were a minority group.

Many of the women acknowledged their senior roles set them apart from other mothers, but did not want to trade places. Rowena, for example, referred to the other mothers at her kids' school as 'very married' and found it irritating when she was asked on a regular basis 'what does your husband do?' Meanwhile Jenny commented on her early days as a manager: 'I can't think of a single manager at [a large pharma] or at [another large pharma] whose wife worked.' Jenny's own mother had pursued her career when Jenny was a child, and Jenny was outraged as she recalled the way her mother had been ostracised with comments like 'How could you leave those babies?'

A few of the women, however, shared their feelings about not being, or not being seen as 'ideal mothers'. Nerida, for example, reflected on not conforming to her own mother's image:

> The guilt of being an absent mother was huge. I travelled a little bit with work as well, not too much, but I was away about three nights a month, and to leave your child … It is hard when your mother is a nurturer. It's only the last couple of years that I've given way to not carrying the guilt that [my husband] does more of the housework than I do. It defines a good mother. And a good wife is someone who does these things.

Meanwhile Kath found she became more reflective about missing the children and would get 'teary' when she travelled, but conceded that ultimately she was 'driven by the joy' in her career.

All of the mothers were committed to their careers as well as to their families and, in general, their strong egalitarian views were reflected in their family arrangements. Most used some form of paid childcare, ranging from childcare centres, after-school care, nannies and relatives. Table 6.25 shows how the managers shared childcare responsibilities. I have used the term 'working carer' (Pocock et al. 2012) to describe those biotech managers who had to organize their work schedule to fit around the children's needs. This includes coordinating the childcare, stepping in when the childcare is unavailable or the children are sick, dropping off and collecting children from childcare or school, cooking meals, and organising children's activities outside childcare hours. For simplicity I have used the term 'primary carer' in relation to partners with this responsibility, although I note some of these partners were also working carers combining caring with part-time work in the typical Australian 'one and a half earner' model (Pocock 2005).

Table 6.24: Childcare arrangements for firm managers with dependent children (n=16)

Managers*	Working carer	Shared care	Partner as primary carer
Male	0	0	6
Female	2	5	3

*For those who are no longer firm managers or no longer have dependent children, these are the arrangements they had in place when they were firm managers with dependent children.

Table 6.24 shows that, of the 16 managers with dependent children, the largest group (6 men and 3 women) were 'ideal workers' with partners as primary carers (Acker 1990). All of these managers acknowledged they could not do their jobs without their partners' support looking after the children. Representing the societal 'norm', the men in this group did not express feelings of guilt, although they were conscious of the 'trade off' both they and their wives made. John, for example admitted he was never home, rarely saw his wife and kids, and usually spent the first two days of any holidays sleeping. He expressed some regret about this now that his children are older, but on reflection did not think he could have done it differently – he just loves his work. He conceded if his wife did not do what she did, they would not have had children. Other men expressed similar views, such as Bill who commented: 'I have worked crazy hours, done a lot of overseas travel. I couldn't have done this without my wife looking after the kids.' All of the men in this group indicated that their partners were not career-oriented. In this frame, their partners were not 'making sacrifices', raising the kids was their preference. In particular, the men made comments such as 'it's important to her to pick up the kids from school' or 'she felt protective … she wanted to raise the kids'. By contrast, the three women in this group did not speak in terms of their partners' preference to raise the children, but with gratitude for their 'sacrifices'. For example, Nerida commented: 'This is a generous offer that he's made, and at the same time it's a generous offer that women make to stay at home and raise a child.' Meanwhile, Kath emphasised how their childcare arrangements were unusual:

> [My husband] would be the only guy at the mums' group. The children and he never worried about that, they loved him. And you see these news reports about this growing trend in men taking care. This is now 20 years later and there is no growing trend.

A second group of five managers shared care responsibilities relatively evenly with their working partners. It is noteworthy that all of the managers in this group were women. Many described their 'egalitarian' agreements with their partners. For example Jenny, whose husband also has a demanding professional career but was keen to have children, explained that she agreed to children on the basis that they would engage a nanny. Their egalitarian approach involved not only sharing care, but also sharing 'career sacrifices' when necessary, with Jenny recognising her husband's sacrifices: 'he would have gone overseas to work in other medical centres, his peers did, but I was doing an MBA so he made a choice not to go.' Others had similar give and take arrangements. Helen and her husband had an agreement to 'alternate the right to choose the best job', with the other partner taking the lead role with the children. As it turned out, Helen took more time out than her husband but she had been happy with that. Meanwhile, Sarah's husband followed her interstate according to their agreement they would relocate together with the kids for 'whoever gets the best gig'. Like Jenny, both Helen and Sarah had engaged nannies at various times. They particularly needed the nannies for when they travelled, with Jenny thankful that her husband travelled only occasionally: 'If he travelled a lot that would be really hard, we would have to have two nannies … I had to travel from when [our first child] was two months old. I've travelled a lot'.

The final group comprised only two managers, both women, who took primary responsibility for childcare whilst also working as biotech managers. Louise, a C-suite BD manager, had just returned to work part-time after having a baby. Even working part-time, she described how she has 'zero time' even though she has a cleaner and lives close to work and childcare. She explained that when you are a senior manager, 'you are the company,' and so she had been working at night when her baby was asleep, and getting some help from her husband when she had early morning teleconferences. The jury was out on the sustainability of that relatively new arrangement. The other primary carer, Rowena, had worked full time in a C-suite BD role. Rowena described herself as 'mad', having spent most of her career working full-time as the main bread-winner, cooking all the meals, doing all domestic duties and arranging the childcare. Now a CEO, Rowena has since divorced her first husband and settled into a more egalitarian relationship where her new partner recently passed up an interstate promotion saying: 'It's your turn.' During the mad times, however, Rowena had relied heavily on extended family to help raise her children.

Like Rowena, others had also 'done it tough' before reaching their current egalitarian relationships. Sarah, for example, described her five years as a single mum, working in senior roles in large pharma. She had a day nanny, a night nanny and did nothing else but work, study and raise her child. Meanwhile Janet complained how her first husband 'never took a day off when the kids were sick' whilst she struggled as primary carer with three part-time jobs. These women's stories demonstrate the unsustainability of combining senior level management work and primary carer responsibilities. Yet they did not ‘opt out’. Instead, they opted out of their unequal marriages and all of them continued on to CEO roles. The determination and career focus of the firm managers, both women and men, was very evident throughout the interviews.

6.4: Networking and job mobility

Having established that these men and women are very focused on their careers, I now examine how they have gone about establishing those careers in the fast-paced world of commercial biotech. With the majority having reached the ‘C-suite’, the first observation I would make is that they are survivors. They are highly qualified and highly skilled, but they have also worked very hard to achieve their status and reputation in the sector. Most of them have many years’ experience in biotech management and largely through career mobility they have built extensive professional networks. These networks, together with their professional reputations mitigate job insecurity in the sector. Without exception, all of them reported finding most of their work through networking, as summarised by Neil, who declared ‘Everything I do is through networking. Every single job I have got is through networking.’ Whilst some of the managers had applied to job ads for entry level positions, none of them had applied to job ads for management positions. It was certainly a case of ‘what you know’ and ‘who you know’ at this level.

On the other side of the equation, for cash-strapped firms, advertising is expensive and time-consuming, and given the skills shortage may not be fruitful. The first strategy for VCs and CEOs is usually ‘who do we know?’ One CEO explained: ‘There are only a limited number of people with the management skills needed for commercialising biotech, who have done it before … you chase those people up.’ Meanwhile Deb described her experience on the receiving end of this practice when a biotech lawyer gave her name to another firm: ‘I didn’t even call [firm] about the job, they called me and they said “Oh yeah you sound like the sort of person we want” and it all just happened from there.’

A strong recruitment theme was the emphasis on personal characteristics as much as scientific expertise. Candidates are favoured for their ability to combine specialist science knowledge and generalist management skills, and their flexibility to 'get the job done', even if they are working outside of their original brief. Janet described the kind of working style that is valued:

> Usually there's very little recruiting because you're so cash strapped. In a small company it has to be about their multi-functionality, and working in a small company is not for everyone. We've had people who are used to working in a big company and they've had a very linear approach to things. So often we just use consultants and give them a run. And sometimes then we decide to recruit them.

Indeed many of the managers stressed the importance of flexibility, including one VC, Glen who observed: 'The technical skills in a biotech firm are not much different to those in 'large pharma' except the personality is different. You're never sure if lights will go on ... has the bill been paid? Glen went on to describe other important personality traits including strong relationship skills. When discussing a recent unsuccessful applicant, he explained: 'They need to walk tall, look you in the eye, smile and laugh; go to Singapore and have presence. I interviewed someone recently, he was goofy.'

The managers I interviewed seemed to be confident, flexible, risk tolerant and willing to take an entrepreneurial approach to their careers. Whilst a few of them talked about the business risks involved in biotech, and many had experienced job instability, there was very little reference to personal career insecurity. Instead they seemed to thrive on the fast pace and the risks associated with biotech. The corporate managers in particular, both male and female, consistently described themselves as impatient and easily bored.

Many capitalised on the often short lifecycles and relatively small size of most firms. Helen, for example, compared the career opportunities in biotech firms to the research institute and university environments where she had also worked. She explained: ‘if you’re looking for your career path through one [organisation], moving upwards slowly to the next level up and the next level, then you might not get that in the vast sum of biotechs.’ However, she elaborated that ‘normally they’re so small you can wear lots of different hats because they’re always short of somebody who’s got the right one or other.’ She described how this provides an ‘incredible opportunity to pick up different skills sets … whether that’s taking on a quality type of role or getting more experience in managing regulatory or taking responsibility for one external relationship.’ Helen emphasised how you use that experience ‘to be portable in your career.’

Despite their specialised early training, most often to PhD level, this open-minded attitude to becoming a generalist was a strong theme. Kath, for example, described how her career changed for the better when she started to pay attention to written work and delivering speeches, rather than the technical training that had been the focus of her PhD. Similarly, Josie, who had moved into biotech on her pharmacist credentials, was enjoying the writing aspect of her role, explaining that English had been her best subject at school but she had not thought there would be any jobs in that.

For virtually all of the corporate managers, this crossing of the domains was a deliberate career strategy, although the opportunities themselves were often serendipitous. For example, Deb, who was originally employed for a clinical development role, found herself compiling the annual report shortly after joining the firm, when the Chief Financial Officer fell ill. She described the event as follows:

> I was left with the whole annual report including the numbers and everything so I was thrown into the fire. And you know it all came together… and so I guess part of that was that I did show I could do that sort of work … I could do work that was not necessarily my area of expertise, but I could do it well and meet deadlines. Anyway, after that my role changed and I became director of business development.

For many of the managers, I would describe their career strategies as 'planned spontaneity'. They positioned themselves to be 'in the right place at the right time' to take up opportunities that might arise. But their lead-up personal marketing was often very targeted and very time-consuming, such as Josie's 'audit' of biotech firms with in-house business development functions and Nerida's extensive interviews with VCs and CEOs that commenced as far back as her undergraduate studies. Their efforts challenge Sennett's thesis that elite workers with skills and networks are less reliant on long term strategic planning and have the luxury of being able to 'dwell in the present' (2006: 80). In fact, the managers I interviewed did both – strategic planning as well as dwelling in the present.

Three of the development managers I interviewed were initially reluctant to move to industry, having commenced their careers as pharmacists in hospitals. They had chosen this pathway, rather than retail pharmacy, to be 'close to the patients'. However, all three found themselves eventually looking for more challenge, and pharma opened up a commercial world they had not previously considered, two of them referring to this as 'the dark side' and another referring to it as 'flogging drugs'. Once they had joined this new world, however, all three changed their attitudes. They undertook post graduate management studies to complete their crossing of the domains and used their pharma regulatory and clinical experience as an 'entry ticket' to biotech, where such experience is highly sought-after, and in short supply (ACG 2010b). As Janet explained:

> I ended up in start-ups because they had no idea about drug development and I had a pharma background. They didn't even know what they didn't know. You would ask questions and they would say we didn't think of that, maybe we should get you involved.

Consulting assignments were often the first point of entry into a firm, or could be longer term arrangements. Sometimes firms initiated a consulting arrangement and sometimes managers preferred this form of employment as they combined biotech consulting with other business ventures. Many of them were quite entrepreneurial.

Janet, for example, described how she and two other managers had formed a consulting group ‘to do consulting but also to raise funds because we could see that shareholders weren’t happy’. This group raised funds to spin out a technology they identified in a university. Meanwhile two of the development managers described how they had pitched ideas to previous employers, including the establishment of a pharmaco-economics group for a clinical research organisation and an oncology pharmacy in a major hospital. Many of the managers also combined other business ventures (usually biotech – related but not always) and Board appointments with their biotech management jobs.

Despite the flexible approach and general appetite for risk amongst the biotech managers, there was some vulnerability about job security. The managers who raised concerns did so in the context of their family responsibilities. Nerida, for example, was pregnant when I interviewed her, and wary of the downturn in investment in early stage firms in the sector. She had worked in a number of CEO and COO roles in early stage firms. When I asked her where she saw herself going she explained how a VC had warned her that the ‘niche window is over’ and she should ‘start looking broader. At the same time recruiters had advised her she is ‘too much of a generalist to be taken seriously by large pharma’ because she does not have ‘true technical skills like a regulatory person or a pharmaco-vigilance person.’ Having always been very career-focused and a forward-planner, Nerida was getting concerned, admitting ‘I feel really exposed now in these roles.’

Meanwhile Deb was planning a family and just beginning to think about job security. She highlighted the potential ‘downside’ to being a generalist and was considering her next job move might be to pharma to further develop her specialist skills:

> In a small company you can almost mould a role for yourself and try lots of things, which is a positive. In some ways the negative is that if you’re not part of a larger company you never really get to specialise say in clinical trials or specialise in one area. You do a little bit of everything. To me that’s a bit of a catch 22.

These women spoke confidently of their skills but were both conscious of the downside of becoming a generalist and limitations to the portability of their skills outside commercial biotech. In a sense these women, and most of the other firm managers, had become ‘specialist-generalists’. They were aware that the longer they followed this generalist path in biotech, the more difficult it would be to return to ‘traditional jobs’ in academia or pharma. Deb had moved into commercial biotech from academia and Nerida from pharma. Whilst there was a high level of job mobility between biotech firms, inter-organisational mobility with the larger organisations was more difficult.

The relatively small size of the commercial biotech sector makes networking simpler and more personal. Once a manager becomes known for delivering high quality work there is little need for ‘self-promotion’ as demonstrated by the experiences of many of the managers who had been ‘tapped on the shoulder’ or simply ‘given a go’. This aspect of the commercial biotech sector may suit women with family responsibilities who want some work, but not a lot of work at this stage of their careers. Being offered opportunities on the basis of their ‘recent reputation’ may also suit women who have moved in and out of the workforce and therefore have not been able to establish a long term ‘track record’.

Given the high level of career mobility and the project-based nature of management work in biotech firms, intuitively one might assume that employment arrangements would be dominated by short term contracts and consultancies. In fact, my questionnaire data shows the opposite is true, with 66 of 83 firm managers (80 percent) employed on a permanent basis and the remainder employed either as term employees or self-employed sub-contractors or consultants. Yet, on reflection, this is quite consistent with the interview feedback that employees may start as consultants and move into more permanent employment positions, or that they simply move to other firms once a project is completed. In this way, job mobility occurs automatically as a consequence of the work, not necessarily because of short-term contractual arrangements based around individuals.

There was a transparency about these comings and goings. People came into commercial biotech jobs expecting they would not last forever and that the whole company could 'go bust' on the back of a poor clinical trial result. With this shared understanding there seemed no need to place individuals on term contracts. The firms did not seek to hold people to three or six-month contracts to avoid termination payments if their roles became redundant. In this relatively short-term environment such payments would not be prohibitive, and would only serve to 'personalise' the job insecurity in an already insecure sector. Looking back on my own experience, most of the managers I worked with held the view that employees on short terms spend most of their time looking for their next job rather than being productive in their current one. There was also a sense that we should bring in people with potential and 'see what happens' as in the new meritocracy (Sennett 2006). What may have appeared to be a short term project often turned into a longer one, or evolved into a different job altogether. There were no recruitment 'rules' about sticking to the original job description.

6.5 Career congruence and 'one-way' streets

In career theory, Holland (1996) refers to the match between personality and work environment as congruence. People seek out work environments that align with their personality. Many of the firm managers sought career congruence by leaving academia when they realised they were not cut out for academic research. In general they preferred a fast-paced commercial environment and the opportunity to work with other people. They were upbeat about these aspects of their work, often associating them with 'fun' and 'excitement'.

Whilst most of the managers emphasised their strong interest in, and sometimes passion for science, the corporate managers in particular were not motivated to pursue a research career in academia, often because they did not think they had the right skills or temperament. They also had other priorities. Neil, for example, realised soon after completing his PhD that he would never be as good (at science) as his peers:

> I came to the realisation that I wasn't going to be one of the best in research. I didn't want a career as a scientist. The people are all outstanding. It was more about job security, and lifestyle, probably more of a material thing with regards to potential income and lifestyle. One doesn't do science for money. They were exactly the people I wanted to work with but I didn't think I could be one of the best, and there was the security. And also at that stage I developed other interests, like how I could use my knowledge of science in the business sector, which is what I've been doing for the past twenty five years.

Others shared this sentiment. After working in laboratories for a couple of years Nerida had realised: 'I'm better not at the bench … I get distracted'. Similarly, Jenny realised early: 'I definitely didn't want to do research … too painstakingly slow … didn't move at the right pace … required too much patience. I wanted to do something more practical and vocational.' Even those who went on to become research managers had expressed an early preference for commercial science. Helen, for example, who had worked as a research manager in a research institute before moving into a firm CEO role, explained how she had always wanted to work in industry: 'I liked projects with an applied outcome – I'm not a discovery research person.' Similarly Matt said he wasn't particularly interested in 'studying chemistry for chemistry's sake' and needed some outcome from it. Having worked in a university and a research institute, he described how his thinking evolved: 'whenever I published a paper, it was sort of like big deal, what next?'

Many of the managers mentioned pay and job security as a reason for moving from academia to commercial biotech. Rod explained how he'd had an epiphany when he and his wife returned from overseas research positions to start Australian research positions: 'It wasn't going to work, two scientists with crap career paths, both funded on 'soft money' (grants).' He spoke with an academic colleague who had joined a biotech firm, and explained how 'we started talking about making money and getting good management into science.' Deb had similar concerns about grant funding in academia. Having worked as a post doc for four years on vaccine development, she had been managing projects and given exposure to industry collaborations when her supervisor asked her what she planned to do next: 'I said I don't know but I'm not sure I like writing grants to get my income every year. The contracts keep expiring.' She began studying her MBA soon afterwards.

For some this transition to commercial science flew in the face of their early influences. Rod had come from three generations of academics and had always wanted to be a scientist. He admitted he had been 'ingerminated with [university] thinking that commercial money is dirty money.' Kath had similar experiences, explaining how when she was a junior scientist accepting money from industry was considered 'prostitution' and commented:

> When I left academia and started a company I thought I was by definition a failure, and everybody knew it; my family, my friends, my peers, my supervisors. I thought clearly I hadn't made it because I wasn't staying in academia. I wasn't writing successful grants.

But there seemed to be no regrets from the managers for succumbing to the lure of commercialisation. When I asked Neil if he had ever regretted his decision to leave a research career, he was emphatic in his reply:

> NO, not at all! I compare myself to my peers … now a lot of them are very famous professors around the world. I take great pleasure in their success. I take pride in them; they're very influential. I work with these individuals.

Others, however, were at pains to emphasize their 'divorce' from academia. Rod had come full circle and now considers an academic career less prestigious than biotech. He described it as 'ineffectual nonsense, not focused or outcome-driven…nebulous'. Kath said she would far rather her children join industry than academia and expressed her concerns about what academia had become: 'I worry that there are a lot of extremely poor publications and that 'we're so proud of our publication list and the number of times it's been cited'. That community of institutions has lost sight of how to assess productivity and achievement.'

Although the academic environment was incongruent with the firm managers' career aspirations, the research managers in firms were an exception. They sought to remain closer to academia with three of the four I interviewed having combined on-going positions in academic research whilst directing firm research programs on a part-time or secondment basis. The firms had a vested interest in these research managers maintaining their research profiles. Their roles were not only to direct the science, but importantly to bring their scientific reputation and research institute affiliation to the profile of the firm. Ellen, for example, had worked for many years in a University-based research institute, which she referred to as her 'day job' but also had been involved in setting up and heading the research of three biotech firms. David and Luke both worked as senior managers in independent institutes whilst undertaking their consultancy-based part-time firm research management jobs, one of them directing the firm's research personnel who were physically located within the institute. These research managers resembled the 'amphibious creatures' described by Powell and Sandholtz (2012: 386) who move back and forth between firms and research institutes.

By contrast, only one of the corporate or development managers I interviewed had returned to academia. Helen had worked as a biotech CEO before she returned to academia – although this time not to a research management role, but a BD role. For the rest of these managers, the move from academia to commercial biotech was a one-way street. This was due to a combination of preference and the realisation they 'couldn't get back in'. Deb explained how a move into a corporate management role would ruin any chances of a return to academia:

> Essentially the day when I made the decision to take that business job my science career was over because you don't publish, you're not pumping out a couple of papers each year. Even if you wanted to go back into the science world, you wouldn't be able to because you haven't got enough publications. You'd never be able to get grants without that publication record behind you. People expect you to get your own money.

The research managers were also conscious of this. Although they appreciated the need for a commercial focus, most did not lose their ‘academic side’. Louise, for example, described the CSOs at both of the biotech firms she had worked for as ‘very intelligent but living in a bubble world opposite to the commercial world’, and warned the ‘academic side has to be managed.’ Others made similar comments about CSOs along the lines that they often lack the skills or interest to take on a corporate role. David was proud to sit at this ‘less commercial’ end of the spectrum. After two years running a firm’s lab part-time as a consultant, he was offered a full-time permanent role in the firm, but declined. Whist he had enjoyed the money, fun and ‘perks’ of biotech, he ultimately wasn’t enticed by this. He discussed the offer with the Director of his home research institute who thought David had ‘potential’ and ‘a bigger role to play’. David admits this played to his ego, and was concerned that if he went to [biotech firm] he would lose the sense of generator discovery.

Having worked in both environments, many of the firm managers compared commercial biotech to academia, and highlighted the fun and excitement of the commercial sector. Fun was associated with the ‘thrill of the chase’ as well as the financial rewards, as described by Jenny:

> It’s a much more risky sector than retailing or some others, but it also offers the ability to do all sorts of fun things and create all sorts of value products and important products that have the ability to return much higher than those other sectors.

Likewise, Nerida described how she enjoyed raising funds for one biotech firm: ‘It was fun and fast and exciting, it was really fun … it was a $12M series A and a $27M series B.’ Meanwhile, David found the commercial environment quite a contrast to his concurrent institute job:

> It was a lot of fun. You know, for the first time in my life I got given a company car … they wanted me to be part of it, you know. They wanted me to feel the tie and an obligation and to do well.

Having 'fun' was often connected to working with others. Most of the managers referred to the collegiate environment of biotech, and compared it to previous roles, especially in academia, where they had felt isolated. Jenny explained: 'Having spent so much time acquiring scientific knowledge, I wanted to have a working role that combined the scientific side with commercial. I found I really enjoyed industry. You got to work with people.'

The managers referred to inter-firm collegiate relationships just as often as their own internal teams. More than networking, there seemed to be genuine friendships and shared experiences across the sector. Kath suggested the collegiate nature of biotech could be due, in part, to the lack of experienced people:

> You try to hire someone with business development experience in biotech, good people are hard to find, experienced good people. So what would be the thesis here? You must consult; you must be collegiate in order to gain the knowledge.

Personally I experienced this camaraderie through the number of referrals for interviews. People gave me long lists of colleagues to speak to, and they did so with obvious affection and admiration. There was also a strong sense of 'a community with a common fate' (Powell et al. 2012: 435). It reminded me of my experience working in one biotech firm where the CEO was genuinely disappointed for another CEO when his firm's clinical trials failed. She claimed he was 'a really nice guy', and everyone on the management team could 'feel his pain'. This happened on many occasions. The managers were all aware of what was happening with other biotech firms. And notwithstanding friendships, negative outcomes for any firm could impact on the general risk profile and share prices across the whole sector.

The question could be asked if women are attracted to commercial biotech because of this communitarian environment. Yet both the women and men firm managers in this study seemed equally attracted to this type of environment. Their personalities were well suited to a sector that involves developing and maintaining relationships, along with the practical application of scientific knowledge and 'making money'. This is a very different work environment to academic science as I will discuss in chapter seven. There is a strong perception that once you leave academic science it is very difficult to return, although it appears the research managers in firms, more so than the corporate or development managers are best positioned to move back and forth across the sectors. Hence, as there are relatively more men working in research roles in firms they may have more opportunity than women to be ‘amphibious creatures’. Women seeking to move from academia to commercial biotech would find more opportunity if they changed to a development or corporate role, which may or may not be congruent with their career aspirations. On the other hand, women seeking to move from firms into academia may find it difficult given extremely limited number of corporate roles and virtual absence of development roles in academia. Overall, career mobility seems to be largely limited to *within* the commercial sector rather than *between* the academic and commercial sectors.

6.6 Turnaround and fix-it jobs

Challenging assignments have been identified as integral to the career development of executive managers (McCauley 2006). The interviews with firm managers revealed how the Victorian biotech sector is fertile ground for such assignments, characterised by high stakes where ‘failure’ of the drug or other development program often results in failure of the company. Amongst the range of challenging assignments on offer, what stood out particularly was how often the managers referred to ‘basket case companies’ and ‘turnaround’ or ‘fix-it’ jobs. Most of the managers recognised there are a high number of companies that fail in this sector, and had themselves been associated at some stage with companies that had either folded or been subject to takeovers. John surmised this is because ‘most biotech firms are not commercially focused … you can’t run companies with only one product; there’s so much risk.’

Some of the managers spoke in-depth about their personal turnaround or fix-it experiences, having inherited problems with products, employees and external partners. Rather than backing away from these problems, they relished the learning opportunities they presented. Some of the CEOs described themselves as change agents and ‘fixers’. Sarah claimed: ‘I like the fixing ... I need a challenge at work ... I can't just do the status quo, I've got to be growing the business or fixing it.' Bill used similar language, referring to himself as a 'change agent' who 'fixes or grows the business, or both.' Meanwhile Kath declared 'I like being in control, I like running a company, I like high risk'. Jenny considered herself to be in the right sector because she 'enjoys creating things' admitting, 'I have enjoyed turning [biotech firm] around, it would have folded'. I note that many of the managers took on these challenging roles because it was their first experience of running a publicly listed company; they wanted to add another string to their bow. Janet laughed: 'If anyone is dumb enough to ask me to run a listed biotech company, that's something I haven't done, give that one a shot!'

Sometimes the managers knew the extent of the turnaround problems they were taking on, and sometimes they did not, but ultimately they all took responsibility for their decisions and made the most of them. Josie, for example, did not feel 'tricked' when she joined an early stage firm whose funding dried up when the investors 'suddenly realised the timeframes involved'. She was philosophical about it, saying 'I didn't do my due diligence.'

Having taken on two turnaround jobs, Jenny spoke of the difficulty of identifying this situation before actually signing up. For her first turnaround, she took the job because 'it seemed on the outside like a bunch of well-credentialed investors in a company that had some good technology with a reasonable amount of cash.' However, after joining the company, she learned of the internal problems, including a dysfunctional Board, a high cost base with too many staff, and what she described as 'the ridiculous expectations' of the investors who had paid too much for an old technology. Consequently, Jenny's role was largely focused on addressing these issues, starting with a reduction in staff:

> I had to get rid of them and rid of them and rid of them. Actually the original asset had no value so we then had to try and create a silk purse out of a sow's ear, and the investors were only interested in the purse, didn't care about the sow's ear. Eventually I thought bugger it, I'm wasting too much of my life here.

Many of the CEOs shared similar experiences, including taking on more than one turnaround, not realising firms were dysfunctional when they took the jobs, and feeling uncertain if they could actually turn the companies around. Sarah described the uncertainty of the task: 'I wasn't sure I'd be able to pull that one out of the bag. I feared that I would be shutting it all down.'

Of the 20 firm managers I interviewed, five female, but only one male manager, talked in depth about their own turnaround and fix-it experiences. This raised the sceptre of the glass cliff (Ryan and Haslam 2005; Ryan et al. 2011) where women are preferentially appointed as leaders when the chances of failure are higher. Indeed, when I specifically asked about this relationship between women and turnaround jobs, a few of the female managers expressed the view that women may be more likely to take on such jobs and also may be better at them. For example, Jenny commented:

> I think the characteristics of women mean they end up being more effective in this type of work. I just wonder if it isn't to do with learning to find a way through and make the best of what's not an ideal situation, and whether there's a degree of tenacity and resourcefulness and flexibility that others may not have. Women are maybe more patient and persistent. It can make the difference. Men might want more immediate success.

Sarah agreed:

> Yes I do think women are more likely to take on these roles. One, all the boys have already refused them. Or two, we're pretty good at multi juggling … you just do the work ... pull it together... make it happen.

These comments by Jenny and Sarah invoke stereotypes of 'women's skills' that have traditionally been undervalued because they have been considered 'natural' female attributes rather than skills (Fletcher 1999). The depth of stereotyping is apparent when these comments were made by two women who particularly emphasised their commitment to equal opportunity. For example, at another point in the interview when I had asked Sarah whether any particular jobs are suited to women in biotech she described that kind of thinking as a ‘cop out’.

Despite the hardships, the managers who took on turnaround jobs usually saw them as opportunities, like Janet who commented: ‘I don’t regret any of them because I learnt so much along the way. But I do regret that there isn't an achievement, so with this company I want to get it transformed and get it up on its feet.’ When Kath became CEO of an early stage biotech she was unaware of the mess she was walking into, including litigation involving board members. She claims not to have handled the stress of the first six months well. She was in a new field, retrenching people and worried about the litigation. However, she persisted and reflects:

> Now if I had the same sets of challenges, I would know what lawyer to ring, I would know which director to trust, I would have a team of people around me who I could share my ideas with. I was all alone in my pyjamas, trying to understand if I in fact understood the problem, let alone solutions. So I think it was a great experience. I’m glad I went through it. I think I did a reasonable job at it. So to that extent I enjoyed it.

When I asked Kath if she would have taken the job if she’d known it would be like that, she replied:

> Now that I know where [the firm] has gone, I think you would have to say yes. But at the time I couldn’t believe the position people had put me in, and knew about it. It’s dishonest. I don’t mind a disagreement but this was blatantly lacking integrity.

The fix-it jobs often did not work out well for the firms, but usually worked out well for the managers’ careers. To some degree this is at odds with the glass cliff phenomenon where women are seen as being set up to fail and potentially to become scapegoats for poor company performance. In particular, the thesis that female traits are favoured when a management role involves staying in the background and enduring the crisis (Ryan et al. 2011) does not apply here. The entrepreneurial women I interviewed were not ‘stay in the background’ types. In fact, they found these turnaround experiences challenging and sometimes knowingly went back for more. They also took responsibility for their decisions to walk into ‘dodgy’ companies. There was a general acceptance that such pitfalls are endemic in commercial biotech as well as an understanding that failure can be attributed to a range of factors, not least the technology itself.

To a large extent this understanding reduces the stigma associated with failure and provides greater opportunity for managers to learn and develop. It is also learning that happens relatively quickly in terms of a manager’s career. Taking on a series of ‘fix it’ jobs for small firms could almost be likened to undertaking a MBA or other management development program. It is high quality management training involving a range of high stakes activities undertaken in a relatively short timeframe. Women with family responsibilities who have had disrupted career paths are likely to benefit from this type of executive ‘training’.

6.7 A ‘gender neutral’ sector

There was general consensus amongst the firm managers that commercial biotech is a ‘good’ sector for women, with two strong themes emerging. First, most managers considered commercial biotech to be ‘gender neutral’ although they expressed different understandings of this concept, sometimes in relation to workplace culture and sometimes in relation to ‘women’s skills’. Second, many of the managers considered the working time arrangements in this sector to suit women with family responsibilities. Drawing on gender as an organising frame (Ridgeway 2011), this discourse often invoked gender stereotypes about how both women and men behave, and what motivates them. I discuss gender neutrality in this section and working time in section 6.8.

6.7.1 Gender and culture

Many of the managers differentiated biotech from the hegemonic masculinity commonly associated with commercial environments. Sarah, for example, commented that 'science transcends things – if you are a gifted scientist gender is irrelevant'. Helen observed biotech is not a male dominated sector, having a gender diverse culture with a 'cadre of intelligent, tertiary-educated people'. Meanwhile, one VC commented that biotech is a young industry that 'doesn't have the biases and ingrained attitudes of other sectors … it's not a macho industry, it's the opposite of that.' Similarly, John interpreted gender neutral as less aggressive, competitive and chauvinistic. Having worked across different industries, he concluded: 'There is a nice gender mix, with women CEOs and senior managers … science favours females as much as males; the research environment is benign.'

Despite these gender neutral overtones there was some evidence of sexism in the sector. Firstly, many of the women in the over 45 year old category had experienced direct and overt discrimination earlier in their careers, with one losing her job for being pregnant and another being declined a job because she might become pregnant. They knew this because these reasons had been openly disclosed to them. Others had directly experienced sexual harassment in the form of 'disgusting language and smutty jokes' or been physically touched by older male managers. The men also had stories of witnessing these kinds of behaviours. Whilst the managers shared these stories with me, all of these incidents occurred during the 80s and 90s. The lack of more recent discrimination of this type is likely to reflect changes in attitudes since that time, anti-discrimination legislation, or possibly the age and career stages of the women interviewed. Whatever the reasons, in this study my focus is on the contemporary biotech environment. Therefore I do not focus on the discrimination of the past, but consider it a useful baseline against which to compare the current situation.

Whilst the managers reported less overt discrimination in contemporary biotech, there were a few examples of 'macho' behaviours at the executive and Board levels. Rowena, for example, related an incident from her own management team on which there was one other woman beside herself, who was junior to the rest of the team:

> One of the men just really hoed into her and thought it was sort of OK because she's junior. And every time she tried to defend herself he'd just shout her down because he had a deeper voice and a louder voice. And so I was gob-smacked, looking at my boss, and he finally did something.

Some managers singled out board members as exhibiting particularly competitive and aggressive behaviours. Nerida, for example, described one particular board member as 'a strange man - he starts everything by putting his penis on the table … but I have to hand it to him, he raised a lot of money for this company.' Meanwhile, Jenny described some of the board members she had worked for: 'you wouldn't want to spend time with them … completely unprincipled … [name] is just an arsehole, he would sell his own mother'. Janet rolled her eyes as she described the board of one company as 'an interesting group of accountants … you can imagine.' These women were all referring to behaviours around profits and shareholder returns rather than science, the pointy 'commercial' end of biotech. In this context, Bill described how his previous manager had asserted 'the business needs a man' when he had recommended a woman as his own CEO replacement.

Others accepted these behaviours as 'par for the course'. For example, Kath did not think 'the testosterone a woman feels in a conference or a group environment, or a business meeting' was any different in biotech to other sectors she had worked in, whilst CEO Janet held a general view that 'most men have enough confidence for everyone in the room … women are incredibly competent, they suffer without saying anything.'

The interesting observation about this stereotypical agentic male behaviour is that all of the examples relate to the Executive or Board level, where profit, funding and capital-raising are of primary concern. None of the managers described the research and development environment in this way, but were at pains to emphasise its gender neutrality.

6.7.2 Women's 'special skills'

A further discourse of gender neutrality in this sector also draws on stereotypes, but this time stereotypes of women, highlighting their 'communal' qualities. Bill, for example, considered biotech 'more accepting of women because it's about care, it involves female traits'. Meanwhile Matt observed:

> Clinical research is reasonably people focused. The motivation behind what you're doing is obviously based in better health care, maybe that has a nurturing element, and aspiration …you're doing something for others.

Interestingly, Bill took a structural perspective on whether the sector welcomes women, whilst Matt considered women's agency in choosing whether or not to work in the sector. Others considered both structure and agency, like one CEO who gave a range of reasons why biotech is good for women: 'It's not testosterone driven, not like IT, fast decisions, black and white; its long term thinking and women are better planners.'

Several managers emphasised women's relationship skills, organisational skills and ability to multi-task. Luke, for example, compared the career trajectories of women and men in biotech:

> The guys seem to be more technically focused and the females seem more organised. The skills that are very valuable in a company are project management skills, and the ability to talk to partners, do deals, be organised. [It's] very rare for males to be very organised … show a level of detail … make sure all the right things are done.

However, the notion that women's skills are especially suited to commercial biotech was contested. Matt, for example, along with some of the female managers, dismissed the idea that women are necessarily 'better' at project management, commenting 'that's just what characterises the industry.' These managers resisted the temptation to stereotype women according to their 'special skills'. Indeed, the women themselves seemed more agentic than communal, and certainly made it abundantly clear that they were motivated by commercial considerations, not ‘care’.

Williams (2010) observes that whilst some women may seek to assimilate with male norms in the workplace and others to empower their traditionally feminine roles, the important issue is not this difference, but the gender dynamics that disadvantage either group. On the basis of these interviews, I cannot conclude that women progress in this sector because they are female. However I can conclude that organisational and relational skills stereotypically associated with women are highly valued, when they are often undervalued in other sectors, including academic science. The ‘gender neutrality’ of commercial biotech may or may not rest in its breaking down of gender stereotypes, but in its recognition of the need for a diverse range of skills in the achievement of commercial success.

6.8 Working time

Most interviewees referred to some aspect of working time in biotech as advantageous to women, and many of them, both women and men, had availed themselves of this at some stage during their careers. In the following sections I examine the managers’ experiences with flexible hours, part-time work and career breaks, especially as they relate to the time squeeze associated with combining high pressure jobs and families. Consistent with much of the literature in this area, this time squeeze seemed to impact more heavily on the women I interviewed than the men.

6.8.1 Long hours – preference or necessity?

Many of the firm managers, especially the CEO and COOs, reported working long to very long hours – ranging from 50 to 80 hours per week – often including evenings and weekends. There was not a gendered pattern to these hours. There were both men and women at the 50 hour end, and men and women at the 80 hour end, with hours varying over their careers as the managers took on different jobs in different organisations.

The managers seemed to move between specific activities or projects requiring long or very long hours, but no-one reported working nine to five. Often the peaks and troughs in working hours were associated with the number of products in development. As discussed in chapter five, the very small firms often would have only one product, although more than half of the managers I interviewed were working in firms developing multiple products. The smaller firms, of course, had fewer staff to manage the workload, which also impacted on the managers' working hours.
John, who referred to himself as 'a commercial guy', considered biotech a less commercial environment than other sectors in which he had worked, including insurance and IT. He commented: 'In more commercial environments, say advertising, it's brutal, misogynist, demands full time attention and effort.' John equated 'commercial' with multiple products and relentlessly long hours. From this perspective the peaks and troughs in biotech rendered it 'less commercial' than other sectors, but also, because of this better for women with families. Nevertheless, almost in contradiction, John personally had worked an average of 60-80 hours per week in both of his biotech management jobs. He considered these long hours necessary to get the job done, commenting that whilst he doesn't consider himself particularly smart, 'you would have to be brilliant to work nine to five.'

John's approach to his own working hours was typical of most of the managers, men and women. In the context of an endless amount of work that could be done, long hours were partly self-imposed because the managers loved their work and wanted to do a 'good job'. Helen aptly described this situation: 'There is a wealth of opportunity and the only limitation is the number of hours in the day'. For most of the managers, long hours were driven, not only by the quantum of work to be done, but their own high expectations.

Nevertheless, working hours were not described in heroic terms. There was not a generalised culture of overwork or face-time. Josie, for example, left pharma because she was 'fed up with the long hours', and sought better work-life balance in biotech. Similarly, Rod had sought a role in biotech because he thought it would be 'more balanced' after a two-year stint of what he described as excessive hours in management consulting. Whilst he found biotech more balanced initially, when licensing deals and a merger came along, that job, too, became ‘all encompassing.’ Often the managers described their long hours in terms of global logistics. As Matt observed:

> Nah, you don’t get any time off, it’s constant. Saturday is Friday in the US, and Sundays are catching up. Then you go again. That’s one downside to the industry.

Similarly, Deb described her after hours work with the firm’s European collaborators:

> There are certainly many conference calls in the evening back and forth. Probably two to three evenings a week I’ll be on conference calls. So work doesn’t stop when you get home.

In this context, balancing work and family was challenging for many of the managers, although the women were the most vocal on this issue. The men tended not to complain about a ‘time squeeze’ as they were all in relationships where their wives took the primary carer role. Helen, for example, explained that of her numerous management roles in research and corporate functions, her biotech CEO role was the most demanding time-wise. She was regularly on conference calls to the USA out of hours, and worked weekends. She explained how it was a tumultuous time where even when she wasn’t working there was ‘no time when I wasn’t thinking about work … FDA approval, capital, uncertainties …’ Helen was comfortable using a full time nanny for childcare, but like many professional women, also wanted to spend quality time with the children herself. She was of the view that women are more balanced in their work-life decisions, and that ‘work is not everything’. Despite this belief, however, she had usually worked longer hours than her manager husband. She found the pressure of biotech had prevented her from achieving her work-life balance goals and admitted that when she finally left her high-pressure CEO role she was exhausted and crying from the built-up stress.

The female managers gave numerous examples of the ‘time squeeze’. ‘Out of routine’ situations caused the most problems, especially travel and sickness. Some management roles, particularly the corporate roles, involved overseas business development and investor meetings. The CEOs and COOs quoted between two and five months travel per year, depending on the stage of the company. Sarah, who had left her child at home when she travelled for four months during the first year of her CEO role, stressed the need for family support: ‘You have to have a relationship and structure that allows you to do that otherwise you just can't take those roles.’ Even for those with a stay-at-home spouse, the travel was difficult. Kath observed: ‘There was one year, the year my father died; I was overseas 5 months that year. It was just ridiculous. I can’t believe it now I’m saying it.’

The development and research managers tended to travel less often than the corporate managers although the global nature of biotech meant that virtually all managers had to travel at some stage. Bron commented on the importance of travel, even in roles that can be relatively flexible in other respects:

> Clinical trials - you can do that from a distance because a lot of them are done outside Melbourne and outside Australia but there is always some element of travel. And I think that the issue for the biotech industry in Australia is that it's small and if you're going to make any sort of impact you do have to travel outside Australia. Regulatory affairs - again you need to be across the international regulations, but you really can't do that just from Australia. You need to travel, you need to be in the environment, attend the workshops and meet the movers and shakers.

Whilst the managers did not wear long hours as a badge of honour, they did what it took to get the job done and did not allow personal commitments, even illness, prevent them from working. There was not a culture of face-time, but most of the managers worked long hours, sometimes because it was required and sometimes because they were passionate about their work. Nevertheless, a key observation is the project based nature of the work meant that very long hours tended to peak and trough and hours also varied according to the size of firm and number of products in development, allowing for a range of working hours options in this sector.

6.8.2 Part-time and flexible hours

Part-time hours and flexibility were often conflated in the interviews but they are quite different concepts. Flexibility, such as the ability to work around personal commitments and appointments was available to all of the managers, although high workloads and scheduled meetings limited that flexibility in practice, and working from home during normal working hours was often considered unsuitable. Meanwhile, part-time work of less than 35 hours per week was very definitely dependent on the job that needed to be done. In either case, decisions were at the discretion of the CEO. Interestingly none of the managers made any reference to 'policies' or the 'right to request' either part-time or flexible hours under Government legislation or company policies. As managers themselves, they respected their own managers' prerogative to approve or deny their requests.

The biotech managers provided some insight into patterns of part time and flexible work through their personal experiences as well as through their attitudes as managers of others. Whilst all but one of the managers I interviewed were effectively working full time (three of them with multiple part-time roles), many of them, both women and men, had worked either in part-time or 'non-standard' roles such as consulting or contracting in the past. These experiences led them to be open-minded about part-time work but did not diminish their commercial focus. In decisions regarding work hours, their number one priority was productivity, and they applied this mindset to the staff they engaged to work in their firms, and to themselves.

Analysis of my quantitative sample of managers showed a higher proportion of women than men work part-time in firms. Table 6.25 shows that 35 per cent of women managers and 18 per cent of men managers work part-time, although a chi-square test showed this difference is not significant (x^2 =2.807, *df*=1, N=85, *p*=.086). In other words, part-time work is normalised for both male and female managers in the sector.

This differentiates commercial biotech from most workplaces where it is usually women who make up the bulk of the part-time workforce.

Table 6.25: Firm managers employment status (full/part-time)

	Full time (%)	Part time (%)	Totals (%)
Women	15 (65)	8 (35)	23 (100)
Men	51 (82)	11 (18)	62 (100)
Totals	66 (78)	19 (22)	85* (100)

*Missing data for one woman manager

In chapter five I showed that a significantly higher proportion of managers work part-time in small biotech firms than in medium or large firms. One could surmise that women with family responsibilities seeking part-time work might be more highly represented in these small firms. However, a chi-square test showed no significant relationship between gender and firm size amongst the firm managers (x^2=2.905, *df*=2, N=86, *p*=.153). Importantly, therefore, working part-time does not lead to the 'ghettoisation' of women in small firms. My interviews suggest this is likely due to the high level of mobility in the sector whereby women and men can develop biotech management skills in part-time roles in small firms that are transferrable to roles in larger firms.

Part-time work and flexibility do not always go together. Apart from business considerations, the general attitude of the CEO or Board toward non-standard work hours, and their attitude towards individual employees influence decisions about working hours. In some very small, 'virtual' firms part-time work is accompanied by greater flexibility, but often this is because there are only one or two employees, or because the head office is located in a university. For example, Neil, a CEO in a virtual firm located in a university, took a 'portfolio' approach to his career, combining various part-time biotech jobs:

> I have work to do and I get judged on whether I get it done. I wouldn't have a clue how many hours I work on [biotech firm]. I don't keep hours, that's a very old fashioned way of thinking about work. I would say on average I would work about 60 hours a week, including all the companies I work for. I don't think of it as a technical definition of work. I enjoy what I do.

In many firms, a manager's ability to negotiate non-standard arrangements depends to a large degree on their skills and reputation. John summed up the general attitude: 'I don't go out of my way for nine-to-fivers – they have to earn it, get runs on the board first'. Meanwhile, Janet explained how having the right skills would also influence the negotiation:

> The skill sets are rare so if you find someone who is good … Like a staff member here, she lived in Melbourne and I met her when I was consulting in Sydney. I said you can stay in Melbourne, work from home, it's all fine by me. She works at home a day a week now. Whatever she wants to work is just fine by me because she does the job. She works longer hours than just about anyone else.

Similarly, Sarah had an open mind to flexible work arrangements for the 'right staff':

> You pick and choose the people you're more flexible with. For example, when I was at [biotech firm], we had a lady who didn't drive so it was very difficult for her to get to work. So we let her work from home two days a week. What she did at home in two days was probably worth five days that others worked because she was just so incredibly grateful.

Similar stories abounded in the interviews. Flexibility could not be taken for granted. It was only for trusted, highly committed and highly skilled employees.

In general, the managers seemed more amenable to flexible work than to less work. CEOs Janet and Sarah, for example, referred to the importance of putting in the hours to get the work done. Janet was clearly impressed by her development manager working ‘longer hours than just about anyone else’ whilst Sarah was very pleased with her manager’s five days of work completed in two.

This attitude that part-timers are ‘good value’ was very widespread amongst my interviewees. Bill recalled being pleased when he negotiated a job share arrangement for two women who worked for him, resulting in ‘a six and a half day week’ from their combined efforts. He claimed this had been his general experience with women working part time. Others agreed. Neil expressed a general view that women are more focused:

> I think a female who has had a family and come back three days a week would be more productive than a male or female working in the very same role full time five days a week, because they are focused, very productive. They get in at a particular time and leave at a particular time and are extremely productive and effective. And that's also the view of other people I speak to.

However, for those managers working part-time, especially women, this ‘good value’ was often a double-edged sword that saw them ‘buying out’ of long hours by reducing their formal paid hours and increasing their unpaid hours. In management roles, where the work is complex and highly skilled, it is unlikely to be completed effectively in a truncated timeframe. The interviewees who had worked in part-time biotech management roles at various times in their careers related many tales of overwork and exhaustion. In most cases they had been doing whatever it took to retain their flexibility, usually to fit in with their family responsibilities.

Consider, for example, the situation of Louise, a senior BD director. She was surprised when the CEO agreed to her working part-time after the birth of her first child: ‘I was expecting them to say you have to come back full time but they said no we're comfortable with three days a week and if there’s more than three days required you can do it at home.’ Louise went on to explain that if she needed to work extra she did not get paid for it; that was part of the trade-off for the flexibility. When I questioned the fairness of that arrangement, she stressed that before she’d had her baby she had worked evenings and weekends voluntarily. She loves work, and did not see this as much different, accepting that she had been the one to initiate the three-day week and being so grateful that they had agreed to it. Like many professional women working part-time Louise couched this arrangement in terms of ‘choice’.

Whilst Louise had only just commenced her part-time ‘doing extra hours for free’ arrangement, Nerida had been working this way for years. She was feeling burnt out from combining part-time CEO jobs and was considering taking a full time role so that she would not be pulled in so many directions:

> These companies are all overcommitted. They need people who are workaholics to make these companies work, and they spread you so thin as well. I'm with three different groups at the moment and they all just expect you to be more attentive to their company if something happens. And there's no allowance for the fact that they're only paying me for half a day a week. And yet they're expecting me to be responsive right through the whole clock.

Similarly, at one stage it dawned on Janet that her part-time clinical management and consulting jobs added up to more than a full time job so why didn’t she just get a full time job?

> I have done a lot. I was shocked because every job I've had pretty much I was doing three jobs at a time. I don't know that I recommend it. I ended up working more than a full time person but had flexibility … did some consulting, worked for a CRO, ran some clinical trials. When you have kids you're exhausted anyway, and I needed the money.

Now she is a CEO, Janet is supportive of other women seeking to work part-time or from home, but interestingly she does not question the perpetuation of the micro emancipation (Alvesson and Wilmott 2002) that she herself has experienced:

> Pretty much everyone at [CRO] was a part time mum - more reliable, more desperate. I've been there, done that. And turning things around overnight it’s not an issue. People were happy to have the flexibility. I've got an investor relations lady who has

> just had a baby; she is working twice as hard. She's more responsive than before.

Similarly, Kath used part-time work as a strategy to attract top quality women, claiming: ‘It’s one of my little models that you can get a really top woman if you offer four days a week.’ However, she also described how she had ‘overblown it’ earlier in her own career and knew that hadn’t been good for her:

> I worked out of home for a year to save [biotech firm] money, and that’s dangerous I reckon. For me it’s dangerous, I need to get out and see people. You end up working way too many hours.

These women all described the long hours associated with their apparently ‘part-time’ and ‘flexible’ biotech management jobs. This style of working had helped them to reach CEO positions, and sometimes continued once they were in CEO positions, although usually by the time they reached the most senior job, they were working full-time. As CEOs they did not consider their commercial focus on ‘good value’ as exploitation of their female colleagues even though they could see how they, themselves had struggled in similar situations. Instead, they saw it as a ‘win-win’ and the only way women with family responsibilities can compete effectively in the workplace. In doing so, they perpetuate the common situation where women over-perform to ‘deserve’ flexibility (Pocock et al. 2012). This struggle to keep hours in check, especially for those managing family and work responsibilities, was a strong theme in my interviews with women, but not in my interviews with men, reminding us that even high level professional women operate within an overall work-care regime that sees women working longer hours overall than men. Due to the long hours required and, for some, the career mystique, the effects of this regime are potentially worse for women in elite jobs despite their high salaries and ability to purchase domestic help.

Some managers did not consider part-time work compatible with management level positions, or were keen for managers to work in the office, not from home. Rod, for example, was generally open to part-time project management work, but he started from the traditional 'ideal worker' position that the jobs were essentially full-time and could be reorganised to cater for part-time requests, although not for managers:

> I've created 9.30 to 3.00 jobs [school hours], but not managerial jobs. It depends on the complexity, the number of cross-interactions. My US experience was that there were too many meetings. It makes it hard if you can't be in a meeting.

Other managers explained how their requests to work from home had been refused by CEO's who insisted on face-time. Josie, who had worked for three different biotech firms of various sizes, commented that she had seen many people working flexibly in biotech, but in the end flexibility 'comes back to the manager'.

Several managers linked the flexibility of project management work, especially in clinical development and regulatory roles, to women's work preferences because it provides peaks and troughs and can fit in with other activities. Some went further, claiming women are better at working part-time than men. For example, one CEO was very enthusiastic about the capabilities of the female managers on his senior team. He took the view that development work is a natural fit for a part-time or flexible work model:

> Biotech is project management based. Women are better at it. A lot of blokes won't do part-time but women are more flexible, they're enthusiastic about part time work. And working from home is fine. You don't have to be there for a project management position … analysing data can be done at home.

The managers saw fewer opportunities for part-time work in research management. Part-time in this role was usually associated with consulting. Anne, who worked as a full-time research manager, thought career prospects would be poor for anyone working part-time in an 'in-house' role:

> If you are talking about doing a role part time it would be easier to do it with project management or clinical positions than lab work. I have a friend, the company wanted her to return after maternity leave, they wanted to retain her skills and she wanted to

> work part-time. It was easier to be absent if she was in a more senior role so they promoted her because they could retain her, and it was more workable than being a floor manager.

Overall, there was ample evidence of part-time and flexible work in commercial biotech, but only for roles considered suitable, and for people considered 'deserving'. Such decisions were underpinned by concerns about productivity, with CEOs holding a range of attitudes about 'what works' but mostly keeping an 'open mind' about the possibilities.

6.8.3 Career breaks

Amongst the group of managers I interviewed, both women and men had experienced several changes of employment. Of the 16 firm managers with children, all of whom were C-suite managers, nine had experienced discontinuity of traditional full-time on-going employment. The most common forms of discontinuity involved periods of maternity leave (for women only, as none of the men had taken parental leave); periods of short-term project-based consulting; and periods of part-time work. Helen observed that the discontinuity associated with project work, and biotech firms generally, fits quite well with family responsibilities and women's career trajectories because 'when you look at the lifecycle of biotech companies, a lot of them don't last much longer than five to eight years.'

Of the ten women with children, only four of them had taken maternity leave of more than three months. The remaining six had taken three months or less off work. There are various reasons for this, but it is important first to note that all but two of the women had their children in the 1980s and 1990s. Moreover, at the time their children were born, only three of the women were actually working at biotech firms, whilst four were working at large pharma, one at a research institute, one at a university, and one in another sector altogether. The women's use of parental leave entitlements therefore should be seen in the context of time and place.

For those women who had children in the 1980s and 1990s, all but two had access to statutory parental leave of 52 weeks unpaid leave, for which legislation had been introduced in 1979[24]. The remaining two women did not qualify for this as they were not long-term employees. Notwithstanding their entitlements, however, most of the women reported negative attitudes from managers about taking maternity leave and feared their career opportunities would be limited when they returned. Whilst these experiences do not necessarily reflect directly on contemporary biotech firm workplaces, they are experiences that have influenced the careers of these women, and that influence the way they think of parental leave now that they are C-suite managers. Bron, for example, who had faced choices about taking maternity leave earlier in her career, observed:

> Men take a path 'more well-travelled'. They are not faced with the same choices. I am currently managing men becoming fathers – their career paths are still not being interrupted in the same way as women giving birth.

One pioneering woman who worked as a biotech commercial director when she had her first child in the 1990s was told she was ineligible for leave at that senior level and that her job would not be held open for her, despite her intending to take only three months. However, when things 'fell apart' whilst she was away, the CEO rang her and asked her to come back, which she did, part-time, when her baby was six weeks old. She said her manager had apologised and changed his view.

The women working in the larger organisations, including both pharma and research institutes, described difficult environments and some entrenched gender biases. Helen, for example, who clearly had been second in charge in her research group when she went on maternity leave, came back a year later only to be overlooked for an obvious promotion. Others, aware of such biases, were reluctant to take leave,

---

[24] Since 1979, female Australian employees employed on a long-term basis (i.e., 12 months or more) have been entitled to 52 weeks of unpaid maternity leavehttp://www.aifs.gov.au/cfca/pubs/papers/a143831/03.html accessed 2/8/2013

although still couched their decisions in terms of ‘choice’. Jenny, for example, returned to work three weeks after giving birth to her first child. Her ‘choice’ would seem clear by her comment that she ‘couldn’t get back to work fast enough’. However, her desire to ‘protect her job’ in the competitive, male-dominated work environment also influenced her decision. Referring to what she considered a dysfunctional work environment at the time, she reflected:

> Well I couldn't take a year off. If I had taken a year off then my job would have had to be given to someone else. I knew I couldn't afford to leave otherwise they would end up just stuffing everything. We had made improvements; it would all be just stuffed up.

Jenny admitted that she was not under pressure from others to return to work but was also conscious of the gender biases she had witnessed in the workforce and the gender subtext that women with children, or the potential to have children are not suitable for management roles. Rather than being disapproved of, she thought taking leave would have been viewed as an example as to why a woman couldn’t have a management job at her senior level. She explained:

> The other guys I worked with, some of them were incredibly sexist. All of them had stay at home wives. All of them had, you know, everything on beck and call and stuff like that … but none of them had to face it [maternity leave].

In many ways, Jenny fits Hakim’s (2000) description of a work-centred woman, prioritising paid work, and taking full responsibility for her choice. However, Jenny’s reflections demonstrate that even women who are very clear about their priorities make decisions within the constraints of gendered expectations. It is not clear whether Jenny’s career progression would have slowed if she had taken longer maternity leave, but she held a strong perception, based on her workplace observations that it would have. This perception may not have altered Jenny’s decision, but many other women might have responded differently in those circumstances.

Although maternity leave has become more widely available since Jenny's experience, two of the more recent mothers demonstrated the reluctance of many managers to avail themselves of that right. Louise started doing a few hours' work per week at home from when her baby was four days old although she did not return to the office until her baby was eight months old, and then only part-time. Similarly, Nerida was keen to return to work quickly. She was back in the office one day per week when her baby was three weeks old, claiming it made 'the world of difference' to her, giving her back control and authority and allowing her to be professional and capable.

The experiences of these women across various organisational settings over many years indicate that legislative rights to take a year or more of parental leave are largely irrelevant in managers' decisions about their working arrangements. Most of the women made minimal use of parental leave entitlements, although Nerida and Louise did request flexible and part-time work, and were then both caught up in the double-edged sword arrangement of 'doing work for free' to retain that flexibility. Like many managers and highly skilled professionals, the women generally accepted the temporal organisation of their chosen profession and adopted strategies for managing their work and private lives that were generally more *work*-friendly than *family*-friendly (Moen et al. 2013).

Whilst these work-centred women were reluctant to take time out of their careers, others were reluctant even to start a family. Anne, who had been working as a firm research manager, explained how she had put off having children:

> I would not have been comfortable having a family at [biotech firm]. I would have felt under a great pressure and like I was doing the wrong thing and that I was cheating them.

Anne's nervousness, however, extended beyond how she thought pregnancy would be viewed at the biotech firm to her own career expectations:

> I’ve been nervous for 10 years thinking about when I want to do it. I’ve been perpetually scared this is going to be a bad thing for my career. I couldn’t see that there would be a way that it wouldn’t affect your career … how can it not affect your career?

It was difficult to untangle the reasons for women’s reluctance to take time out of the workforce. Was it their work-centred preference to be at work rather than at home with a baby, or would they have liked to have more time at home but feared losing career momentum? In order to understand this better, I asked the biotech managers who had faced these parental leave decisions, how they view parental leave in the contemporary environment now they are C-suite managers. Their responses were grounded in commercial realities, and the kind of thinking that influenced earlier decisions about their own leave. For example, Jenny had reached the conclusion that even though theoretically you would wish it to be possible, holding a job open for a year is impossible for most biotech roles:

> I do think there are a lot of jobs where it is impossible, and this is accentuated in a small organisation. It is impossible to resource it properly so you're compromising the business.

Bron also acknowledged the difficulties associated with covering parental leave in a small firm, compared to a large organisation.

> It’s easy to be critical of companies that don’t offer paid maternity leave or don’t offer people time out to spend with their babies … because you’re trying to run a business at the same time. You’re trying to meet the business needs. I think in a small organisation it’s incredibly difficult because you don’t have the kind of back-up or a number of departments and then you can cross somebody over.

Overall, there was a theme that despite the ‘peaks and troughs’ in biotech firms, covering parental leave absences can be difficult, and the commercially-minded women who work in this sector are acutely aware of this difficulty. In fact, many of them clearly adapted their behaviours to accommodate these business imperatives.

Despite these general difficulties, however, a number of managers identified development roles, particularly clinical development roles, as slightly easier to cover during an employee's absence. According to one CEO, managers can take time out from development roles because the strategy does not change: 'you can pick it up again.' He highlighted the difference between these roles and the research management roles in academia where 'women are just making their mark at 30-35, then they have a kid and they can't catch up again - experiments don't wait.'

Many women held the view that time off would adversely affect their careers, whether this was based on the 'the vibe' from their employer, their observations of others, or their personal fear of losing career momentum, justified or otherwise. Sometimes it was difficult to differentiate between these different influences. Nevertheless, the high degree of mobility within the sector, breaks between projects, part-time work and consulting projects all contribute to the normalisation of non-linear careers in this sector, for both women and men. In this environment, the leave taken by women to care for children is just one of the many twists and turns characteristic of this career path.

6.9 Chapter summary

In this chapter I have demonstrated that commercial biotech management provides an egalitarian and largely gender neutral environment where traditionally 'female' skills are highly valued. Although women may congregate in 'family friendly' development roles, this does not lead to 'ghettoisation' in a female niche. My interviewees' experiences demonstrate this work can also provide a launching pad for C-suite careers, although such advancement requires career mobility within the sector, a strong commercial focus, tolerance for risk, and enthusiasm for 'turnaround' jobs. Opportunities for advancement are facilitated through a collegial network and provided on the basis of a manager's reputation and potential. Although most of the firm managers in this study positioned themselves as ideal workers and took minimal breaks for child-rearing, many had also worked in part-time or consulting roles and were open-minded about offering non-standard work. A strong theme is that whilst non-standard, including part-time, work is normalised for women and men this is largely driven by commercial imperatives, not gender equity concerns. Overall, the career experiences of these firm managers are markedly different from those of the academic managers as I discuss in the next chapter.

7. Women, men and academic biotech careers

In this chapter I examine the career experiences of women and men in academic biotech, comparing and contrasting these with the experiences of firm managers. Similar to the firm managers, the academic managers are career-focused, work long hours, and face on-going job insecurity. And those with children experience a similar 'time-squeeze'. However, unlike in the commercial sector, there is very little job mobility or variety in academic biotech. Career paths are linear, continuous and full-time. The 'race for discovery' is unforgiving of career breaks and there is a strong perception that part-time work is not feasible at the management level. This is exacerbated by the competitive grants system where a time-based assessment of research productivity prevails, job insecurity is personalised and teamwork and other management contributions are undervalued. Whilst academic managers work flexibly, this does not reduce the heavy workload experienced by many. The temporal organisation of work and view of productivity in academic biotech creates an environment that makes it very difficult to balance work and family life despite policy initiatives to improve gender equity outcomes. As a result, female managers in this sector are concentrated in lower level management positions and earn lower pay than their male colleagues.

7.1 Vertical segregation in academic biotech

Given the hierarchical structure of the sector, most studies of academia draw on classification data as an indicator of career progress. For my sample of 315 academic biotech managers, however, I gathered information about job titles and responsibilities rather than classifications. As described in chapter five, I grouped those job titles into the three hierarchical management levels of lab head, senior manager, and executive manager. Table 7.27 shows the vast majority of the managers hold lab head positions, with 90.4 percent of women and 73.7 percent of men in those roles. These data show that within the management ranks, women are over-represented as lab heads and under-represented at senior management and executive levels. A chi-square test showed the relationship between gender and management level is statistically significant (x^2 =9.816, *df*=2, N=300, *p*=.007).

Table 7.26: Management levels of women and men managers

Management level	Women (%)	Men (%)
Lab Head	75 (90.4)	160 (73.7)
Senior Manager	6 (7.2)	45 (20.7)
Executive	2 (2.4)	12 (5.5)
Total	83 (100)	217* (100)

*Missing data for 7 women and 8 men

Not surprisingly, this vertical segregation of women's and men's management levels is also reflected in salaries. Figure 7.4 shows women congregating in the lowest two salary ranges, with a median salary range ($100-129K), and none earning over $250K. By comparison, the median salary range for male managers is ($130-149K), with 6.7 percent earning over $250K, and 2.2 percent earning over $350K. A Mann-Whitney U test comparing the mean ranks of female and male salaries shows this difference is statistically significant (*U*=3507.500, *p*=.000, *r*=-0.27).

Given that more fine-grained units of analysis tend to reveal greater segregation I undertook further analyses to determine whether this pattern of vertical segregation continues within the three management levels. These analyses showed that this is indeed the case. Whilst there is no significant difference in salaries between women and men within the senior and executive management levels, a Mann-Whitney U test showed that within the large group of lab heads, the mean rank of male salaries is significantly higher that of females (*U*=1864.000, *p*=.003, *r*=-0.24). Figure 7.5 shows that whilst most of the lab heads are paid between ($100-129K), women are over-represented in the <$100K range and under-represented in the higher salary ranges.

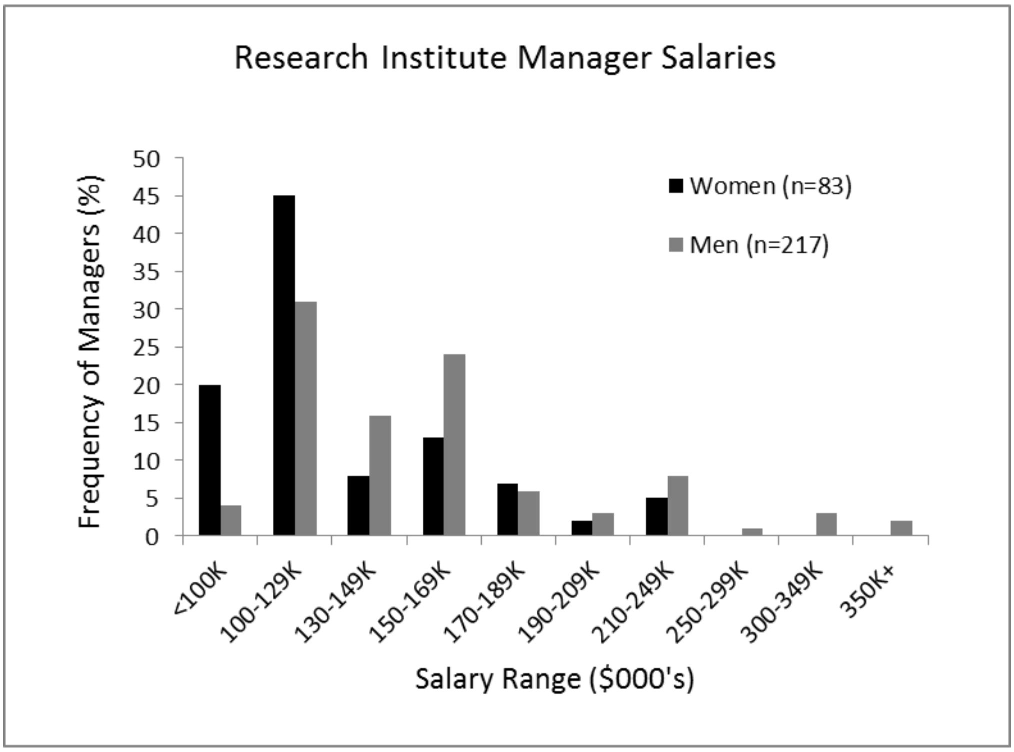

Figure 7.4: Salaries of female and male research institute managers

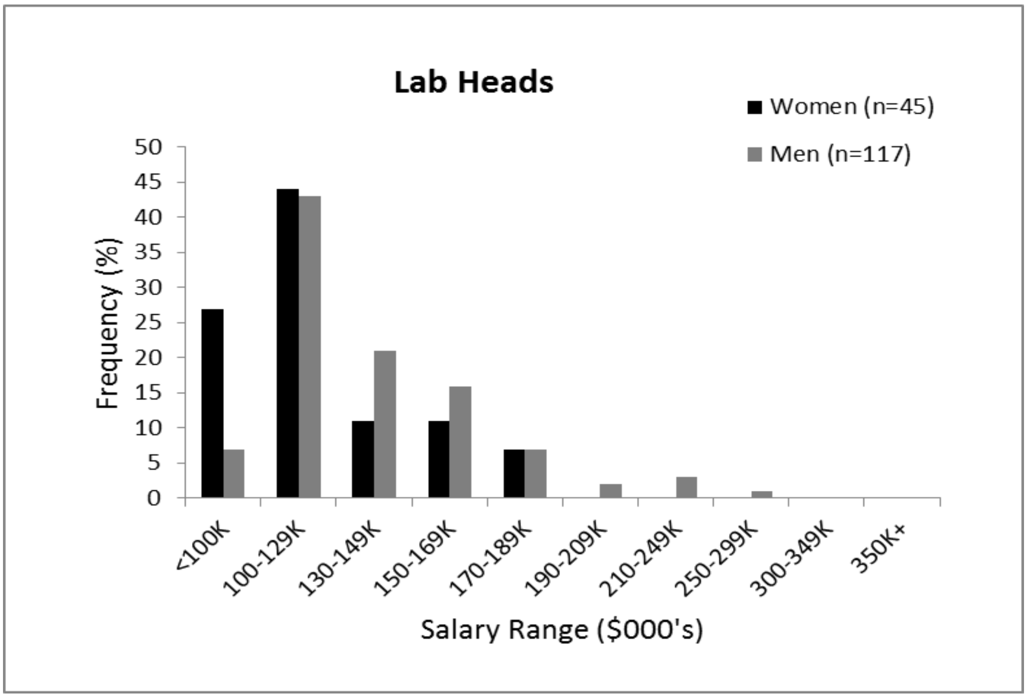

Figure 7.5: Lab head salaries by gender

To gain insights into this salary difference I then compared the job responsibilities of female and male lab heads. Table 6.28 shows there is no difference in the median number of staff supervised by women and men. The median budget managed by the male lab heads is higher ($101-200K) compared to the female budget ($51-100K), although a Mann-Whitney U test indicated this difference is not statistically significant (U=993.000, p=.378, r=-0.08). It is therefore unclear why the men's salaries are higher than the women's at this level. One possible explanation may be that men are awarded higher grants than women, given that grants are a major factor in determining salaries, or possibly that men negotiate better salaries (where this is possible within the academic system). Whatever the cause, this data is reflective of the gender pay gap identified more broadly in the workforce, particularly at the managerial level (Baron and Cobb-Clark 2010).

Table 7.27: Academic lab head job factors by gender

Gender	n (missing)	Job Factor	Median	Min	Max
Women	69 (6)	Staff supervised	3	0	15
	26 (49)	Budget	$51-$100K	<$51K	$1-5M
Men	153 (7)	Staff supervised	3	0	18
	86 (74)	Budget	$101-200K	Nil	$5-10M

In chapter five, I demonstrated that women scientists working in academia hold significantly fewer management positions than men. These further analyses demonstrate that even when they do make it into management, women face further gender inequality. They are concentrated in lower levels of the hierarchy and, as lab heads, are paid lower salaries than men despite similar levels of responsibility. It is noteworthy that the relatively few women who make it into the senior levels of management are paid equally to men. These women are celebrated for their achievements but they do not represent the vast majority of female managers in science.

The academic biotech managers I interviewed were all aware of gender inequities in their sector. Three of them, including one institute director, were actively trying to influence change. One was on her institute's gender equity committee. The remaining managers, however, seemed resigned to the situation. I got the impression that the problems faced by women and men in this sector are simply part of being a scientist and reflect a global situation they are powerless to change. For the remainder of this chapter I describe the challenges they face 'in the system' as they pursue their passion for discovery science. Their struggle with the organisation of work in this sector should be read in light of those who have left academic science, possibly due to similar experiences.

7.2 The managers – career and family

Of the eleven academic managers I interviewed, five had also worked as firm managers as described in the previous chapter. I re-introduce Anne, Ellen, Helen, David and Luke here in the context of their research institute roles, but I also explore their inter-organisational experiences to draw comparisons between academic and commercial biotech management. The names I have given to the academic managers along with details of their management experience are listed in Table 7.28 (including a recap on the five managers in both subgroups). There are seven female managers and four male managers.

7.2.1. Career

The academic managers had followed very different management pathways to the commercial managers. Whilst more than half of the commercial managers had started out with a PhD in science, some had lower level science qualifications and most had business qualifications. The academic managers, however, were all PhD qualified and only two of them – those working in BD in academia - had completed MBAs. Also differing from the firm managers, all but one of the academic managers had begun their management careers whilst they were still working at the bench and most had remained 'close to the science' for their entire careers.

Table 7.28: Management experience of research institute managers

Name	Current Position	Qualifications*	Functional Management Experience			Organisational Management Experience (in addition to RI or Uni)		
			Corp	Dev	Res	Firm	Pharma	Consulting**
Anne	Lab Head	PhD			√	√		
Christine	Senior Research Manager	MBBS, PhD			√			√
Ellen	Centre Director	PhD			√	√		√
Helen	Bus Dev Executive	PhD, MBA	√		√	√		√
Jess	Senior Research Manager	PhD			√			√
Leanne	Lab Head	PhD			√			
Penny	Head of School	PhD	√		√			
David	Director	PhD	√		√	√		√
Jeff	Bus Dev Executive	PhD, MBA	√		√		√	√
Luke	Deputy Director	PhD	√		√	√		√
Mal	Head of Department	PhD			√			
Totals	11		5	0	11	5	1	7

* MBBS includes medical and veterinary doctor
**Any consulting experience, including self-employed or working for a large consulting firm, or combining consulting with a full-time job (e.g. academics consulting to biotech).

All eleven of the managers had research management experience, five had both corporate and research management experience and none had worked as development managers. Their roles ranged from lab head, through senior management positions such as division head and head of department, to executive levels of director, deputy director and head of school. For the lab heads and senior research managers their primary focus was research - both managing it, and doing it. For three of the executive level managers, David, Luke and Penny, most of their experience had been in research management but their seniority and the scope of their roles had given them corporate experience as well. The other two executive managers with corporate experience had settled into BD/industry engagement roles with minimal involvement in research, although they had both worked as research managers earlier in their careers. Their commercial focus set them apart from most of the academic managers, with experience in marketing, BD, and production similar to many of the commercial managers. I chose to interview them specifically because of this breadth of experience, but their career paths were not typical of academic managers.

In terms of organisational experience, six managers had worked in management roles outside of academia. This includes the five who had worked in biotech firms and one who had worked in large pharma. However, David, Luke and Ellen had all worked as biotech managers concurrently with their academic appointments. Hence, in effect, only three of all eleven managers, Anne, Helen and Jeff, had actually left the academic sector and returned. And notably, only Anne had returned to a research management role after a stint in a biotech firm. Helen and Jeff, on the other hand, came back to industry engagement roles. That outcome is consistent with the observations of my interviewees that people generally do not return to academic research after they leave it.

So, both in terms of the organisations they had worked for and their management experience, most of the academic managers had followed a well-established academic career track. In general they had completed a PhD followed by one or two post docs, usually overseas, and then returned to an Australian research institution to set up their own lab. Three had returned to the same institution in which they had completed their studies. As one lab head commented:

> The institute is accused of being incestuous. People who work here were trained here. They go overseas then come back. If you did well enough and you if you had good relations with the people who were here when you left, you could come back.

Whilst most of the managers had worked overseas early in their careers because, as Helen commented, ‘that is the prevailing wisdom, to go overseas for career visibility’, they had stayed put once they returned to Australia. Of the eight managers who had followed the standard research career track, seven had worked in only two institutions and one had worked in three institutions since completing their PhDs. By contrast the commercial managers were highly mobile, many having worked in various combinations of biotech firms, large pharma, and academia.

Seven of the academic managers had undertaken consulting work, mostly to biotech firms. However, for five of them the consulting work was concurrent with their academic appointments. This distinguishes their consulting work from that of the commercial managers, many of whom had spent periods of time ‘consulting for a living’. Only two of the research managers, Jeff and Helen had consulted ‘for a living’ before taking up their industry engagement roles. However, a few spoke of their research collaborations with other academic institutions, hospitals and Government departments. It was mainly through these collaborations that they gained some exposure to work environments outside academia, rather than through independent consulting.

7.2.2. Family

Ten of the academic managers had dependent children. In this their stories were remarkably similar to the firm managers; they experienced the time-squeeze familiar to most parents combining care and high level management work. Table 7.30 shows who took responsibility for arranging care, using the categories defined in chapter six. It was straightforward to categorise the men in this way, but for the women it was more complex.

Table 7.29: Childcare arrangements for research institute managers with dependent children (n=10)

Managers*	Working carer	Shared care	Partner as primary carer
Men	0	0	4
Women	2	1	3
Totals	2	1	7

*For those who no longer have dependent children, these are the arrangements they had in place when they were research institute managers with dependent children.

Of the ten managers with dependent children, the largest group (all four men and three women) had ideal worker arrangements in place (Acker 1990). The three women, Christine, Jenny and Ellen were categorised in this group because their husbands worked from home, and were therefore available to pick up children or supervise them at home if the women worked late. These husbands, however, did not take on the role of primary carer in the traditional sense of attending to most of the children's needs. Christine, for example, had an egalitarian marriage in which she took an equal parenting role including dropping the children at school four days a week. Her husband had a high pressure job on a 24-hour cycle, but his working from home provided Christine much needed flexibility. They had also employed a nanny at various stages. Christine acknowledged the difficulties experienced by some of her female peers who had to rush off from work to pick up their children. But despite her support at home, with two primary school aged children she emphasised that she does not separate work and home, taking calls from her children at work and claiming 'the answer to her life' is her I-phone'. She explained:

> I'm extremely fortunate because I have a husband who works from home, and who doesn't have a type A personality, and everyone would say that's why I manage to do so much, and that's true, but I have to manage to organise him and the kids.

The other two women in this group, Ellen and Penny, were both over 55 and had been the primary earners in their families with little option other than to keep working.

Perhaps reflecting the traditional norms of their generation, initially they had been unable to relinquish their primary carer roles despite their partners either working from home or working intermittently. Like the female firm managers who had found themselves combining work and primary care, these women found the situation untenable and had acted to change it. Penny explained how her husband 'never did anything with the children, it was always me dropping off, picking up, being social secretary, that sort of thing'. She estimated she did 86 percent of the household tasks and brought home 100 percent of the income, and eventually went 'on strike' to convince her husband to share the load:

> When the kids were about 12 and 7, I looked around and thought I'm doing everything here, this isn't right, so I suddenly went on strike. I put a notice on the bench, "on strike until further notice" and I sat down and watched the television.

In retrospect, Penny considers herself fortunate that her husband did not have a job because she had no option but to pursue her career, which was eventually very successful in terms of scientific achievement. This was despite not being particularly ambitious early on. Meanwhile, Ellen, who eventually became the Director of a university research centre, also claimed not to have been particularly ambitious early on, but had not been in a position to 'opt out':

> I can remember actually saying I want to give up and [my husband] said you can't, we need the money. I know it came up but it just wasn't an option. I still enjoyed the research. I believe if other women's husbands are earning a lot of money, and actually I believe if mine was earning a lot of money I would have said no, why would I do this?

Although it may seem counterintuitive, I have categorised Christine, Penny and Ellen as ideal workers because despite early difficulties managing work and family commitments, their situations had evolved so that for most of their careers as academic managers their partners had the flexibility to and had agreed to, albeit reluctantly or only partially, manage the children.

Unlike the female 'ideal workers' the four men in this category were protected from work-family interference. Their wives were generally accepting of the demands of their work and therefore did not place high expectations on their contributions at home. David, for example, described how his wife had made his life 'easy' by looking after the children: 'She wanted to do it, it was her life plan. She wanted to look after the boys.' Similarly, Mal's wife did not return to work until their child went to school and then only part-time so she could do the drop offs and pick-ups. Mal's ideal worker status was enhanced by his wife's understanding of the demands of the job: 'She is totally different, not a scientist. But she went out with a scientist before me and that was really important so she could understand where I was coming from.'

Luke and Jeff both had remarried and their first wives continued to provide primary care for their children. Luke and his second wife did not have children, and she was also an academic, which he considered advantageous:

> My current wife is also a researcher. Non-academics don't understand the demands of science, they don't understand why you're there late at night, that you have to work weekends, that you're writing grants all the time, so if you're married to another researcher they understand it very well, but you still have to compromise because they've got to do the same thing.

Meanwhile Jeff admitted his corporate management career, which had been largely outside of academic biotech and had required long hours and travel, had taken a toll on his relationships with former wives and with his children.

The two managers who took on the role of working primary carer both expressed feelings of guilt about not being able to spend more quality time with their children. Leanne, who is now in her fifties, described her domestic situation as 'kind of traditional, I do ninety percent of cooking, seventy percent of the washing.' When their child was young her husband had worked long hours and also travelled regularly so Leanne had to manage her work hours around running their home at a time when there was very little support for working mothers. She spoke often throughout the interview of her struggle with this and thought it had negatively impacted both her career and her family relationships.

Although Jess was also a working primary carer, for her the pressure typically associated with this role was mitigated by sharing a 'joint appointment' at the institute with her husband. In this way her situation was arguably more manageable than Leanne's had been. Jess and her husband were able to cover for each other in the lab which Jess considered a huge advantage both to the couple and to the institute. As a partnership, and together with the help of a nanny, they were able to manage the conflicting time demands of home and work: 'It's great because we understand how difficult science is…I usually run out the door just before 5.30 and if there are things unfinished [my husband] will always help me out by doing it'. Despite her senior management position, it was Jess's clear preference to be the primary carer:

> I like to be home to prepare the dinner and sometimes we wait for [my husband] and sometimes we don't. I've always done the bathing, put them to bed, the homework. I wanted to do it and I never asked [my husband]. I wanted to be there, it's just a normal part of being a mother really I think.

As she climbed the hierarchical management ladder Jess was finding the combination of management work and family responsibilities increasingly difficult, admitting, 'it's just endless and so now I find it very difficult to switch off.' She was also concerned about the impact her work was having on her family:

> My daughter drew this picture of me sitting in front of the computer because I'd get home and I'd think my God, I forgot to email a scientist and I'd quickly get the computer on and send an email. You know it would only take 5 minutes, but still that's the vision. I'd quickly say hello to everyone and I'd be doing the cooking and doing the computer at the same time, so that is hard, it's hard.

Only one of the academic managers had a genuine 'shared care' arrangement in place. This was Helen, who had also worked as a firm manager and whose domestic situation I described in chapter six whereby she and her husband alternated the role of primary working carer. They also hired a nanny to support these arrangements. Helen had not followed the traditional academic career path and, indeed, this had been precipitated by her desire to share the care of their children. Her pathway changed from research management to business development when she was employed at a research institute and came about not because she wanted to leave research but because her supervisor at that time viewed her caring responsibilities as a lack of commitment to research.

Across both the academic and commercial sectors the domestic themes in interviews were essentially the same. First, the managers made it clear that combining children and biotech management is very demanding, requires reliable, flexible and often expensive childcare such as a nanny, or support from extended family. Second, it was clear that working as a biotech manager is more manageable for those with ideal worker arrangements in place. Indeed, of the 22 managers with children across the two sectors, 13 were ideal workers. And, without suggesting this is a representative sample of biotech managers' domestic arrangements more generally, it is noteworthy that all eight of the men were in this category. It is also noteworthy that, of the nine women who were not ideal workers, five used nannies to 'buy' greater flexibility. This group of managers worked at a senior level and were therefore able to afford nannies. Managers working at a less senior level, say as lab heads, may not be able to afford this level of childcare support.

Overall, the men's arrangements reflected separate spheres whilst the women's could be described as an eclectic mix of arrangements that reflect a transition in gendered domestic roles for professional women. Like many highly-educated women, these managers were less supportive of the male breadwinner, female homemaker model (Brewster and Padavic 2000), and their evolving domestic arrangements illustrate how women's employment is an important mechanism driving changes in attitude towards gender specialised family roles (Cunningham 2008).

7.3 Prestige, credentials and staying on track

The academic managers' careers were more different than similar to the firm managers' careers. Their paths diverged soon after completing their PhDs or other science qualifications. The firm managers took a pragmatic approach to their careers, applying their science as needed in their management occupations whilst the academic managers viewed science as a vocation in the traditional sense of a 'divine calling'. The motivation of the academic managers was captured by Leanne:

> What's appealing is the work, the discovery and the creativity and the excitement and knowing something for the first time before anybody else knows it and thinking about how that little bit of information can be useful. And maybe, oh what if we could take that molecule we just discovered and inhibit it in this disease? And you know you go whoa, wouldn't that be exciting? That's what drives me now, yes to cure diseases.

At the same time, most of the academic managers avoided 'business' activities. Most simply were not interested, like Penny who declared, 'I lose interest at the point where it goes commercial'. Similarly, Luke refused a full time position in a biotech firm because, as he put it, 'I don't want to be marketing all the time'. Others also added that they would not be good at it, like Leanne who claimed 'I'm not an entrepreneur… and absolutely no good at trying to sell things to people' or Jess who admitted she 'would have been absolutely useless at business development.' Not only did Jess emphasise she wanted to work in research, but only in 'high calibre' research, adding she would not work in an Australian biotech because she considered 'the depth is not there'.

The academic managers highlighted the long-term nature of discovery research, and the personal qualities required to be successful. Leanne explained: 'It's a very, very, long term goal … a long time between drinks … and a really short time between whacks on the head.' In this context, persistence is everything. As Jess observed, 'You have to be passionate about science; I think it's a very tough career'. She explained:

> I mean it's always been tough; no matter what you do a PhD in, it's difficult, OK. But once you do that post-doctoral position there's a lot of pressure on you, because it's an extension really of your PhD, so you've been trained further and you really have to produce results. But let's face it, you know eight times out of ten the results are negative. They're results, but they're not interesting, they're not publishable. So you really have to be passionate and persistent, you cannot give up.

Whilst the firm managers' self-confessed impatience appeared suitable for short-term projects, the academic managers were prepared to toil away for years under uncertain circumstances for the big breakthrough. As one research institute HR Manager commented: 'they do it for the great discovery, the Nobel Prize!'

Networking played an important role in the academic managers' careers. However, unlike the broad networks of the firm managers, their networks were very much centred in academia and the managers placed great emphasis on the credentials of their supervisors and prestige of their institutes. They were proud to associate with the 'best and brightest'. One manager, for example, proudly described one colleague as having 'a brain as big as a planet'. Many also mentioned the importance of employing 'high quality' post docs, who would only be attracted to 'high quality' supervisors. These managers were keen to describe their networks, like Christine:

> I've always stuck with the top institutes all the way along, the top supervisors, the best that I could possibly manage. And it is just a self-fulfilling prophecy that if you don't fall off, what you've just had helps you get the next thing.

Meanwhile, Jess proudly described how working in prestigious labs had helped her:

> I applied to one person and he said he would take me. I think it's because I'd worked with very good people at the [university], with very good people at [research institute] and I'd been productive. I went to the [department] in [university] which was one of the leading universities. It was an extremely exciting department to be in and the number of people who came from that department and have gone to various

institutes all over Australia, it's truly phenomenal. I'm very grateful to have had my training there.

In the quest for scientific credibility, the research managers stressed the importance of minimising any distractions from the science itself. Deb, now a firm BD manager, had undertaken MBA studies whilst she was working as a post doc at a university. She recalled the importance of demonstrating a total commitment to research in academia:

> When I applied for grants I would never put down that I was doing an MBA…that would be viewed as a distraction and "I'm not science-focused" so I'd never put that down and sometimes not tell people about what I was doing.

Moreover, focus usually meant more than simply concentrating on research, it meant focusing on a particular specialisation within a scientific field. Ellen, for example, observed, 'If you look at all the research fellows, they are all very focused on one area and you can build on that and become a real expert. Success in academia is a 'Nature' paper.' David explained how any deviation from this primary focus can be quite difficult and also risky for career progression:

> You know, one of the things in science is if you make a discovery, for the next few years there's a really linear, predictable set of things you have to do to make the most of that discovery. And you can get in a, like a rut, or on a highway. Let's put it on a highway rather than in a rut. And you just go. And it's very hard to get out of that. You've had grants, you've had obligations, you have students. It's very hard to change direction, even if you want to change direction.

Another manager explained what happens to people who do deviate from the academic track and then try to go back. He described how a colleague in his institute was having trouble getting an internal promotion. After her post doc at Oxford, she had spent many years working in industry, including in an industrial lab and a biotech firm. Although she had a strong patents record and brought complementary skills to the group, her promotion was stymied by her lack of publications. My interviewee explained that despite his colleague's breadth of experience, the non-standard nature of her career path was difficult to recognise in a system where most people had followed a similar track: 'It's just harder to write the case – it's always much easier to write the case if there are publications.'

There was, however, one example of a change in attitude towards this linear approach. Christine praised her institute for supporting her change in research direction through the award of an internal fellowship. She stressed: 'That approach is absolutely correct. I think you're really allowing people to shift fields, do innovative work and take risks.' Without the support of that fellowship, she claimed 'there's no way I could have generated research, I couldn't have changed my track record.' Yet, as Christine conceded, hers was an unusual story. Most researchers had little opportunity to change research focus, let alone do something outside of research, even for a short time.

Teaching was also considered to be a distraction from research. David recalled his early years in an independent research institute where 'really bright' researchers did not teach:

> There was a slightly scornful attitude to dealing with undergraduate students, as if it was beneath us. We're a research institute, we don't have to deal with students and lectures are a distraction, we don't need them. But it was elitist in a good way, you know, in that there was an expectation that people would do excellent research, and they wanted bright people.

According to many of the managers this attitude persists today, with teaching responsibilities considered damaging for career progression. Leanne, for example, explained that she would like to do more teaching but could not risk her research output:

> People who have to do a lot of teaching also have trouble with their track records. Anything that takes you away from the pure publication, invitation to big conferences and getting grants takes you away from success in the system.

This attitude extended to universities. A few of the managers stressed how university researchers are under increasing pressure to combine teaching and research, and how those who teach struggle to compete for grants against full-time researchers. Mal described how his department is atypical because it limits the teaching load to give researchers more opportunity to apply for grants:

> We are very strong on research in our department, very successful at research and part of the reason is that we've kept our teaching down. Other departments have a higher lecture load, and part of it is justification to keep going down a path and not be as research-successful.

There was a strong perception that prioritising research above all else is both an expectation and a requirement to succeed in academic biotech management. Whether this is true or not is a moot point. Some of the managers, like Mal, perceived 'lack of research focus' as a choice, whilst others emphasised the constraints associated with this narrow path. Constraints could be imposed by 'the system' when researchers are expected to undertake teaching or other responsibilities, or by family commitments that preclude them from sustaining the intense, long term effort required to deliver research results. Having been successful in the system themselves, most of the managers in this study emphasised the role of agency in 'staying on the research track', despite also recognising the structural and cultural constraints. In this context, those who are distracted from research by teaching or family responsibilities are not necessarily thought to lack research focus; they are simply not 'research-focused' enough.

In this demanding environment, the academic managers continually referred to *leadership* rather than *management*. They all wanted to *lead* the research and they wanted the freedom to do it their own way. They did not want management imposed on them. In this way, leadership was often intertwined with the desire for autonomy, but rarely portrayed in terms of managing a group of people. For example, when I asked Luke why he preferred to stay in academia rather than moving across to commercial biotech, he replied 'probably because I love to lead. I want to lead and discover. They [research institute] don't tell a person what to do, which you wouldn't have with a biotech [firm].' Moreover most of these managers knew they wanted to lead from early in their careers. Leanne, for example, had observed early how life would be as a research assistant: 'you had to do what your boss wanted you to, and if you weren't interested in it, or if you were only sort of interested in it you still had to do it.' Likewise, Jess commented 'it was a pretty straightforward decision to go on and do a PhD because I didn't want to stop; I was so into it. Well I wanted to be much more than a RA [research assistant]; I wanted to pursue a career eventually as an independent researcher.' Even a couple of the women who claimed to be 'less ambitious' knew they wanted to do their own research and did not succumb to the research assistant career path chosen by their female peers. Penny explained that she was the only one of her academic friends who did not take a part-time tutoring position after she became pregnant, as was generally expected in the 1970's.

So with a focus on science leadership, the managers, both women and men, were generally ambitious. They were also aware of the competitiveness required to achieve their ambitions because it was fostered in their early lab experiences. Leanne recalled working as a post doc in one eminent professor's lab:

> He had an embarrassment of riches. He had about 30 post docs … incredibly talented people … they're all like professors and directors of institutes now and that sort of stuff. But some of them were pitted against one another, not by him, but it was tolerated that they would be both working on the same project and he would benefit from the competition. So that was interesting. Everyone was kind of there on their own merits.

Leanne was very positive about this experience, proudly using the language of academia to describe working in a prestigious lab and witnessing early in her career that competing with your peers is the way to demonstrate 'merit'. In general, the managers portrayed their post doc days in positive terms, and had thrived on the competition which played to their longer term goals to lead the science.

The competitiveness often meant long hours in the lab but many of them saw this as a social activity as well. Jess described how she would work until late, then go and 'see a French film' and return to the lab for a few hours. Similarly, Mal enjoyed the competitive environment in his post doc lab: 'It was extremely competitive, this was the world stage; it was one of the best labs. There were competing labs all around and we were always getting papers coming up and reviewing publications.'

Some of the managers described the post doc period as the best time in an academic career. However, as they continued along the academic career track the 'fun' of the competition became a matter of career survival. Indeed, for some women combining the race for discovery with raising a young family, life became very complicated.

7.4 Careers over time

In contrast to the fit between women's lives and commercial biotech, the managers portrayed academic biotech as a sector that is only just beginning to accommodate women and with limited success. I need to distinguish here between the interviewees' personal experiences, especially early in their careers, and their views about how women are faring in the sector now. Whilst I am primarily concerned with the present state of affairs the traditions of academic science are enduring. Having survived a 'winnowing out' process the women in this study had experienced success in the system and had come to identify with these traditions despite also having struggled with them. Their past experiences provide important context to how they might view the possibilities for change.

7.4.1. Early experiences

Consistent with much of the literature on women in science, many of the female managers had lacked female role models and felt isolated in male-dominated labs early in their careers. Ellen and Penny described how there were no other women with family responsibilities when they were establishing their careers. Penny described how she could not 'fit in' due to her family commitments:

> It was extremely hostile. I faced just not being one of the group. It was very social, there would always be beers in someone's office but I couldn't stay for that because I always had to go and collect my children. And so I'd come at 9.00 and I'd work like crazy and I got stuff done, you know I did my teaching, I did everything, but I was just not a part of the social scene.

Leanne also commented 'although it's less true now, at the time, most of the women who were lab heads here were married to scientists or were unmarried or had no children.' Meanwhile, Christine, who was establishing her lab in the late 1990s, described herself as being in 'the gap.' She explained how, early in her research career, there were three women in senior roles who 'didn't behave like women', women in her lab who were all research assistants and women PhD students who were ten years younger. She claimed to have felt 'an absolute sense of loss … I really was in crisis, I couldn't see myself and I didn't know what was wrong.'

These women also experienced direct discrimination in various forms. Two of them described how they had 'lobbied' to be promoted after seeing too many men with lesser credentials promoted above them. Mal had also seen his female colleagues face this problem, describing how, until recently, promotion was 'by invitation'. Ellen described how her manager had reluctantly changed his traditional gendered expectations:

> I was probably doing the best of all of them. I asked for a senior promotion once I got one of these grants in. They said OK but it had happened automatically for the other guys, they just got it. He thought his successor would have been a man but I was doing better and eventually he recognised this.

It was interesting to observe how this direct gender discrimination had diminished over time. Christine, for example, had complained immediately when a job she had lined up was almost withdrawn because of her family situation: 'I got a call and they said look we've just realised that you're actually going to have a young baby and you might not really be able to be productive.' As Christine explained, she only had to raise the issue with the head's secretary without even bothering to point out the illegality of the comment, for the situation to be rectified. This is in contrast to Ellen's vulnerability ten years earlier when she had missed out on a job with the professor unashamedly declaring: 'My wife and I believe that you can't have a career in science with children'. Direct gender discrimination and a lack of family friendly options had been the norm for Penny and Ellen, whilst a decade or so later there was a heightened awareness of gender equity issues.

According to my interviewees, and consistent with recent international research (Heilbronner 2013), issues of direct discrimination in academic science have diminished over time. Yet indirect discrimination persists. This is manifest in the competitive processes that drive science funding and, in turn, both job security and career advancement.

7.4.2. Career advancement in the contemporary environment

Grants and competition

Competitive grant funding drives the appointment and promotion of research managers in most independent research institutes and to a large degree in universities. It reflects the priority reward system in science, where, to quote Merton, 'the race is to the swift, to him who gets there first with his contribution in hand' (1957: 646). This 'race' underpins global competition in medical science. The 'local' effect of the race is that researchers must maintain an international reputation in their field to be competitive for funding awarded locally. This system leads to competition between colleagues, job insecurity, and a workload that involves, not only the intense pressure to maintain an international research profile, but the time-consuming process of writing competitive grant applications.

Managers working in institutes heavily reliant on grant funding are required to win grants just to remain employed, let alone progress through the research management hierarchy. Even though 'bridging' support may be provided to those who are temporarily without their own funding such support is for a limited time. Luke explained, ‘the way we work at the institute is we always look at the potential of someone coming in and if they don’t get a fellowship straight off and we think they’ve got the potential to, we support them initially’. Christine, who worked at a different institute, explained how any internal funding is limited and carefully allocated. Competitive principles still apply albeit with some discretion from the Director:

> You could take the same pot of money and redistribute it more evenly across the group, but [my Institute Director] will always be inclined to fund someone who shows extraordinary productivity. If you spread the money around you won’t get the outcomes.

There was general acceptance amongst the researchers that this is the best way to get excellent science, and indeed to be competitive internationally. Penny observed: ‘It’s a shitty system but there’s nothing better’.

Although researchers working in the appropriation-funded institute were under less pressure to compete for external grants, similar competitive processes applied internally. Researchers often had to compete for internal positions to secure their employment. One manager described how work allocated in this environment may be ‘obvious for some, but there are a lot of people who run around trying to get people to allocate them – they ring people up and say “what can I do for you?”’ He added that ‘in the extreme, this process resembles a labour hire system.’ With careers and ultimately livelihoods on the line, he felt under great pressure as a manager in this situation.

Overall, the academic managers described a dynamic tension between cooperation and competition in grant and promotion processes. Given their early socialisation that competition is the best way to get exceptional performance in science, the discussion around this issue focused, not so much on whether competition is necessary, but the types of behaviours that are expected and rewarded through the process. Christine, for example, explained how sometimes a number of individuals might compete but sometimes it might just be two individuals whose working relationship is very much built of helping each other, who are suddenly pitted against each other.

There were mixed views as to whether women might be less comfortable than men with this competitive culture or the self-promotion required for career advancement. Although some of the managers' comments invoked gender stereotypes of agentic men and communal women, there was also recognition that competitiveness can take many forms and is not necessarily gender-specific. One HR manager, for example, described medical research as 'gently competitive', having previously worked for a large mining corporation which she described as 'very aggressive and competitive'. In general, she portrayed the researchers as: 'competitive, especially for grants, but they don't step on each other, they're nice people'.

Christine took a similar view:

> I think for women it's a big issue of when you're prepared to tread on people around you and there are ways in which that can be done nicely and ways in which each individual would draw the line.

She had observed some women being reticent in pushing themselves forward, but was not reticent herself, commenting 'there will be times when you really have to go for it, and the higher up, the more individual you become.' Meanwhile others were convinced that men are more 'driven', referring, for example, to the high proportion of men awarded lucrative federation fellowships, describing their heathy egos and behaviours such as 'a push on getting results', 'micro-management' and 'ticking boxes all the time and getting awards'.

I am mindful that my interviews were with women and men who, by and large, had been very successful in 'the system' and it is unlikely they could have done so by 'being reticent'. If I had interviewed people who had left the system I may have gathered quite different responses. Notwithstanding the collaboration involved in day to day research, those who have been 'unsuccessful' may be more questioning of the effectiveness of individualised competition as the best way to get results in science or to allocate funding.

Grant fatigue and job security

Virtually all of the managers complained of ‘grant fatigue’ and the associated workload. Penny, for example, commented that she could write two to three publications in the time she could write a grant application. Jess captured the general sentiment:

> If only they could change the grants system so there is a lesser requirement to apply, at least less often, so I can have time to be creative without thinking do I need to write another grant.

Indeed, some linked the relentless workload and requirement to continually ‘prove your worth’ to women’s under-representation in research management. Jess went on to blame the system for some of her female colleagues opting out:

> I’m aware of a couple of very bright women who have dropped out. In fact they were doing quite well with all of their grants. I suppose it’s the grants system, having to write these grants every year in order to procure a salary and research funding. And one of them must have spent twenty years doing it and the other ten, and I think they just woke up one day and decided I’m not doing this anymore.

However, it was not only women who had opted out. Indeed, as discussed in chapter six, some of the male firm managers I interviewed had left academia for the same reason. This system is difficult for both men and women, but is more often cited as a reason why women opt out because when it is combined with the major responsibility for organising children, the workload simply becomes too great. A typical example was provided by Penny:

> A lot of women post docs, and two of them that I was sure were really going to make it, decided, no, it was too hard. One very brilliant young woman who published two *Nature* papers, she could have really gone on. Now they’ve had two children, and her husband travels a lot and it was too hard, and she just fell back and back, and I could just see it happening and she made a decision it was too hard.

As well as workload, the job insecurity associated with grant funding was a major concern to many interviewees. This job insecurity, together with the limited alternative career options in academic biotech, forces the managers to participate in 'the system'.

The data from my quantitative sample confirmed this picture of job insecurity. As shown in Table 7.30, the proportion of managers on term appointments in the academic sector (56 percent) is significantly higher than the proportion on term appointments in firms (20.5 percent). A chi-square test demonstrated this difference is statistically significant (x^2 =31.570, *df*=1, N=331, *p*=.000).

Table 7.30 : Comparison of employment terms in academic and commercial biotech

Organisation type	Employment term		
	Indefinite (%)	Term (%)	Total (%)
Academic biotech	109 (44)	139 (56)	248* (100)
Firms	66 (80)	17 (21)	83* (100)

* Missing data for 70 managers (67 academic biotech managers and 3 firm managers)

It is also noteworthy that within academic biotech, due to their heavier reliance on competitive grant funding, the proportion of managers on term appointment is higher in research institutes (62 percent) than in universities (38 percent), with a chi-square test showing a statistically significant relationship between type of academic organisation and term appointment (x^2 =10.102, *df*=1, N=248, *p*=.001). However, even in universities where there are fewer term appointments, the proportion is still significantly higher than in firms (x^2 =4.875, *df*=1, N=139, *p*=.023).

Job insecurity in research institutes affects managers through to the highest levels and in many institutes is directly linked to the grants system. As the HR manager in one institute observed: 'The least secure jobs in the institute are the academics … even lab heads who start to fail to get funds, they have to move on ... even the director'. Illustrative of this, Luke explained how he had recently been awarded a grant at a lower level than his previous funding; even as a deputy institute director, his fate was in the balance with the possibility the institute might not make up the shortfall in his salary, although he expected to remain employed.

This job insecurity is further compounded by the low success rate for grant applications, which has been consistently reported at around 20 per cent (NHMRC 2013a). Having sat on numerous ARC grant panels, Penny explained the fate of many excellent applications:

> People would get scored and there's a huge bulge of people on something like 87 percent. I mean that's like an A+, but that's where most people are. And you have to draw a line somewhere, and it's terrible because you know the people below the line.

In this context the managers were very mindful of casualties from the system. Leanne, for example, spoke candidly of her own disappointments. She no longer thinks she is good enough to move from Lab Head into a higher management level. When I asked why, she attributed her lack of confidence to some of her previous 'failures in the system':

> Not getting a fellowship; critical comments you get from either interviewers or reviewers; or grant applications you don't get. And I just … I take it really personally and that's probably just an overreaction I guess because a lot of people aren't fortunate. But it really hurts, and I think it really hurts everybody. It's a very unfortunate system that, you know, such a specialised smart bunch of people who have so much promise get beat up so badly just to be able to do what they do. It's really hard.

Penny told me she had counselled many researchers who were struggling with the system:

> Basically more money is needed in the system; increase it so there is something that people can feel optimistic about. I mean there are so many people who just think, why

> do I bother? And you know it's pretty miserable for these people at the top, they're really just miserable, they know they're just losing out, but they have to apply because what else do you do?

Whilst job insecurity is intrinsic to management careers in both academic and commercial biotech, the nature of that job insecurity differs across the two sectors. Job insecurity is personalised in research institutes. It sends a message about how an individual is 'valued' and many of the academic managers struggled with this. Short term employment was not their preference; it was imposed on them by the system. By contrast, job insecurity in firms is more closely associated with the fortunes of the firm. It is also congruent with the commercial and entrepreneurial career preferences of the managers. Having worked in both environments, firm manager Deb considered the management work in firms not only more 'secure' but also more collegiate:

> I think one of the things that I mentioned before is about grants and when they expire people just leave the university. One thing I like at [biotech firm], is if it doesn't raise money, everyone is in the same boat. The CEO, everyone from the top to the very bottom is in the same boat. To me I find it's more of a level playing field. So in some ways people think oh it's a bit of a risk to go and work for a biotech. But I think it's actually more risky to stay at a university and try to write grants and be in that environment, so in fact I find [biotech firm] is more collegiate.

Grants and teamwork

Competition and teamwork sit side by side rather uncomfortably in academic biotech. Whilst the competitive grants system both reflects and perpetuates the individualistic culture, a few of the managers explained how there is also an increasing emphasis on collaboration and teamwork. Christine observed: 'most of us do work in a collaborative environment and we do work as a team and you don't want to be pitted against your team members.' She went on to describe how academic biotech is trying to become more collaborative, but also the resistance to this approach:

> There's much more talk about collaboration and we're playing up collaboration in all our applications now … but it is a two-edged sword because some people don't think it is a strength.

Interestingly, when discussing how they worked with others, the managers sometimes referred to 'teams' and sometimes to 'collaboration'. Whilst they did not differentiate the two, they seemed to use the terms in a nuanced way. Team seemed to be used when referring to their 'own team', meaning the researchers who reported to them. This usage had hierarchical overtones. Mal, for example, emphasised that someone must drive the team:

> We must be a team, it's extremely important to be a team, we never publish a paper as a single author or two authors – it's always quite a number of people. Of course it might be driven by somebody, but there's others sharing in helping get that project up. It takes too much time otherwise.

Mal described how those who are not driving the team 'help' and 'share', thereby distinguishing different levels of individual contribution.

When the managers spoke of collaboration, however, they were most often referring to their work with other senior researchers who were experts in different fields or sub-fields. These collaborations were becoming more common, perhaps reflecting the increasingly interdisciplinary approach in biotech. These seemed more like the inter-disciplinary teams in biotech firms, where a range of experts contribute on a relatively equal footing. Ellen, for example, emphasised the collaborative environment in her small research centre: 'we had about 20-30 people; it was the ideal size; everybody was working together in all different areas but it was very collaborative.' Meanwhile Leanne, who had felt 'isolated intellectually' when she first became a lab head, eventually joined forces with three other researchers and experienced success in winning a prestigious grant. She praised the team approach: 'all this complementarity, everyone brought different things to the table and the sum was so much greater than the parts'. Leanne emphasised they were relatively junior researchers at the time and they had set up their group in a flat structure which was, and still is in her view, a different way of setting up a group in academic science.

Despite these team 'success stories', the managers described how the priority reward system encourages researchers to 'carve out their own space' intellectually rather than learn together as a team. This is the opposite of commercial biotech where the more generalist nature of the work not only enables easy sharing of information, but also interchangeable roles. In this context, Luke compared the teamwork in commercial biotech with the collaboration in academic biotech:

> In [biotech firm], I can tell you it's much easier to manage the team than in the research institute because in the institute they're all after the individual reward. In [biotech firm] it's all structured around the team. In the institute it's all about doing deals to get what you want. You can get on a paper because that promotes individual aspirations, it helps both. It's very different.

The emphasis on individual achievement seems to be greater when researchers are first establishing their reputation in a field. For example David emphasised that to be competitive for a Lab Head role, a post doc needs a record of having been the first or second named author on a paper; in other words, their individual ranking on the 'team publication' will be noted. Meanwhile, Penny recounted the story of two talented post docs in her team, both of whom had recently been applying for permanent jobs. She had found over the years that often referees would call her and make a comment to the effect of 'Well, he looks great but that might just be because he's in the [Professor Penny] lab.' Penny explained:

> Both of them have been very aware of this and anxious to prove independence which means they have to go off and do things on their own, which is a shame because they'd get a lot more done if they stayed around and collaborated.

So, in effect, working in academic biotech is an individual pursuit where researchers must specialise and demonstrate originality to progress, even if they are working in a team environment. In this context, it follows that spending too much time helping 'the team' is likely to inhibit one's own career progression.

Some managers wanted to see a broader perspective on what actually counts toward a track record. They recognised the different contributions necessary for a successful research outcome, especially the 'invisible' relational work that is often undertaken by women (Fletcher 1999). Christine, for example, described how women are often the 'glue' that gets a project over the line:

> You could actually make someone else's project much more productive because you've spent the time counselling the junior staff, sorting out the lab problems, making sure that people actually get on together, drawing new collaborations together between people who never would have thought they could work together before. I mean this all rings true, right? Women around me do this very well but they're not going to get official NHMRC recognition if they're renowned for that.

The communication and collaboration skills required to 'pull something together' are reminiscent of the project management work in firms. However, in the commercial sector managers are recognised and rewarded for this contribution whilst in academic biotech there is no mechanism to do so.

The grants system and its role in the appointment and promotion of managers in academic biotech is a stark contrast to the way managers are appointed in firms. Having worked as a manager in both commercial and academic biotech, Luke compared the selection criteria in these two sectors as well as the processes. In terms of selection criteria, he considered publications a very low priority in industry whilst the ability to work well in a team is a high priority: 'the metrics that are used in academia aren't there in biotech … everything is about team outcomes whereas in academia it's very individual.' In terms of process, firms like to 'try before they buy' by bringing managers into the firm initially to assess their potential:

> They [biotech firms] are looking for ability, and they like to appoint in-house because they can see the person and see what abilities they've got, because they're looking for certain abilities that they like. And once they're there, its performance based.

Luke's comments highlight the difference between the 'old meritocracy' where an individual's merit is judged by looking at the concrete results of their labours, for example publications, and the 'new meritocracy' where talent is not content-specific or content-determined, but rather based on potential ability (Sennett 2006: 114-115). Whilst academic research and its system of competitive grants is very much grounded in the old meritocracy, the willingness of firms to appoint on potential first and then give managers a chance to 'prove' themselves on the job is indicative of the new meritocracy.

In this way, the appointment process is 'uncoupled' from the promotion process in commercial biotech. Individuals are not required to 'apply' for promotion in firms. It is considered the role of the CEO and senior managers to recognise talent and reward it. The fast pace of commercial biotech and job mobility tend to guard against poor appointments or a 'boys club' mentality. If a firm fails to recognise talent, another is likely to do so. If a firm makes a poor appointment, it is highly visible and can be quickly reversed. In academia, however, the relatively narrow research skills of the managers mean job mobility is rare, and even if a manager does relocate to another academic setting, she or he will most likely have to apply for grants and promotion through 'the system' that is common to all.

The perceptions of academic appointment and promotion processes discussed in this section were expressed by 11 academic biotech managers. These managers have been successful in the system, some working at the highest echelons. This does not constitute a representative sample. Moreover, not all of them linked their perceptions to indirect discrimination. Nevertheless their perceptions contribute to a broad understanding of why women with families might opt out of academic biotech management. Whilst not all of the managers had a problem competing with their peers, some did, and some had observed women having a problem with this. This does not mean that men do not have a problem with this competitive system; it is just that there is more focus on women perhaps due to the stereotypical view that they are less competitive, and also because they exit the system in disproportionately higher numbers.

Whilst they had mixed experiences with teamwork, all of the managers could see that teamwork is not well-recognised or rewarded in the system, and that competitive pressure is largely borne by individuals. Meanwhile all except the two who worked in the appropriation-funded institute were jaded by the relentless workload associated with the grant system and the personalised job insecurity that comes with it. I argue that when successful managers portray ‘the system’ in this way, our sociological imagination tells us these pressures may well have been intolerable for those who have left the system, or are struggling at lower levels within it.

7.5 The clockwork of careers

Competing in the ‘race for discovery’ requires careful and strategic use of time. In this section I discuss how various management processes impact on the ‘clockwork’ of academic biotech careers, including how women and men manage their families in an environment where being the best and brightest effectively means working the longest.

7.5.1. The flexibility of long hours

Although the managers in research institutes and in firms reported similarly long to very long working hours, in the range of 50-80 hours per week, the general approach to long hours differed across these two sectors. Whilst the commercial managers regularly worked long hours, they also experienced peaks and troughs associated with the various stages of development programs and investment activities, and adjusted their hours depending on the needs of the business. By contrast, due to the continuous nature of research, most of the academic managers worked long hours all the time. This is not to say long hours are intrinsically valued in academia. In this environment, as in firms, outputs are most valued. The differences rest in the type of outputs required by organisations, or desired by the managers themselves, and the temporal arrangements perceived as necessary to produce them.

Whilst they accepted the need for long hours in their chosen profession, some of the academic managers felt 'burnt out' from this relentless work, and also felt burdened by administrative loads they considered to be the main cause of their long hours. Although they no longer spent long hours in the lab as they did during their post doc years, by this stage long hours had become a normal way of working for the managers. Ellen described how researchers are socialised into a long-hours culture:

> We had a federation fellow here - he actually gave a talk at one of the seminars we have for younger people. What he said was if you want to succeed in science, you work in the lab and you sleep in the lab. And once you get into a senior position, you work in the office and you sleep in the office. And one girl, she was a lecturer at [university], she was really good, she asked what about if you have kids, you can't do that … and he said, oh yeah … and he'd only just got his first child and I'm sure his wife left her job so he could work like that … and this is only a year ago.

David was well aware of this generalised attitude to long working hours in academic science, although he stressed that personally he doesn't share this view:

> Part of the problem is we crank academic science, and probably academia generally, as some sort of heroic pursuit. You have to be a bride of science in order to excel. You have to work long hours. You need to make the sacrifices. You know, you can't expect to get anywhere if you don't feel the pain. That's absolute nonsense. It's just glorifying.

In fact, David emphasised the flexibility of academic science, where 'you have the absolute privilege of coming in and doing whatever you like'. Jess agreed, commenting 'that's the beauty of being a scientist, it really doesn't matter if you turn up at ten in the morning and leave at five or seven, as a scientist you do have flexibility, that's one of the perks of the profession'. Mal also took a similar view:

> As a Group Head, really all you're expected to do is run the research labs, get your grants done, look after your lab and do your teaching when it's required, and people can be here or not be here, and that's always been the case. Some people – it's really difficult to find them because they're never here – but you need to actually do something. They're not just sitting at home or playing tennis or something, they're actually working, there's no big issue about that.

In their descriptions of working time, these managers conflated work hours and work flexibility. Yet these are separate issues. None of the managers I interviewed from a range of institutes and universities complained that they were required to put in face-time. They readily acknowledged the flexibility of the work hours. However, just as it was for the commercial managers, that flexibility provided micro-emancipation only; the work still had to be done. The managers felt under constant pressure to perform, to publish and to write successful grants, and much of this work was done flexibly at home after hours.

Jess, for example, described how the pace of work seems to be increasing:

> I just think it's faster moving now. It's more competitive, and it's because we're in this electronic age. You know papers, we used to put them in a Fedex envelope and you'd breathe a sigh of relief, you'd think ah the paper's gone. We'd Fedex it to the States and you knew you would have a few weeks where you could just clear your mind and you could focus on something else. Now in less than 24 hours it's coming back from the journal, it's been rejected or it needs to be modified. It's just endless.

According to Jess, there used to be some peaks and troughs, but now there is no chance to take a breath. To keep up with the pace, virtually all of the managers were forced to work at home regularly. Luke's routine was fairly typical: 'Now, and ever since I've had my own lab it's been about 60 hours a week, including at night. I do it for grants - that's the big problem and also the increasing admin and bureaucracy.'

Many managers with children found the long hours challenging, both men and women. More often, however, it was viewed as a challenge for women. For example, David stressed any system that values people by hours worked disenfranchises women, 'whether billable hours as in a law firm or numbers of papers'. He recalled having worked some very long hours himself, especially when he was combining management and lab work: 'I would work from 6am to 5pm most days, and then do stuff at night, writing.' He did that when he had young children but his wife had been the primary carer. David was sympathetic to women's plight but lived the life of separate spheres himself. Moreover, he spoke only of the disenfranchisement of women, not men, caused by long hours, with an implicit assumption that women are the ones who will bear the responsibility for children, as was the case in his own family. This illustrates the gendered logic that frames the discourse around working hours in professional occupations.

The theme of separate spheres was apparent in many of the managers' experiences. Leanne, for example, regularly worked about 50 hours a week but her husband also worked long hours and travelled, so she was the one available for their child. She felt she hadn't done as well as others partly due to her relatively 'short' hours:

> Oh yeah, people work 'til much longer hours. On the one hand I feel like, well this was all part of the not feeling very good about myself, I feel like geez I'm not working as hard or I'm not as serious. But on the other hand I thought, well, I might have a more balanced life and I'm just going to be happy about that.

As was the case for the firm managers, travel added to the time-squeeze for the academic managers. The usual reason for travel was to attend or speak at conferences, with the imperative greater in the establishment phase of the managers' careers. Hence, the peak time for travel often clashed with their responsibility for young children. It was at this juncture of her career, for example, that Penny put the pressure on her husband to help out more at home: 'I really began to realise that I had to go to, particularly international, meetings if I was going to be taken seriously.' Meanwhile, it was easier for those with a partner looking after the children, like Mal:

> It really helps that my partner's not working full time. Fortunately we only had one child; it makes things a bit easier. It really would have been a pressure on our relationship, there would have been sacrifices made. Part of getting into this kind of position is you've got to give seminars overseas.

Travel does become more manageable over time however. David disliked leaving his family when he had to travel, even though his wife was the primary carer: 'The big thing that killed me was travel. I was probably travelling seven times a year overseas and that was hard. I got to hate that really quickly.' After about five years of regular travel when his 'international reputation was taking off', he eventually scaled back by saying no to a lot of invitations to conferences. Likewise Jess still receives many invitations to speak at overseas conferences and finds them 'incredibly interesting', but she described the travel as 'horrific' and 'exhausting' and has therefore learnt to say no to some things as her priority is the family. David and Jess had reached a stage in their careers where it is possible to reduce their travel, but conceded this had not always been the case.

I should also emphasise that not all of the managers were dissatisfied with long hours. Similar to the commercial managers, it was difficult to untangle how much 'overwork' was attributable to the managers' work-loads and how much it was to do with their personal achievement-orientation or the 'career mystique' (Moen and Roehling 2005). Jeff, for example, explained how he had consistently worked 80-100 hour weeks for his entire career, including during his PhD: 'I always work weekends and late at night. Work for me is not work, it's a lifestyle. It's things that I'm interested in'. He was able to do this because his wife, and later ex-wife, cared for the children. Despite his long work hours, Jeff claimed to get around seven hours' sleep most nights. Christine also willingly worked long hours, but because she combined this with childcare, like other mothers I interviewed, she rarely got enough sleep:

> The thing that does come with [success] is enormous hard work and an unwillingness to let something ride, and so the reason that I think I've been well supported is that I

> very rarely say that something's too hard, and that essentially means that I don't get a lot of sleep.

Christine directly linked the 'support' she has received to the effort she puts in. This is consistent with a gendered organisational logic that 'honourably' rewards those who go beyond the call of duty, but in effect rewards those who work long hours (Ely and Meyerson 2000a). My interviews highlight the difficulties faced by mothers when they are required to continually devote long hours to conduct research, publish, apply for grants and manage a team in medical science. Whilst family work is acknowledged, it is generally not captured in notions of productivity which are centred on 'work', not 'life'. Christine, for example, emphasised the importance of integrating home and life on the one hand, but on the other hand psychologically divided her 'jobs' into work and home:

> You know you'll do your day job, you'll do your home job, and then you'll do the work that hasn't been done between the hours when everyone else is asleep, so that's really hard work.

Despite working this double shift, Christine was grateful for the 'support' [meaning funding] provided by her institution because it enabled her to do more work. In academic biotech the reward for working hard is the opportunity to continue your passion.

Whilst the intrinsic satisfaction of work appeals to many high-level professionals, work devotion schema may be even more pronounced in medical research because, as indicated by my interviewees, the 'heroic' motivation to generate new knowledge to save lives drives many researchers. Moreover, once a grant is awarded, the obligation to do more work is directly linked to individuals and is relentless because for most researchers the work is essentially one very long continuous project. The commitment and sacrifice required to do that in the context of children is especially high in this sector. Despite David's denial that successful scientists must become 'brides of science' that does not seem far from the reality of my interviewees, and interestingly of David's own career at an earlier stage. By contrast, the link between funding and work is more indirect in commercial biotech. Funding for the firm may or may not mean a continuation of work for any particular individual; it is not person-specific. There is also greater opportunity to take a break before moving onto more work in the same or a different firm.

In academic science, the rhetoric is very firmly around being the 'best and brightest' not working long hours. But for the managers I interviewed, they are one and the same. Given that only elite professionals qualify for 'the race', biotech managers know they will fall behind unless they work long hours, no matter how talented they are. In this way, the priority reward system in science indirectly perpetuates gender inequity by rewarding 'ideal workers' who minimise their responsibilities outside work, or simply get less sleep.

The perceptions of the biotech managers themselves are important here. All of the managers in this study linked productivity directly to time. They applied this logic to themselves and to others, perpetuating 'the system' informally through peer pressure and formally through the system of peer review. In this environment, the expectation of long hours is mostly implicit. It is not like many other professional environments where face-time and long hours are demanded explicitly. Consequently, family-friendly policies focused on work hours and flexibility cannot fix 'the problem'; the focus must be on how productivity is defined, what is rewarded and how it is rewarded. Indeed, the scientists themselves must be convinced that working constantly is not necessarily productive.

7.5.2. Part time work

According to most of my interviewees, part-time work is not feasible for academic biotech managers. This view was borne out in the quantitative data presented in chapter five showing that only five percent of managers work part-time. Table 7.31 shows the gender distribution of those part-time managers, with nine percent of women and four percent of men working part-time. A chi-square test showed this gender difference is not statistically significant (x^2 = 2.171, *df*=1, N=242, *p*=.131) which is not surprising given the low number of part-time managers of either gender. For women, this level of part-time management is particularly low compared to the Australian average of 19 percent part-time managers, and especially so for a female-dominated sector. For men, the percentage of part-time managers is just over the Australian average of three percent (Watson 2010). The difference in the availability of part-time management work across the commercial and academic biotech sectors is striking, with a rate of 35 percent female and 18 percent male part-time managers in firms.

Table 7.31: Number of managers working part-time in academic biotech

	Full time (%)	Part time (%)	Totals (%)
Women	53 (91)	5 (9)	58 (24)
Men	177 (96)	7 (4)	184 (76)
Totals	230 (95)	12 (5)	242*

*Missing data on 73 managers

These data reflect both the way work is organised and different notions of productivity across these two sectors. In relation to management work, the emphasis is not on whether part-time work is *available*, either through legislation or organisational policies, but whether it is considered *suitable*. In commercial biotech, for example, the nature of the work, the size of firms and the network form of organisation drive part-time hours. Any effort to accommodate family responsibilities is of secondary concern. By contrast, in research institutes, the nature of the work and the organisational form make part-time hours difficult despite an array of 'family-friendly' policies. The rationale is the same, but the outcome different. Moreover, negative attitudes toward managers working part-time often contradict existing policies or legislation, thus undermining their emancipatory intent. When it occurs, this contradiction is less blatant in firms because there are fewer policies in the first place.

This overriding concern with productivity means that negative attitudes toward part-time management work can occur in either commercial or academic organisations, and is situation-dependent. The line manager's view of productivity is also an important factor no matter what type or size of organisation. Indeed, some of the firm managers I interviewed had previously worked in large pharma where they found the senior management attitude in that commercial setting different to the attitude in many small firms. Whilst part-time work had been actively promoted to attract women, two of them explained how, when employees utilised these family friendly policies, especially managers, they were treated with disdain. Rowena commented 'If you worked part-time or took the 40/52 option[25], in reality they would crack the shits, especially at the higher levels' whilst Bron observed how the part-time women lawyers in the company 'felt like lepers'.

Some of the managers who worked in large academic organisations related similar experiences. Helen, for example, had wanted to return part-time after maternity leave but her manager was not supportive despite the institute's promotion of part-time work to assist families:

> [My manager] had a very definite view that unless you were full time, highly ambitious, in the lab, you know, 150 percent then you weren't serious about being a researcher. So when I took time off from the group he made a comment before I left, because I had asked about coming back part-time, that he couldn't guarantee that there would be an interesting career role for me if I came back part-time.

Leanne had experienced a similar rebuff when she had tried to negotiate some flexibility when her child was young:

> When [my child] was in crèche, about the third year or something, I'd get phone calls regularly and they'd say "can't you get the day off because [your child] really misses you and would really like, you know just a hug." And when I went in that day to say I'm

[25] Policy allowing employees to work 40 weeks of the year and average the pay deduction over 52 weeks.

> going to leave to pick up [my child] the [Director] said "Lab Heads don't work part time" and so I knew that what I was doing was wrong.

I should emphasise these were not recent examples, although apart from Leanne's experience they all occurred at a time when family friendly policies were being promoted. In Leanne's institute, policies promoting part-time work have since been introduced, and she thought a few female Lab Heads might be working four days a week now.

Despite the introduction of policies, however, the sceptical attitude towards part-time management remains in academic biotech. This is primarily because the role of manager is intertwined with a researcher's personal research contribution to the project. The researcher is usually only a manager by virtue of that contribution. For this reason, Jess, along with others, did not think it was feasible to be a successful research manager working part-time:

> A lab head, you can't do that [part-time] being a lab head. Ultimately you have to decide. As a lab head you can't work as a part time scientist for a couple of years because the lab wouldn't go anywhere, you wouldn't have any grant funding, you wouldn't have any papers, and therefore the lab's not going to be sustainable.

Jess's view reflects a very 'hands on' approach to managing research that requires a manager to be 'doing science' and often 'in the lab'. This was the most common management style amongst the managers I interviewed, and aligns closely with their science-focused career motivations. This suggests that whilst part-time management is not considered feasible because of the way work is organised, to some degree it is organised according to the managers' preferences. There is also the 'career mystique' (Moen and Roehling 2005) at play whereby a large proportion of the managers simply do not want to work part-time because they prioritise discovery science over other parts of life. In a sector dominated by such individuals, anyone working part-time in a management role is likely to be marginalised in terms of promotion opportunities.

Nevertheless, a dissenting view was expressed by David, who advocated that part-time management would be feasible if a lab head has a team working on her project. This would require delegation and a more ‘managerial’ style. David did not, however, specify how long part-time work could be sustained without impacting negatively on career advancement. Although his concept may be worthy of practical trial, it is at odds with the prevailing view of productivity expressed by the managers, and, equally importantly, their perception of others’ views of productivity. In such an environment, part-time work can be damaging to careers, not so much due to reduced productivity as to perceptions of reduced productivity. It is therefore not surprising that very few managers take up part-time work in this sector.

7.5.3. Career breaks

The incompatibility of scientific careers and women’s biological clock is well-recognised. As David described it, the post-doctoral period is a time when ‘your whole productivity is tied up in your own hands.’ For many female post docs this coincides with their prime child-bearing years. As David explained, unless they have their own funding to employ researchers to keep their research project going, women wishing to start a family face a difficult choice: Do you have children; take maternity leave, step out of the lab, knowing that your career’s going to grind to a halt?

The perception that one’s career might ‘grind to a halt’ largely explains why the women I interviewed had been reluctant to take career breaks. Of the six female academic managers with children, five took three months or less maternity leave. The shortest break was one month. Some of the women also came in for meetings during their leave and one held group meetings at her home. All but one of the women returned to work part-time initially in an effort to maintain continuity rather than take a longer full-time break.

This trend was similar to the commercial managers. Indeed, across the two sectors, I interviewed 14 female managers with children. Overall, they took maternity leave ranging from three weeks to around twelve months, but only four of them took more than three months off work. This is low compared to the eight months average maternity leave for Australian working women although managers take shorter breaks on average for maternity leave (Baker 2011). [26] As in the commercial sector, the two common themes amongst the academic women were a preference to work and a desire to protect their careers, or both.

Christine, for example, preferred to work. She explained how she had timed her babies to coincide with natural career breaks:

> I decided I needed to get pregnant at the same time I was doing my PhD. I didn't risk my career or the baby by having them together … I carried my thesis on my belly for six weeks. I had the next job lined up although not starting immediately. I'm actually not very good at staying at home. I had the money saved up to pay a part time nanny after 8 weeks.

Jess was also too involved with her career to take much time off. She was living overseas when she had her first child, and both her and her husbands' parents came over to help mind the baby so she could go back to work after two months. Jess explained there was 'no way' she could take more time off, stressing 'if I hadn't gone back to the lab I wouldn't have been able to publish these two papers and I'd put too much into that'.

Helen took the longest period of maternity leave and then worked part-time for around 12 months after the birth of her first child. This 'long' break and subsequent part-time work prompted her transition to a business development role in the institute and later to a commercial biotech career. Helen told me about her 'falling out' with her research institute supervisor who never treated her as a serious researcher after she

[26] The average length of both paid and unpaid leave taken by Australian women with a child under two at November 2011 was 32.4 weeks, and 84 per cent of them returned to part-time roles. Of those who returned to work full time, 6 in 10 preferred to work part-time (ABS 2011).

took maternity leave. Having worked as his deputy for many years, he overlooked Helen for a promotion opportunity, and she was very upset:

> [My colleague] had been lobbying hard for opportunities to advance his career and they put him in the role. And I put it to [my supervisor] that he didn't even raise it with me whether I would be interested in taking that on because he had used me as his invisible number two for years, writing his reports, preparing everything for him on the understanding that I would be staying in that kind of role.

Notwithstanding the attitude of her particular manager, Helen transferred into a part-time business development role after realising career progress would not be possible if she worked part-time in research. Since then, Helen has followed the non-linear path of a typical commercial biotech career, working mostly full-time but with some part-time consulting assignments. Despite her work-centred approach and willingness to employ a nanny, it only took a break of about 12 months from full-time work to end her research career.

Helen's experience was in the late 1990s, but female managers are still very wary of taking a break from academic biotech. I met with Anne when she had just left work at her research institute to prepare for the impending birth of her baby. She was already concerned about the effect of her absence:

> The science is moving and I guess it's that I'm not involved in it, and I've set up all these projects and got things running and got the funding and now I'm removed from it. And it's always hard for me to let go of things. It's partly not being involved for a while. And you can come back, but you just miss out a little bit.

Anne's concerns were echoed by others. There was a strong perception that taking leave would mean missing important scientific developments. If this is the case, there may be an inherent incompatibility between science and maternity leave. Nevertheless, judging by the participants in this study, perhaps the feasibility of longer term maternity leave is rarely tested in academic science. Either way, the organisation of scientific work around individual CIs and focus on individual career achievements appear to place serious limitations of women's maternity leave options in this sector. Indeed, managers who had taken little time off for children themselves were recommending the same approach to their female colleagues today. Penny explained:

> I would never try to talk a woman out of leaving science for the sake of her family, but I would try to make sure she knows what that path will lead to ... you can't get back in. Maternity leave works against women. I've seen it work to such an extent that a woman just is not competitive coming back. I mean 6 months totally out of it, and a year, you're just never going to get back. I'd much rather see a woman go part time and come to lab meetings and discuss papers, have a project, even writing some trivial little thing to keep in touch.

Ellen also observed 'it's difficult to get back into it if you take time off' and knew of a couple of women who had recently returned after having babies, only to leave again soon after. Ellen described them as 'very promising' but surmised 'it's just too hard getting the grants and trying to match the high achiever guys'.

Women who take time off not only find it difficult to catch up 'in the race' but also can be up against negative attitudes, often unspoken. For example, one manager confided that he never asks about women's family commitments when he is recruiting but is glad when applicants say 'don't worry I've had all my children'. He went on to explain:

> If a woman takes maternity leave, her money comes out of the grant, and so I have to show results at the end of the three years of what we've done. Imagine a small team with a small grant, and she has been off six months.

Although the academic and commercial managers both demonstrated a general reluctance to take a career break, the career-damaging consequences of taking a break seemed greater for the academic managers. Aside from the full-time consulting work of Helen and Jeff whose paths were atypical, the only breaks taken by the academic managers were childbirth related. Breaks simply were not part of a traditional academic research career, and the women I interviewed did not feel either inclined or empowered to change this tradition. By contrast, fifty per cent of the firm managers I interviewed, both women and men, had worked in short-term consulting roles and in part-time roles. Some of this consulting and part-time work had been associated with raising children; some not. So although the women firm managers I interviewed were not inclined to take extended maternity leave breaks, the normalisation of non-standard employment arrangements in the commercial sector means that taking a break for children would not particularly differentiate women's non-linear careers from men's. Moreover, some roles, particularly development roles, offer natural career breaks that may suit women wishing to take maternity leave. The commercial sector is more 'forgiving' of time off work than academic research.

As a firm CEO, Jenny summed up the problem as she saw it for academic managers:

> There's a degree of constancy required in academia. You're the person on a contract, you're responsible for getting the contracts, you've got all these people working for you and you can give them no certainty or anything. It would be tough.

In the final section of this chapter I examine the interviewees' responses to some recent initiatives aimed at addressing aspects of this indirect discrimination in academic biotech.

7.6 Accommodating women in academic biotech

Three interviewees were active in trying to improve gender equity in this sector, whilst the others were concerned but not particularly active in driving change. They were frustrated but accepting, generally viewing women's decisions to leave science as their 'choice' and their personal responsibility. Jess, for example, commented that women who find research too onerous to combine with family simply 'don't come and work here'. She suggested 'they are more likely to go into genetic counselling or something'.

Nevertheless they were all aware of recent gender equity initiatives. Mostly they spoke positively of them, including those at the national level being implemented through the ARC and NHMRC, and locally at one large research institute. Their comments were broad and highlighted the complexity of implementing change in 'the system'. Despite support in principle, there was also some scepticism about the feasibility and effectiveness of implementation.

Many of the managers expressed support for ARC and NHMRC changes to include consideration of career disruptions such as pregnancy and childbirth in the assessment of grant applications. Penny, for example, commented:

> I'm very happy with the change that ARC has made for anyone with career interruptions - that they're not judged on their last 5 years publications. I would really hope that gives a longer lead time for a talented woman that has had a career interruption.

Yet support for these changes was tempered by concern about how the impact of career interruptions can be measured when the fundamental basis of assessment remains time-based productivity. Luke, who has extensive experience on grant review panels, provided an example to illustrate his concerns:

> When women are on maternity leave, they are supposed to be treated relative to their experience. Say person A who is a male has 10 publications over the last 5 years and person B who is a female has only 1 publication over the last 5 years, and she says the reason is that I've been on maternity leave and had 2 children. There's no way of judging it. If the success rate is 20 percent of getting fellowships it's not worth taking the risk. Science is missing out on whole generations of female scientists because you can't rank them.

Luke's example highlights three issues. First, it highlights the difficulties that arise when there is 'a lack of structural means for translating equity policies into meaningful equity practice' (Berg 2002: 253). When panel reviewers don't know how to incorporate additional information into their assessments, women may not benefit from these considerations – in other words how many papers is a baby worth (Klocker and Drozdzewski 2012)? Second, it highlights the preoccupation in academic biotech to measure ‘worth’ by metrics. Third, it highlights the inclination to avoid risk when there is little money to go around.

The first issue, translating policy into practice, is compounded to some extent by the reluctance of some high achieving women to seek ‘special consideration’. Ellen observed that ‘most women just do the right thing and then wait for the recognition.’ One such example was Christine, who had applied for a grant unaware that she could have pro-rated her achievements for having two children under two. She has since realised that researchers ‘have to look out for themselves because the system is heavily reliant on the discretion of individual reviewers and ‘no-one is actually responsible for solving these problems’. Yet as Luke pointed out, relying on reviewers’ discretion is problematic. My own review of the guidelines available on the NHMRC website for assessment relative to opportunity and career disruption indeed shows that applicants are encouraged to declare any disruptions and assessors encouraged to consider these, but there are no guidelines as to how. This is a discretionary judgement which can, of course, cut both ways. However, these comments suggest more specific guidelines are required for both applicants and reviewers.

The second issue, reliance on metrics, primarily publications, to measure productivity is deeply institutionalised in the academic science community. My interviewees accepted that publications are the ‘product’ of scientific research and therefore did not object to the use of metrics per se. But some did object to prevailing management practices that prioritise publications disproportionately higher than any other measures of productivity, and thought that women are disadvantaged by this. They call for broader selection criteria that include teamwork, communication and management skills.

On the one hand, researchers call for greater ‘precision’ in calculating the effect of career disruptions, whilst on the other they call for broader assessment criteria. The first appears to require greater objectivity, whilst the second introduces greater discretion or subjectivity. One way to achieve both of these goals may be to decouple the selection of research managers from the allocation of grant funding. At present in most institutes, and increasingly in universities, these two processes are intricately entwined. One institute, however, is implementing a new initiative of appointing managers without grants, as 'junior' lab heads. David, the director, claims to be committed to changing a culture of risk aversion where researchers are expected to 'tick all the boxes of being a lab head' before they are actually appointed as a lab head. In some respects his approach resembles 'the new meritocracy' of biotech firms, where the focus is on potential:

> What we've basically said is we don't care if you have grants – grants are something you get when you're a lab head. We don't care if you've supervised PhD students – that's something you get when you're a lab head. We want to see that you're innovative; that you're excited; that you're somebody who is likely to have good ideas.

Whilst it may be subject to criticism for raising discretion and subjectivity, the rationale behind David's approach is not only to recognise broader potential, but also to bring forward the timing of lab head appointments. This would allow researchers to establish a team to continue their research whilst they take parental leave or work part-time for a period. This approach aligns with the findings of Smith-Doerr (2004) that women working in a team environment in biotech firms are insulated from the pressure to continue working full time or risk losing career momentum.

David's strategy could be described as a hybrid system that includes an assessment of a researcher's early record of achievement but also includes consideration of broader criteria including relational skills, teamwork and an ability to inspire others. He emphasises that 'just producing papers isn't what we're interested in', and claims to be taking 'a kind of developer's perspective' which perhaps reflects his experience working in the commercial sector. There was support for these initiatives from senior managers in his own institute, but David admits his approach is unusual in the sector and does not see an appetite for such 'risk-taking' in other institutes.

This leads to the third issue, risk-taking, which requires delineation between the role of national funding bodies such as the ARC and NHMRC, and the role of individual research institutes. Funding bodies allocate resources to optimise value for the Australian public and are not in the business of taking risks. In this process, metrics are seen to be the least ambiguous and therefore most 'objective' criteria for funding, despite the disadvantages experienced by women with family responsibilities. Although they sought some improvements, the managers I interviewed did not seek a different system altogether.

On the other hand, research institutes have a different charter. At that level, it is possible to apply greater discretion in appointment and promotion decisions as per some of the initiatives discussed above. The organisation of work and the criteria for advancement, two key areas of disadvantage for women in this sector, could be changed at this level. I argue that the management of academic biotech should be complementary at the national and institute levels, not simply replicated.

7.7 Chapter summary

Academic scientists are socialised into a scientific race for discovery that is highly competitive, demands long hours and devotion to a narrow career track. Part-time work and career breaks are not considered feasible whilst family responsibilities are framed as 'career interruptions'. This pressure is compounded by a competitive funding system that undermines teamwork through rewarding individualistic behaviours and driving competition between colleagues. Meanwhile, appointment and promotion are linked to grant funding in many institutes creating high levels of job insecurity. The result of this family-unfriendly work environment is that female managers are concentrated in lower level management positions and earn lower pay than their male colleagues. Recent gender equity initiatives have focused on ways to accommodate those with family responsibilities into this system, but are likely to have limited success because they stop short of challenging the fundamental time-based view of productivity in this sector.

8. Conclusion

I began this thesis 'intrigued to know more' about why women scientists in commercial biotech appear to be doing so much better at reaching management than women in academic science. Drawing on quantitative and qualitative data for Victorian biotech managers, my investigations have revealed that women commercial managers are indeed 'doing well' in management relative to their academic counterparts. This is largely due to differences in how management work is organised and recognised across the two sectors. Driven by the network form of organisation, commercial biotech offers a range of management roles and modes of working that provide managers choice in how they combine work and family at different life stages. In terms of science management careers, this represents a 'reconfiguration of the sensible' (Huault et al. 2014). Meanwhile, enduring practises in academic biotech reflect the traditional social organisation of science, demanding a full-time continuous research career, and perpetuating women's disadvantage despite decades of concern about their under-representation at senior levels. In this concluding chapter I summarise the major findings of this thesis, discuss its limitations and, drawing on 'what works' in commercial biotech, present some initial recommendations for improving gender equity in the academic sector. A strong theme throughout this thesis is that high-achieving biotech managers of either sector are primarily concerned with productivity. I therefore join other applied social researchers in advocating a dual agenda that seeks improvement in both gender equity and productivity (Rapoport et al. 2002; Bailyn 2011). In the case of biotechnology, however, I extend this concept beyond organisational boundaries to capitalise on, and indeed strengthen the inter-organisational networks in this field.

8.1 Women, science management and productivity

The women and men interviewed for this study are not a representative sample of biotech managers. Nor are they unrepresentative. Their stories seem familiar because they exemplify many of the themes in the academic literature pertaining to professionals and managers. They are highly qualified and achievement-oriented, work long hours and subscribe to work devotion schema (Blair-Loy 2003). Of the 22 managers with children, 13 are ideal workers (Acker 1990), including all 8 men. Of the 9 women who are not ideal workers, 5 use nannies to be as close to ideal as possible. Those working part-time also strive to be 'ideal' by remaining 'on call' and working additional unpaid hours (Lewis and Humbert 2010; Tomlinson and Durbin 2010). Despite organising their lives to accommodate family and work, more of the mothers than the fathers complain of a 'time-squeeze', lack of sleep, and constantly juggling work and care (Pocock et al. 2012) because the fathers all have wives looking after their children. Although their domestic arrangements vary widely, the managers' experiences illustrate that irrespective of type of organisation, management practices or policies, it is difficult to participate at senior levels in the workplace if you have shared responsibility for children, but near impossible if you are a primary working carer.

All of the women and men interviewed for this study acknowledge that arrangements at home have been a major factor in their own career advancement and most, although not all, position the 'problem' of women's underrepresentation in management as directly linked to gendered domestic arrangements that individuals need to solve for themselves, rather than primarily the responsibility of organisations (Hakim 2000). This was particularly the case for the firm managers who consistently prioritised business interests over gender equity. A few of the academic managers suggested some changes 'around the edges' and one institute director presented some innovative suggestions but none suggested a major 're-think' of how science management is organised in order to improve gender equity (Moen et al. 2013). It seems 'tempered radicals' (Meyerson and Scully 1995) are not easy to find. Changing the gendered status quo in science is likely to be a major challenge given the unquestioned prioritisation of the economic over the domestic and an ingrained 'ethos of science' among those in a position to influence change.

The difficulties faced by working mothers in professional and management roles are well known, but I make two particular observations in relation to this study. The first is that despite a strong commitment to their careers, a major investment in qualifications and training and early career progression in a highly complex field, female biotech managers are not immune to the pull of motherhood and societal expectations of the 'good mother'. However, whilst they may reject 'ideal worker' lifestyles, they do not necessarily want to give up their careers (Stone and Lovejoy 2004). Therefore, when the 'time squeeze' becomes too great and they make the difficult decision to leave academic science, I argue this is better described as an 'act of emancipation' (Huault et al. 2014) than a choice (Hakim 2000). My second observation is that commercial and academic biotech managers face very similar work-life challenges. This suggests the explanation for why one group does better in the management stakes does not lie with the women themselves. Their different career goals have led them to work in different types of management jobs in very different organisational settings, one that eases the pressure for working mothers and another that exacerbates it. Hence this comparative analysis not only highlights 'what is working' for women in commercial biotech but 'what is not working' for them in academic biotech.

Women in commercial biotech are over 3.5 times as likely to be represented in management as women in academic biotech. This gives an immediate impression of great strides forward for women and explains much of the 'hype' surrounding women's success in commercial biotech. Comparing across sectors, however, it is apparent this difference is largely due to the higher proportion of managers in the commercial sector. Essentially, Victorian biotech firms are 'management firms' with a high management-to-staff ratio. Career-wise, the goal of taking new medicines to market provides highly trained scientists a wide range of research, development and corporate management opportunities. Management in this sector is defined differently to traditional science. It does not necessarily involve managing large research teams, although sometimes it might. More often it involves a 'department of one' with a specialist biotech manager responsible for a range of outsourced contracts that often requires them to 'cross the domains' from science into commercial management. Productivity is closely associated with the versatility to work across these domains, adapt to new business circumstances and move between roles. As much of the work involves project management, relationship and organisational skills are also highly valued. A suitable 'track record' is both 'deep' and 'broad', encompassing experience in a range of environments. Together with a strong science background, this might include exposure to various stages of the drug development process, 'fix it' or 'turnaround' projects (successful or unsuccessful) and commercial deals.

By contrast, in hierarchical academic organisations, a minimalist approach is taken to management which is most often equated with 'bureaucratic red tape' (Roth and Sonnert 2011). In these organisations, notwithstanding high levels of management responsibility in practice, research 'leadership' is the preferred term to describe those who lead teams of people advancing basic science. Contributions valued in biotech firms, including team facilitation, lab organisation and administration, whilst essential, are generally not highly valued. This difference in emphasis across the two sectors has important career consequences for biotech managers. There are very few alternative pathways to reach senior levels in academic science other than through research 'leadership'. In this sector, productivity is primarily demonstrated through quality and quantity of scientific publications and successful grant applications. Demonstrating high levels of scientific productivity is the pre-requisite to be appointed a 'manager', which, in research institutes, is most often associated with the award of a grant. Unlike in firms, 'management' skills are rarely a prerequisite. It seems a perverse system where to do one thing you must be excellent at something else. This narrow view of productivity that venerates individual scientific achievement and undervalues other contributions underpins many of the problems experienced by women in this sector.

The gender distribution of management jobs in Victoria illustrates who is considered 'productive' under these two different management regimes. Whilst men are more 'productive' in both sectors, they are even more so in academia. Around twice as many male as female scientists are managers in firms, whilst almost four times as many male as female scientists are managers in academic biotech. Once they become managers however, my data indicates women experience an egalitarian management environment in firms, holding positions of relatively equal responsibility and salaries to men. By contrast, in academic biotech there is vertical segregation with women congregating in lower level management positions on lower salaries. Insights from my interviews suggest these differences in management outcomes are linked, not only to very different views of productivity, but also the very different methods of assessing it.

The appointment process in commercial biotech is informal and subjective, with decisions often based on recommendations of trusted colleagues within the biotech network. Often drug development experience is difficult to find so managers are appointed on their potential, based on their technical expertise and personal characteristics, especially adaptability. Managers are often appointed as contractors initially and then promoted on their performance. Women whose careers have been 'interrupted' due to family commitments benefit from this approach. In this respect, their reputation for reliability and delivery of results is the focus, compared to a focus on track records in academic biotech. In academia, formal meritocratic processes, such as the competitive grants system, prioritise quantitative measures, or metrics, such as publication records over qualitative assessments of personal characteristics, such as management competencies. Any criterion that cannot be quantified is regarded with scepticism because it introduces subjectivity into the system. This reflects many scientists' strong commitment to the 'ethos of science' that sees a strong focus on objectivity and a values-free framework in the quest for scientific understanding (Denzin and Lincoln 2003).

It is a paradox in science that the principle of universalism (Merton 1973 [1942]) actually disadvantages women. As Acker and others have observed, addressing inequality is difficult when it is 'concealed within a dominant perception of gender equality' (Acker 1990; Benschop and Doorewaard 2012). On the face of it, rewarding achievement and outcomes without regard to the social status of the scientist who achieves them should guard against gender discrimination. In practice, however, such achievement requires a total devotion to work thereby indirectly discriminating against anyone with responsibilities outside work. To be successful, women must become ideal workers (Acker 1990).

8.2 Victorian biotech: Women, part-time work and segregation

The quantitative findings in this study show a similar pattern to Laurel Smith-Doerr's (2004) study of US biotech managers in the 1990s. Smith-Doerr finds women scientists in firms nearly eight times as likely as women in hierarchical organisations to direct scientific projects or manage the firm in some capacity. The Victorian data show a less pronounced trend, which could be attributed to a range of factors such as time, place, and very different methodologies, including the age range of scientists in each of the studies (my Victorian study includes all managers where Smith-Doerr includes only scientists within 10 years of their PhD). Nevertheless, the pattern is the same: commercial biotech stands out both in the US and Australia as a sector where women do relatively well in reaching management when compared to academia. Like Smith-Doerr, I argue this is due largely to the network form of organisation in commercial biotech and particularly to the flexibility that allows women to combine their work and care responsibilities more effectively.

Notwithstanding these similar patterns, there are some important differences between Smith-Doerr's study and mine - and also between the Victorian and US biotech sectors - that can provide further insights into management outcomes for women. Smith-Doerr's quantitative data is extensive, capturing career histories for over 3000 individual scientists. Originating from a National Institute of General Medical Sciences training grants database, it allows her to compare career destinations including position and type of organisation for life scientists at a similar career stage, controlling for eliteness of doctoral education and gender. However, this national dataset provides only high-level information on the researchers' roles and their employing organisations. By contrast, my quantitative data was gathered directly from employing organisations, enabling me to capture more detailed organisation and job-level data. Hence I am able to build on Smith-Doerr's findings by identifying differences between men's and women's roles both within and between organisations and providing a nuanced interpretation of management outcomes under particular organisational conditions.

My analysis suggests two firm-level characteristics have major implications for women's careers: a firm's commerce or research orientation; and its size. There are differences between US and Victorian biotech on both of these factors. The Victorian commercial sector is dominated by small and in many cases 'virtual', commerce-centred firms. Whilst such firms are also common in the US, the Victorian sector is smaller and less developed, having fewer large research-centred firms (Powell and Sandholtz 2012). According to research in the 1990s, the average size of biotech firms in the US at that time was around 159 employees (Powell et al. 1996)[27]. By comparison, the largest firm in this representative Victorian sample has 78 employees, with an average size across all firms of 9 staff. This size difference is consistent with a higher proportion of 'in-house' research in the US compared to the Victorian sector, as research is more labour intensive than development or commercial activities. Taken together, the commerce-orientation and small size of Victorian firms provides a nuanced understanding of 'flexibility' that overlaps with, but differs slightly from Smith-Doerr's study. Like Smith-Doerr, I have identified the positive effects of teamwork, flexibility and job mobility on women's careers, but I further argue that women benefit from the variety of employment arrangements offered by these firms, including part-time and other non-standard work. Women benefit when different types of management jobs and temporal arrangements are available as their care responsibilities change over the life-course (Moen et al. 2013). The management roles available in small firms are an important part of this mix.

In terms of the type of management work they do, the prevalence of commerce-centred firms in Victoria sees two-thirds of management roles involving primarily corporate or development responsibilities. These roles draw on the managers' scientific knowledge, but do not actually involve the management of research. Much of the work involves managing outsourced activities rather than in-house teams, with some firms operating a virtual model with only a handful of managers directing a range of research and development activities undertaken elsewhere. From a career

[27] The average size of the 225 research driven dedicated biotechnology firms in human therapeutics in the 1994 sample used by Powell et al. (1996) is 158.87 employees (based on table 3, p 133).

perspective, these roles are more amenable, not only to part-time work, but also to working flexibly from home.

In terms of temporal arrangements, my quantitative data indicate 22 percent of Victorian firm managers work part-time, with a significantly higher percentage working part-time in small firms than medium or large firms. In firms with only one product in development, venture capitalists or CEOs often seek out managers prepared to work part-time, with reduced hours more often business-driven than initiated by individuals. Managers often combine a number of part-time roles, building a portfolio of work that fits with their life stage and work-family preferences. They can increase or decrease their workload, and importantly, they are able to do this whilst maintaining career continuity.

It is noteworthy, however, that even in commercial biotech where part-time work is normalised, the enduring image of managers as full-time workers persists. Most of the managers I interviewed were working or had worked part-time as a temporary phase in their careers. Some women had worked part-time whilst their children were young and then returned to full-time work. Others, both men and women, combined their part-time management jobs with other jobs to effectively work full-time. An important distinction between commercial biotech and other sectors, however, is that part-time work is normalised for both women and men and across different management functions. There is not a particular type of management work that is of 'secondary' status or lower quality and therefore considered suitable for part-time work. The array of non-standard, 'mix and match' arrangements means women who work part-time for a period do not stand out as being on the 'mommy track' (Schwartz 1989; Williams et al. 2013) and can usually integrate back into full-time work if they have a reputation for reliability and flexibility. Moreover, they can combine more senior or less senior part-time management positions with various board or committee appointments. There is no formal 'career ladder' in this sector. This works to the advantage of women whose non-linear paths do not align well with 'ladders'.

Consistent with other studies, the double-edged sword of part-time management work applies in commercial biotech, with most part-time managers regularly working extra unpaid hours and effectively 'buying' their flexibility (McDonald et al. 2009; Tomlinson and Durbin 2010; Lewis and Humbert 2010). Whilst some of the part-time managers I interviewed admitted to exhaustion, most accepted the requirement to be constantly accessible as a normal part of management work. As one manager commented: 'It's not like you have to stuff sausages at a factory … when you have kids you're exhausted anyway'. Studies indicate the plight of 'overworked' part-time professionals does not garner much sympathy from colleagues (McDonald et al. 2009). That is also the case here. A few of the female CEOs who had previously worked part-time themselves were keen to engage women with families who would be 'good value'. They framed this 'exploitation' as a 'win-win' because it also enabled these women to continue their careers. The part-time managers were grateful for the opportunity, just as the CEOs had been earlier in their own careers. Despite the normalisation of part-time management work in this sector, it seems the ideal worker remains the default standard by which all other efforts are judged. Nevertheless, the availability of high-quality part-time management work represents a 'reconfiguration of the sensible' in science and a major difference between New Economy firms and traditional academic biotech.

Part-time work may be linked to horizontal segregation in Victorian firms, with my data showing women congregate in development roles. As is often the case with occupational segregation, there does not seem to be a single factor driving this. Two factors were often conflated by interviewees: the suitability of development for part-time and flexible work arrangements; and the particular emphasis on organisational and relationship skills, traditionally considered 'women's skills' (Fletcher 1999; Eagly and Karau 2002). The first proposition is not supported by the quantitative data which shows part-time work is normalised across all functional areas and not specific to development (although this may be different below the management level). The second proposition was contested, with some interviewees sensitive about stereotyping women, including themselves. The female managers overwhelmingly described themselves as ‘commercial’ rather than motivated by ‘care’.

Segregation is most often equated with subordination, even for professional women, where research often focuses on career and salary limiting ‘secondary specialisms’ or ‘support’ management roles (EOWA 2010). However, that is not the case in Victorian biotech. Not only are such roles central to the operation of firms, job mobility in the sector provides the opportunity for these women to complement their technical expertise with broader corporate experience, thus providing a launching pad for executive ‘C-suite’ positions. The important observation here is that, irrespective of its cause, segregation does not lead to ‘ghettoisation’ (Reskin and Roos 1990). If women are valued for their ‘special skills’ (Ridgeway 2011) those skills are highly rewarded relative to other biotech management roles and not career-limiting for those who wish to broaden their expertise.

‘Turn around’ and ‘fix it’ jobs in small firms provide intense learning experiences that prepare managers for their next role. The managers I interviewed portray these as positive experiences. If accepted primarily by women, they could be construed as ‘glass cliff’ assignments (Ryan and Haslam 2005), however in biotech the high firm failure rate means such assignments are normalised for both women and men. These roles, together with the general project-based nature of biotech management, lead to high levels of job mobility. In this context I argue that job change acts as a ‘proxy’ for career break in the sector. The breaks between jobs or projects may be short or long, and although many ambitious women do not want a career break, for those who do this provides flexibility to change their employment arrangements as required. Whichever options women take up, I argue that the variety of employment arrangements in this sector provides genuine choice to highly skilled biotech managers with care commitments. This flexibility is driven by the network form of organisation but accentuated by the small size of Victorian firms.

Whilst job mobility is high between firms, the dominant commerce-centred business model in Victorian biotech may limit the level of job mobility between firms and academia. The 'amphibious creatures' described by Powell and Sandholtz (2012) seem less prevalent than in the US. There was a strong perception amongst interviewees that moving from academia to biotech is a 'one way' street and their industrial experience would not be recognised if they returned to academia (ADoHA 2013; OCS 2014). This differentiates the Victorian sector from the US sector where scientists are able to legitimise their move to commercial biotech on the grounds that they can 'do good science' (Smith-Doerr 2005).

8.3 The 'cocktail': job insecurity, long hours and no career breaks

Long work hours are portrayed differently across the two sectors. The commercial managers give pragmatic reasons for their working hours, such as international time differences and project workloads. Depending on the firm and stage in the development program, long hours tend to come in peaks and troughs; for most there is some 'down time'. Job mobility also provides an opportunity to 'control' work hours to some extent. The time pressures faced by commercial biotech managers are usually shared with their colleagues. When project deadlines are crucial for the survival of the firm, it is usually a multi-disciplinary team effort, with consultants and contractors brought in as needed. Long hours combine with a sense of camaraderie and the sharing of responsibility and risk.

The academic research managers experience long hours differently. They describe a relentlessness of work that spills over into evenings and most weekends for years on end, beginning in the competitiveness of their post doc socialisation and perpetuated by the continuous 'race for discovery'. The 'cocktail' of doing research, writing publications, preparing grant applications, managing a group, and participating in peer review activities escalates as managers progress through 'the system'. Flexible hours do not reduce this workload but simply allow it to be done at any time, a case of micro-emancipation (Alvesson and Wilmott 2002). Whilst academic researchers may work in teams, they are usually hierarchical teams, with the pressure on the managing PI both intense and personal to deliver research outputs necessary to maintain grant funding.

Job insecurity is also experienced differently by the managers across sectors and is linked to long hours. My quantitative data show 56 percent of managers on term contracts in academia (although higher in research institutes and lower in universities) compared to 20 percent in firms. With employment terms often linked to grant funding, job insecurity in the academic sector is highly individualised. When career survival is at stake, the academic managers have compelling personal reasons to work nights and weekends to retain their jobs. They expressed great frustration at the on-going requirement to apply for grant funding, seen as an unwelcome distraction from their science and stressful additional workload. In an environment where long hours are required simply to remain at the forefront of the science, they identified this additional pressure as contributing to the exodus of mothers who are already grappling with work-family pressures. Quite simply, the quantum of work and long hours required to be 'productive' in this system are incompatible with family life. For many, it seems the grants system becomes the tipping point.

By contrast, employment risks are shared between the individual and the firm in commercial biotech. Job insecurity is not personalised; it applies to everyone in the firm, and is more directly linked to the success of the product and the efforts of a broader team than any individual effort. Whilst working in commercial biotech has inherent risks associated with firm failure, most firm managers in this study were not concerned about job insecurity. There are two reasons for this. First, they considered themselves to be working 'in the sector'; not just for the firm employing them at any particular time, with strong connections and friendships in the sector providing links to other work. Second, there is a high degree of congruence between their work conditions, their entrepreneurial style and the potential for lucrative rewards. Unlike the academic managers they have chosen a 'risky' career path, which they tend to describe as 'exciting' and 'fun'.

It seems incongruous that managers in small, often precarious biotech firms feel more secure in their jobs than managers in large research organisations. It is also a paradox that for PIs, long hours are often driven by being at once 'irreplaceable' on their own project and easily 'replaceable' in the system overall. As specialists, the academic managers' skills are not fungible. This increases the pressure associated with job insecurity because it is difficult to transfer to a new role if they slip behind and their position is no longer funded. This link between grant funding, employment term and promotion drives an individualistic and competitive culture where researchers can be easily replaced by another 'more successful' researcher in the next funding round. Having to continually compete for positions, academic biotech managers seem more like self-employed contractors than employees.

Managers from both sectors were reluctant to take career breaks, with the only 'planned breaks' for relatively short periods of maternity leave. The reasons for this varied, including a preference of some managers to be at work, but even so, most felt pressure to protect their jobs and their longer term career prospects. Whilst improved maternity leave provisions have reduced this pressure over time, there remains a strong perception that women cannot take long (more than three months) breaks for child-rearing without damaging their careers. In this sense, Australian statutory parental leave entitlements offering up to two years leave are largely irrelevant to managers who believe they would forgo their careers if they access them. This belief is further perpetuated by female managers who compete in the workplace as though they are childless (some because they believe this is necessary; some because they want to) thereby conveying the message to other women that this is what is required to succeed.

There were, however, nuanced differences between the attitudes to maternity leave from the managers I interviewed across the two sectors. These relate to different notions of productivity. The firm managers expressed frustration at having to replace or hold jobs open for women on maternity leave. They were primarily concerned with the needs of the firm, the timelines associated with projects and the difficulty or inconvenience of replacing the manager on leave. They considered some managers more easily replaced than others, for example, development managers in jobs where documented procedures allow others to 'pick up a file', but most management work is relational and there is an expectation that managers will 'see the job through'. As the sense of urgency in commercial biotech is high, reliability to complete work within project timeframes impacts on a manager's reputation. However, breaks between projects and changes in the stage of development provide 'natural' breaks for women seeking to take family leave. If women protect their reputation for 'getting the job done' they are unlikely to stand out as very different to men who also experience high job mobility and natural career breaks. There is a paradox in commercial biotech, whereby discontinuity and change is rewarded when driven by business needs whilst managers feel insecure about taking a break for personal reasons. This likely reflects the strong ideal worker norm that pervades management work and the professional workforce more generally and the associated flexibility stigma. These perceptions seem to be slightly tempered but not entirely eliminated by the normalisation of career disruption in commercial biotech.

It is noteworthy that the commercial managers viewed career breaks from a business perspective, whilst the academic managers were concerned about the impact on individuals. This reflects the individualistic culture in academia. Here, a manager's future is independent of the organisation. The academic managers stressed that any diversion from the publication and grant cycle is damaging with the oft-repeated message that researchers who take more than a few months off work 'can't get back in'. This strong perception inhibits the use of parental leave and, more recently, has led to a focus on policies such as childcare that help women with young children continue to compete. Whilst such policies are helpful to women who genuinely wish to continue working soon after having children, little support is offered to those who prefer a longer break and a return to work at a later time. Gender equity programs send a clear message as to what is required for a successful career. Although initiatives such as ROPE require consideration of career interruptions in the assessment of grant applications, the association between continuity and productivity persists in practice. The managers were supportive of the gender equity intentions of ROPE, although some were unable to reconcile a commitment to funding 'the best and brightest' with vague approximations of what women might have produced had they been at work rather than on leave. Perhaps due to their socialisation into the priority reward system, together with their limited experience outside the academic sector, many academic managers could not envisage an alternative route to career success other than continuity and constant attention to developments in their field. Without interviewing women who have left academic science, it seems reasonable to assume this consistent message must discourage many from returning.

8.4 Opportunities for change: a dual agenda?

The organisation of management work in commercial biotech has positive gender equity outcomes, but is driven by a productivity agenda. This gives credence to a dual agenda approach that improves both organisational competitiveness and gender equity in academic biotech (Rapoport et al. 2002). It provides a basis for envisaging how academic biotech management could be different for women if it becomes more 'firm-like' in its organisation. As Bailyn (2011: 108) suggests, using a gender lens to examine constraining workplace institutions may 'point to productive leverage points for change that might otherwise be missed.' Increasingly, reports on the productivity of Australian science call for the need to attract and retain women scientists. They also call, often quite separately, for greater mobility between the commercial and academic sectors (OCS 2014; ADoHA 2013). The findings in this study suggest these two goals are complementary: the strategies necessary to increase career mobility, such as recognising diverse experiences and offering a range of different roles, are the same strategies that will attract and retain women who, more often than men, follow non-linear career paths. But men will also benefit from these strategies. On the narrow academic biotech career track, 'non-linear' equally applies to changes to scientific discipline, work in industry or teaching as it does to 'time out' for family. A more flexible approach to 'track record' may also provide the opportunity for many men to take 'time out' for family.

Translating ideas into concrete actions is the next challenge. I propose three priority areas where academic biotech could apply strategies based on 'what works' for productivity and gender equity in firms: teamwork, working hours; and job mobility. The three are interconnected. In commercial biotech, work is organised around a team, with the expectation of changing skills requirements and movement of personnel. When one person leaves, for whatever reason, the work is continued by the team. However, in academic biotech, the organisation of research projects according to the CI model means that when a researcher leaves, for whatever reason, their work often simply stops as does their career advancement. As a result, taking time out of academic biotech is considered particularly unproductive. The managers in this study emphasised the importance of teamwork in academic biotech, but contributions to the broader team, which are difficult to measure by metrics, go largely unrecognised and unrewarded. The best 'team leader' does not necessarily lead the team, unless they also have the best track record.

The long-standing CI model may not be the most productive way to achieve excellence in science because it relies heavily on a relatively small number of elite scientists and has the potential to overload and exhaust them. Meanwhile other highly skilled scientists fall by the wayside because their family responsibilities prevent them from working at that pace. Their skills are therefore underutilised. I argue it would be more productive to share the load. The lack of employer-initiated part-time work in academic research management places the onus on scientists struggling to balance work and childcare to actively request 'special consideration' or leave. Despite 'family friendly' policies, a reduction in workload is rarely perceived as synonymous with productivity. This study suggests many ambitious women are reluctant to compromise their 'productivity'. I argue that to address this combined 'overwork' and 'underwork' problem, workplace flexibility in academia must focus on job design, placing the onus on organisations to take the lead in offering 'doable' jobs and to not only question the assumption that all senior roles in science require long hours, but to do something about it (Lewis and Humbert 2010). This may include more employer-initiated part-time jobs, but also full-time jobs of a manageable scope, keeping in mind that many women work part-time simply to avoid the long hours associated with full-time management work. Job design should also take into account the full range of tasks required to produce high-quality research, including laboratory management, administration, team facilitation and staff coaching. These are core functions that not only require managers who are skilled to undertake them, but an actual time allocation to do them. Some of these roles may be suitable for part-time work. By prioritising these functions in a more 'firm-like' way, academic institutions are likely to achieve productivity gains and also improve gender equity through offering more diverse roles, sharing the CI workload and employing a more diverse workforce.

I argue these changes to the organisation of biotech management will only occur with structural changes that give research institutes more autonomy. One potential area for change is funding. I believe consideration should be given to a 'decoupling' of grant funding and management appointments. A change to the funding mix that reduces the proportion of Government funding allocated through the current CI model and increases the proportion allocated to research institutes as 'block' funding would provide this autonomy. This would allow institutes to allocate resources and appoint managers or team leaders at the local level, rather than relying on the funding of individual CIs. This is a 'shared risk' model where both organisations and individuals shoulder responsibility for scientific productivity, rather than leaving individual scientists to shoulder all the risks as de-facto self-employed contractors constantly reapplying for funding. Increased autonomy would allow organisations to coordinate the movement of staff into high priority projects according to the demands of the work; spread the workload more evenly; employ additional staff to assist with peak loads; create part-time roles at all levels; cover career breaks; and promote teamwork and job sharing. From a public accountability perspective, I argue this model would make individual research institutes more accountable and also promote diversity in the scientific workforce thereby capitalising on the public investment in science education.

Research indicates management practices that work in small firms do not necessarily work in large bureaucratic organisations and vice versa (Krenn 2013). Scientists steeped in the 'ethos of science' (Merton 1973 [1942]) who believe the current system is effective, and even those who want to see change, are likely to have concerns about unintended consequences (Dasgupta and David 1994; Powell et al 2011). In US biotechnology, however, it has been shown that cross-fertilisation of ideas, facilitated by the movement of personnel between the commercial and academic sectors, has been central to the development of innovative management practices (Powell and Sandholtz 2012; Jong 2008). I believe there is scope for greater cross-fertilisation in Victorian biotech and that this is necessary for improvements to management practices that ultimately will improve gender equity. Whilst the commerce-centred focus of many firms and pattern of one-way boundary crossing makes this a challenging task in Victoria, there are also many willing ‘boundary spanners’. Research managers, who make up about one third of managers in Victorian biotech firms, are perhaps best placed to, and most enthusiastic about forging links with academia. To benefit from this diversity and introduce new ideas into their institutions, academia needs to recognise industry experience equally with traditional measures of productivity, such as publications, in their selection criteria for advancement. There have long been calls for academic institutions to make it clear that they are willing to entertain non-traditional candidates for senior positions (Valian 2008). It is time to get serious about this.

8.5 Limitations of this thesis

Studies of women in science have been criticised for concentrating on those remaining in science because they are easier to locate for surveys (Mavriplis et al. 2010). Indeed, one limitation of this study is that I propose reasons for women’s under-representation in academic biotech management based on interviews with women and men who have been successful in ‘the system’. However, I argue that the trials and tribulations of the managers I interviewed enable us to undertake ‘women centred theorising’ (Calas and Smircich 2006: 300). The interviews provide pointers as to why other managers have opted out, not reasons. They enable us to imagine how women without family support, or the income to pay nannies, or, indeed with attractive alternative offers might ‘opt out’ in the face of these trials and tribulations.

A further limitation is the representativeness of my interviewees, particularly the academic managers. Of the 26 managers I interviewed, eleven represented the academic sector and worked across six different research organisations. Five of them, however, worked at one institute that has been proactive with gender equity initiatives. This has likely heightened awareness of the gender equity 'problem' amongst these managers compared to the broader academic population. On the other hand, despite their concerns about gender equity, these managers had, in practice, organised their own lives around scientific productivity. So in some ways this strengthens my finding that the rhetoric of gender equity in academic science is undermined by the organisation of work in that sector.

During the time it takes to research and write a thesis, societal changes can render the final product 'out of date'. However, as a biotech 'insider' I maintained a close association with both the commercial and academic biotech sectors throughout this study, closely monitoring any developments that might affect management outcomes for women. I observed little significant change since my data collection in 2010. Indeed, my findings are consistent with more recent analyses that show, for example, women's greater management representation in commercial biotech relative to other sectors (EOWA 2012) and the continuing under-representation of women in senior management in academic medical science (ADoHA 2013; FASTS 2011; NHMRC 2014).

8.6 Final reflections

Before I started this thesis I did not think I was an 'amphibious creature'; I did not even know what that was (apart from frogs). On reflection though, I have been amphibious in the biotech world and that is probably why I ended up writing this. I have enjoyed working in both commercial and academic biotech but I have always felt that each could learn from the other. Often small organisations import and adapt the bureaucratic processes of large organisations but in this thesis I am recommending that large organisations adapt some of the ways of small organisations. The network form of organisation in commercial biotech provides new opportunities for high-achieving female biotech managers that are not available in the academic sector, although they are driven by business imperatives, not gender equity concerns. Nevertheless, I argue gender equity must remain on the agenda. Commercial biotech is still far from perfect in terms of its gender equity outcomes. Given many of the advantages to women are linked to the small size of this sector, we should be wary of gender dynamics as it grows. Even in a sector characterised by flexibility, women continue to feel the pressure to be ideal workers. It is important to maintain awareness that long hours and work overload drive many talented women to the emancipatory act of leaving elite jobs. Indeed, I argue this situation requires more than awareness; it calls for empathy. Although there are increasing numbers of men with care responsibilities, it is still too easy for those with partners at home caring for children to pay lip service to gender equity whilst perpetuating the ideal worker model through their own work-lives. This also applies to women in senior roles.

On the other hand, gender equity initiatives alone are unlikely to fix the gender equity problem in academia. This study shows that opportunities for high-quality part-time work, team-work, variety and change through-out the life-course increase women's representation in senior roles in commercial biotech. But to implement change of this magnitude into the competitive individualistic culture of academic science requires a strong productivity justification. Recent reviews of Australian science suggest such change is in the wind. In these reviews the link between productivity and the 'gender agenda' is often tenuous and vague, but this study shows in a practical way how flexibility, not only in how work is organised but also in how staff are recruited and promoted, does lead to women's career advancement in science. I argue we should abandon policies that 'level the playing field'; it is time for a different playing field that is suitable for both women and men. Commercial biotech, whilst not perfect, provides a different way to think about productivity in science through organising work differently and valuing contributions differently.

References

Acker, J. (1989). Doing Comparable Worth: Gender, Class and Pay Equity. Philadelphia, Temple University Press.

Acker, J. (1990). "Hierarchies, Jobs, Bodies: A Theory of Gendered Organizations." Gender & Society **4**(2): 139-158.

Acker, J. (1992). Gendering Organisational Theory. Gendering Organizational Analysis. A. J. Mills and P. Tancred. Newbury Park CA, Sage**:** 248-260.

Acker, J. (1999). Gender and Organizations, Springer Science & Business Media B.V. Books**:** 177-194.

Acker, J. (2009). "From glass ceiling to inequality regimes." Sociologie Du Travail **51**(2): 199-217.

Acker, J. (2012). "Joan Acker's review of the contributing papers, edited by Susan Sayce." Equality Diversity and Inclusion **31**(3): 208-213.

Adamo, S. A. (2013). "Attrition of Women in the Biological Sciences: Workload, Motherhood, and Other Explanations Revisited." BioScience **63**(1): 43-48.

Alexander, C. P., G. Bolt and A. Zagorin (1983). "The New Economy." Time **121**(22): 70.

Allan, C., R. Loudoun and D. Peetz (2007). "Influences on work/non-work conflict." Journal of Sociology **43**(3): 219-239.

Allen Consulting Group (ACG). (2010a). "Employer Demand for Researchers in Australia." Retrieved 13/3/2014, from http://www.industry.gov.au/research/ResearchWorkforceIssues/Pages/Library%20Card/EmployerDemandforResearchersinAustraliareport.aspx.

Allen Consulting Group (ACG). (2010b). "Victorian Biotechnology Industry Skills Review." Retrieved 28/10/2014, from http://www.acilallen.com.au/projects/19/education/26/victorian-biotechnology-industry-skills-review.

Alvesson, M. and D. Karreman (2007). Constructing Mystery : Empirical Matters In Theory Development. Academy of Management Review, Academy of Management. **32:** 1265-1281.

Alvesson, M. and H. Willmott (2002). "Identity Regulation as Organizational Control: Producing the Appropriate Individual." Journal of Management Studies **39**(5): 619-644.

Alvesson, M. and H. Willmott (2012). Making Sense of Management A Critical Introduction. London, Sage.

Association of Professional Engineers Scientists and Managers Australia (APESMA) (2007). Women in the Professions Survey Report.

Association of Professional Engineers Scientists and Managers Australia (APESMA). (2010). "Women in the Professions: The State of Play 2009-10." Retrieved 16/10/14 from http://www.professionalsaustralia.org.au/groups/professional-women/.

Australian Bureau of Statistics (ABS) (1980). The Labour Force Australia January 1980 Catalogue No. 6203.0. A. B. o. Statistics. Canberra.

Australian Bureau of Statistics (ABS) (2010a). Labour Force, Australia, Detailed, Quarterly - Table 7. Employed persons by Occupation and Sex (released November 2010), Catalogue 6291.0.55.003. Canberra, ABS.

Australian Bureau of Statistics (ABS). (2010b). "Australian Social Trends, Data Cube - Work, Catalogue number 4102.0, Table 1 1999-2010." Retrieved 25/3/2012 from www.abs.gov.au/AUSSTATS/abs@nsf/DetailsPage/4102.0Dec%202010.

Australian Bureau of Statistics (ABS). (2012). "Gender Indicators Australia January 2012 Catalogue number 4125.0." Retrieved 22/10/2014 from http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by+Subject/4125.0~Jan+2012~Main+Features~Working+Population~110.

Australian Bureau of Statistics (ABS) (2013). Labour Force, Australia September 2013 Understanding Full-Time/Part-Time Status in the Labour Force Survey. **Catalogue number 6202.0**.

Australian Council of Learned Academies (ACOLA). (2012). "Career support for researchers: Understanding needs and developing a best practice approach." Retrieved 19/9/2014 from http://www.acola.org.au/index.php/projects/rws.

Australian Department of Health and Ageing (ADoHA). (2013). "Strategic Review of Health and Medical Research in Australia - Better Health Through Research." Retrieved 17/10/2014 from http://www.mckeonreview.org.au/.

Australian Research Council (ARC). (2014a). "National Competitive Grants Program Trends January 2014." Retrieved 29/10/2014 from http://www.arc.gov.au/general/ncgp%20stats/ARC_NCGP_Trends_web.htm.

Australian Research Council (ARC). (2014b). "ARC Research Opportunity and Performance Evidence (ROPE) Statement February 2014." Retrieved 29/10/2014 from http://www.arc.gov.au/applicants/ROPE_Statement_version_2014.1.pdf.

Bacon, N., P. Ackers, J. Storey and D. Coates (1996). "It's a small world: Managing human resources in small businesses." International Journal of Human Resource Management **7**(1): X5-100.

Bailyn, L. (2004). "Time in careers - Careers in time." Human Relations **57**(12): 1507-1521.

Bailyn, L. (2006[1993]). Breaking the Mold: Redesigning Work for Productive and Satisfying Lives. Ithaca, NY, Cornell University Press.

Bailyn, L. (2008). "Comment on Gender Differences in Research Grant Applications and Funding Outcomes for Medical School Faculty." Journal of Women's Health (15409996) **17**(2): 303-304.

Bailyn, L. (2011). "Redesigning work for gender equity and work-personal life integration." Community, Work & Family **14**(1): 97-112.

Bailyn, L. and R. Rapoport (2003). Moving organizations toward gender equity : a cautionary tale, Massachusetts Institute of Technology (MIT), Sloan School of Management, Working papers: WP 4021-98.

Baker, D. (2011). Maternity Leave and Reduced Future Earning Capacity. Family Matters. A. I. F. Studies. Canberra, Commonwealth of Australia. **89**.

Barns, A. and A. Preston (2010). "Is Australia Really a World Leader in Closing the Gender Gap?" Feminist Economics **16**(4): 81-103.

Baron, J. D. and D. A. Cobb-Clark (2010). "Occupational Segregation and the Gender Wage Gap in Private- and Public-Sector Employment: A Distributional Analysis." Economic Record **86**(273): 227-246.

Baron, J. N., M. T. Hannan, G. Hsu and O. Kocak (2007). In the Company of Women: Gender Inequality and the Logic of Bureaucracy in Start-Up Firms. Work and Occupations. US, Sage Publications. **34:** 35-66.

Baxter, J. and B. Hewitt (2013). "Negotiating Domestic Labor: Women's Earnings and Housework Time in Australia." Feminist Economics **19**(1): 29-53.

Baxter, J., B. Hewitt and M. Western (2005). "Post-Familial Families and the Domestic Division of Labour." Journal of Comparative Family Studies **36**(4): 583-600.

Baxter, J., B. Hewitt and M. Western (2009). "Who Uses Paid Domestic Labor in Australia? Choice and Constraint in Hiring Household Help." Feminist Economics **15**(1): 1-26.

Beatty, R. W. and J. R. Beatty (1984). Some Problems with Contemporary Job Evaluation Systems. Comparable Worth and Wage Discrimination: Technical Possibilities and Political Realities. H. Remick. Philadelphia, Temple University Press: 59-79.

Bell, S. (2009). Women in Science in Australia : Maximising Productivity, Diversity and Innovation, Federation of Australian Scientific and Technological Societies.

Bell, S. (2010). "Women in Science: The Persistence of Gender in Australia." Higher Education Management and Policy **22**(1): 21-40.

Bennett, C. (2011). "Beyond The Leaky Pipeline: Consolidating Understanding and Incorporating New Research About Women's Science Careers in the UK." Brussels Economic Review **54**(2/3): 149-176.

Benschop, Y. and M. Brouns (2003). "Crumbling Ivory Towers: Academic Organizing and its Gender Effects." Gender, Work & Organization **10**(2): 194-212.

Benschop, Y. and H. Doorewaard (2012). "Gender subtext revisited." Equality, Diversity & Inclusion **31**(3): 225-235.

Berdahl, J. L. and S. H. Moon (2013). "Workplace mistreatment of middle class workers based on sex, parenthood, and caregiving." Journal of Social Issues **69**(2): 341-366.

Berg, P., A. L. Kalleberg and E. Appelbaum (2003). "Balancing work and family: The role of high-commitment environments." Industrial Relations: A Journal of Economy & Society **42**(2): 168-188.

Bielby, W. T. (2000). "Minimizing Workplace Gender and Racial Bias." Contemporary Sociology **29**(1): 120-129.

Binns, J. (2010). Leadership and the (In)visibility of Gender. Revealing and Concealing Gender: Issues of Visibility in Organisations. P. Lewis and R. Simpson. Basingstoke, Palgrave Macmillan.

Bittman, M., P. England, N. Folbre, L. Sayer and G. Matheson (2003). "When Does Gender Trump Money? Bargaining and Time in Household Work." American Journal of Sociology **109**(1): 186-214.

Blackburn, R. M., J. Browne, B. Brooks and J. Jarman (2002). "Explaining gender segregation." British Journal of Sociology **53**(4): 513-536.

Blackwell, L. and J. Glover (2008). "Women's scientific employment and family formation: A longitudinal perspective." Gender, Work and Organization **15**(6): 579-599.

Blair-Loy, M. (2003). Competing Devotions : Career and Family Among Women Executives. Cambridge, MA, Harvard University Press.

Blau, F., P. Brummund and A. Liu (2013). "Trends in Occupational Segregation by Gender 1970-2009: Adjusting for the Impact of Changes in the Occupational Coding System." Demography **50**(2): 471-492.

Bottero, W. (1992). "The Changing Face of the Professions? Gender and Explanations of Women's Entry to Pharmacy." Work, Employment & Society **6**(3): 329-346.

Brewster, K. L. and I. Padavic (2000). "Change in gender-ideology, 1977–1996: The contributions of intracohort change and population turnover." Journal of Marriage and the Family **62**(2): 477-487.

Britton, D. M. and L. Logan (2008). "Gendered Organizations: Progress and Prospects." Sociology Compass **2**(1): 107-121.

Bryman, A. (2006). Integrating quantitative and qualitative research: how is it done? Qualitative Research. **6:** 97-113.

Budig, M. J. and P. England (2001). "The Wage Penalty for Motherhood." American Sociological Review **66**(2): 204-225.

Burgess, J. (2005). "Exploring Job Quality and Part-time Work in Australia." Labour & Industry **15**(3): 29-40.

Burris, B. H. (1996). Technocracy, Patriarchy and Management. Men as Managers, Managers as Men. D. L. Collinson and J. Hearn. London, Sage Publications.

Burton, C. (1988). Gender Bias in Job Evaluation. Granville NSW, Commonwealth of Australia.

Calas, M. B. and L. Smircich (2006). From the 'Woman's Point of View' Ten Years Later: Towards a Feminist Organization Studies. The Sage Handbook of Organization Studies. S. R. Clegg, C. Hardy, T. B. Lawrence and W. R. Nord. London, Sage Publications**:** 284-346.

Campbell, I. (2007). "Long Working Hours in Australia: Working-Time Regulation and Employer Pressures." Economic and Labour Relations Review **17**(2): 37-68.

Campbell, I. and B. van Wanrooy (2013). "Long working hours and working-time preferences: Between desirability and feasibility." Human Relations **66**(8): 1131-1155.

Casper, S. and F. Murray (2005). "Careers and clusters: analyzing the career network dynamic of biotechnology clusters." Journal of Engineering & Technology Management **22**(1/2): 51-74.

Cassells, R., R. Miranti, B. Nepal and R. Tanton (2009). She Works Hard for the Money: Australian Women and the Gender Divide. AMP.NATSEM Income and Wealth Report issue 22 April, University of Canberra.

Cech, E. A. and M. Blair-Loy (2010). "Perceiving glass ceilings? Meritocratic versus structural explanations of gender inequality among women in science and technology." Social Problems **57**(3): 371-397.

Cech, E. A. and M. Blair-Loy (2014). "Consequences of Flexibility Stigma Among Academic Scientists and Engineers." Work & Occupations **41**(1): 86-110.

Cervantes, M. (2006). Chapter 1. OECD Background Paper. Women in Scientific Careers: Unleashing the Potential, OECD Publishing.

Cha, Y. (2010). "Reinforcing Separate Spheres: The Effect of Spousal Overwork on Men's and Women's Employment in Dual-Earner Households." American Sociological Review **75**(2): 303-329.

Cha, Y. (2013). "Overwork and the Persistence of Gender Segregation in Occupations." Gender & Society **27**(2): 158-184.

Chapman, J., N. Skinner and B. Pocock (2014). "Work--life interaction in the twenty-first century Australian workforce: five years of the Australian Work and Life Index." Labour & Industry **24**(2): 87-102.

Charles, M. and D. B. Grusky (2006). Chapter 38: Egalitarianism and Gender Inequality, Perseus Books, LLC: 327-342.

Charlesworth, S., L. Strazdins, L. O'Brien and S. Sims (2011). "Parents' Jobs in Australia: Work Hours Polarisation and the Consequences for Job Quality and Gender Equality." Australian Journal of Labour Economics **14**(1): 35-57.

Charmaz, K. (2003). Grounded Theory: Objectivist and Constructivist Methods. Strategies of Qualitative Inquiry. N. K. Denzin and Y. S. Lincoln. Thousand Oaks, California, Sage.

Chesbrough, H. and R. S. Rosenbloom (2002). "The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies." Industrial & Corporate Change **11**(3): 529-555.

Chesterman, C., A. Ross-Smith and M. Peters (2005). "“Not doable jobs!” Exploring senior women's attitudes to academic leadership roles." Women's Studies International Forum **28**(2/3): 163-180.

Chicha, M.-T. (2007). Promoting Equity : Gender-Neutral Job Evaluation for Equal Pay. A Step-By-Step Guide, Geneva, Switzerland.

Cockburn, C. (1989). "Equal opportunities: the short and long agenda." Industrial Relations Journal **20**(3).

Cohen, P. N., M. L. Huffman and S. Knauer (2009). "Stalled Progress? Gender Segregation and Wage Inequality Among Managers, 1980-2000." Work & Occupations **36**(4): 318-342.

Coleman, J. S. (1958-1959). "Relational Analysis: The Study of Social Organisations with Survey Methods." Human Organisation **17**: 28-36.

Coltrane, S., E. C. Miller, T. DeHaan and L. Stewart (2013). "Fathers and the Flexibility Stigma." Journal of Social Issues **69**(2): 279-302.

Connell, R. (2008). "A Thousand Miles from Kind: Men, Masculinities and Modern Institutions." Journal of Men's Studies **16**(3): 237-252.

Connell, R. (2009). Gender: In world perspective. Cambridge, Polity.

Connell, R. W. and J. W. Messerschmidt (2005). "Hegemonic Masculinity: Rethinking the Concept." Gender & Society **19**(6): 829-859.

Conway, H. (2012). Gender in the Workplace - the Journey to Equality. Kingsley Laffer Memorial Lecture, University of Sydney.

Corbin, J. and A. L. Strauss (1990). "Grounded Theory Research: Procedures, Canons and Evaluative Criteria." Zeitschrift fur Soziologie **19**(6): 418-427.

Corwin, V., T. B. Lawrence and P. J. Frost (2001). "Five Strategies of Successful Part-Time Work." Harvard Business Review **79**(7): 121-127.

Coyle, A. (2005). Changing times: Flexibilization and the re-organization of work in feminized labour markets. A new sociology of work? L. Pettinger, J. Parry, R. Taylor and M. Glucksmann. Malden, Blackwell Publishing: 73-88.

Craig, L. (2006). "DOES FATHER CARE MEAN FATHERS SHARE? A Comparison of How Mothers and Fathers in Intact Families Spend Time with Children." Gender & Society **20**(2): 259-281.

Craig, L., M. Bittman, J. Brown and D. Thompson (2008). Managing Work and Family. SPRC Report Sydney, Social Policy Research Centre, University of NSW, Sydney.

Craig, L. and K. Mullan (2009). "“The policeman and the part-time sales assistant”: Household labour supply, family time and subjective time pressure in Australia 1997-2006." Journal of Comparative Family Studies **40**(4): 547-561.

Craig, L. and K. Mullan (2011). "How Mothers and Fathers Share Childcare: A Cross-National Time-Use Comparison." American Sociological Review **76**(6): 834-861.

Craig, L. and A. Powell (2012). "Dual-earner parents' work-family time: the effects of atypical work patterns and non-parental childcare." Journal of Population Research **29**(3): 229-247.

Craig, L. Y. N. and K. Mullan (2012). "Australian fathers' work and family time in comparative and temporal perspective." Journal of Family Studies **18**(2/3): 165-174.

Crang, M. (2007). "Flexible and Fixed Times Working in the Academy: Commentary." Environment and Planning A **39**(3): 509-514.

Crompton, R. and C. Lyonette (2011). "Women's career success and work–life adaptations in the accountancy and medical professions in Britain." Gender, Work and Organization **18**(2): 231-254.

Cunningham, J., P. O'Reilly, C. O'Kane and V. Mangematin (2014). "The Inhibiting Factors That Principal Investigators Experience in Leading Publicly Funded Research." Journal of Technology Transfer **39**(1): 93-110.

Cunningham, M. (2008). "Changing Attitudes toward the Male Breadwinner, Female Homemaker Family Model: Influences of Women's Employment and Education over the Lifecourse." Social Forces (University of North Carolina Press) **87**(1): 299-323.

Dasgupta, P. and P. A. David (2008). Toward a New Economics of Science. The Economics of Innovation Policy. Volume 1. A. N. Link, Elgar Reference Collection. International Library of Critical Writings in Economics, vol. 222. Cheltenham, U.K. and Northampton, Mass.: Elgar**:** 58-92.

Davidoff, L. (2003). "Gender and the 'Great Divide'." Journal of Women's History **15**(1): 11.

Debacker, M. (2008). "Care strategies among high- and low-skilled mothers: a world of difference?" Work, Employment & Society **22**(3): 527-545.

Denzin, N. K. and Y. S. Lincoln (2003). The Landscape of Qualitative Research: Theories and Issues. Thousand Oaks California, Sage.

Diamond, C. and G. Whitehouse (2007). "Gender, Computing and the Organization of Working Time: Public/private comparisons in the Australian context." Information, Communication & Society **10**(3): 320-337.

DiMasi, J. A. and H. G. Grabowski (2007). "The cost of biopharmaceutical R&D: is biotech different?" Managerial and Decision Economics **28**(4-5): 469-479.

Ding, W. W., F. Murray and T. E. Stuart (2010). "From Bench to Board: Gender Differences in University Scientists' Participation in Commercial Science." Working Papers -- Harvard Business School Division of Research: 1-45.

Doherty, L. and S. Manfredi (2006). "Women's progression to senior positions in English universities." Employee Relations **28**(6): 553-572.

Drago, R., M. Wooden and D. Black (2009). "Long Work Hours: Volunteers and Conscripts." British Journal of Industrial Relations **47**(3): 571-600.

Duncan, S., R. Edwards, T. Reynolds and P. Alldred (2003). "Motherhood, paid work and partnering: Values and theories." Work, Employment and Society **17**(2): 309-330.

Dunstone, M. and B. Williamson. (2013). "Gender Equity: Current Issues, Best Practice and New Ideas." Retrieved 16/10/2014 from https://www.science.org.au/sites/default/files/user-content/genderequityemcrforum.pdf.

Eagly, A. H. and L. L. Carli (2003). "The female leadership advantage: An evaluation of the evidence." The Leadership Quarterly **14**(6): 807-834.

Eagly, A. H. and L. L. Carli (2007). "Women and the Labyrinth of Leadership." Harvard Business Review **85**: 63-71.

Eagly, A. H. and L. L. Carli (2009). "Navigating the Labyrinth. (cover story)." School Administrator **66**(8): 10-16.

Eagly, A. H. and S. J. Karau (2002). Role congruity theory of prejudice toward female leaders. Psychological Review, American Psychological Association. **109:** 573-598.

Eaton, S. and L. Bailyn (1999). "Work and Life Strategies of Professionals in Biotechnology Firms." The Annals of the American Academy of Political and Social Science **562**(1): 159-173.

Ellis, P. (2003). "Women in Science-Based Employment: What Makes the Difference?" Bulletin of Science, Technology & Society **23**(1): 10.

Ely, R. J. and D. E. Meyerson (2000a). "Advancing Gender Equity in Organizations: The Challenge and Importance of Maintaining a Gender Narrative." Organization **7**(4): 589.

Ely, R. J. and D. E. Meyerson (2000b). "Theories of Gender in Organizations: A New Approach to Organizational Analysis and Change." Research in Organizational Behavior **22**: 103.

England, P. and A. Srivastava (2013). "Educational differences in US parents' time spent in child care: The role of culture and cross-spouse influence." Social Science Research **42**(4): 971-988.

Equal Opportunity for Women in the Workplace Agency (EOWA). (2010). "Australian Census of Women in Leadership." from https://www.wgea.gov.au/sites/default/files/2010_census_tag.pdf.

Equal Opportunity for Women in the Workplace Agency (EOWA). (2012). "Australian Census of Women in Leadership." from https://www.wgea.gov.au/sites/default/files/2012_CENSUS%20REPORT.pdf.

Ernst and Young (2011). Beyond Borders Global Biotechnology Report 2011, EYGM Limited.

Ernst and Young. (2013). "Untapped Opportunity: The Role of Women in Unlocking Australia's Productivity Potential." from www.ey.com.

Etzkowitz, H., N. Gupta and C. Kemelgor (2010). "The Gender Revolution in Science and Technology." Journal of International Affairs **64**(1): 83.

Etzkowitz, H. and M. Ranga (2011). "Gender Dynamics in Science and Technology: From the 'Leaky Pipeline' to the 'Vanish Box'." Brussels Economic Review/Cahiers Economiques de Bruxelles **54**(2-3): 131-147.

Eveline, J. and C. Bacchi (2009). "Obeying organizational 'rules of relevance': Gender analysis of policy." Journal of Management & Organization **15**(5): 566-581.

Evetts, J. (2000) "Analysing Change in Women's Careers: Culture, Structure and Action Dimensions." Gender, Work and Organization **7**(1): 57-67

Federation of Australian Scientific and Technological Societies (FASTS) (2011). Women in Science and Engineering (WISE) Summit, Canberra.

Ferguson, K. E. (1984). The Feminist Case Against Bureaucracy. Philadelphia, Temple Univ Press.

Fielding, N. G. (2012). "Triangulation and Mixed Methods Designs: Data Integration with New Research Technologies." Journal of Mixed Methods Research **6**(2): 124-136.

Figart, D. M. (2000). "Equal Pay for Equal Work: The Role of Job Evaluation in an Evolving Social Norm." Journal of Economic Issues (Association for Evolutionary Economics) **34**(1): 1.

Fine, M., L. Weis, S. Weseen and L. Wong (2003). For Whom? Qualitative Research, Representations, and Social Responsibilities. The Landscape of Qualitative Research Theories and Issues. N. K. Denzin and Y. S. Lincoln. Thousand Oaks California, Sage.

Finegold, D. and S. Frenkel (2006). "Managing people where people really matter: The management of human resources in biotech companies." The International Journal of Human Resource Management **17**(1): 1-24.

Fletcher, J. K. (1999). Disappearing Acts : Gender, Power and Relational Practice at Work. Cambridge, Mass, MIT Press.

Flick, U. (1992). "Triangulation revisited: Strategy of validation or alternative?" Journal for the Theory of Social Behaviour **22**(2): 175-197.

Fox, M. F. (2000). "Organizational Environments and Doctoral Degrees Awarded to Women in Science and Engineering." Women's Studies Quarterly **28**(1/2): 46.

Fox, M. F. and C. Colatrella (2006). "Participation, Performance, and Advancement of Women in Academic Science and Engineering: What Is at Issue and Why." Journal of Technology Transfer **31**(3): 377-386.

Fujimoto, Y., F. Azmat and C. E. J. Härtel (2013). "Gender perceptions of work-life balance: management implications for full-time employees in Australia." Australian Journal of Management (Sage Publications Ltd.) **38**(1): 147-170.

Gambles, R., S. Lewis and R. Rapoport (2006). The Myth of Work-Life Balance : The Challenge of Our Time for Men, Women and Societies. Hoboken, Wiley.

Garforth, L. and A. Kerr (2010). "Let's Get Organised: Practicing and Valuing Scientific Work Inside and Outside the Laboratory." Sociological Research Online **15**(2): 3-3.

Gidlof Regnier, C. (2006). Chapter 2. Barriers Faced by Women Researchers: Segregation by Field of Work. OECD, Women in Scientific Careers: Unleashing the Potential, OECD.

Gilding, M. (1991). The Making and Breaking of the Australian Family. Sydney, Allen and Unwin.

Gilding, M. (2008). The tyranny of distance: Biotechnology networks and clusters in the antipodes. Research Policy. **37:** 1132-1144.

Gilding, M. and J. Pickering (2011). May contain traces of biotech: (Re)-defining the biotechnology field in Australia. The Australian Sociological Association Conference (TASA 2011). Newcastle, New South Wales, Australia, The Australian Sociological Association.

Glaser, B. G. and A. L. Strauss (1967). The Discovery of Grounded Theory: Strategies for Qualitative Research. New York, Aldine Publishing Company.

Goldin, C. and L. F. Katz (2011). "The Cost of Workplace Flexibility for High-Powered Professionals." Annals of the American Academy of Political and Social Science **638**: 45-67.

Goldin, C. and L. F. Katz (2012). The Most Egalitarian of All Professions: Pharmacy and the Evolution of a Family-Friendly Occupation, National Bureau of Economic Research, Inc, NBER Working Papers: 18410.

Goldman Sachs and JBWere (2009). Australia's Hidden Resource: The Economic Case for Increasing Female Participation, Goldman Sachs JBWere Investment Research.

Gottinger, H.-W. and C. L. Umali (2008). The evolution of the pharmaceutical-biotechnology industry. Business History, Routledge. **50:** 583-601.

Goulden, M., M. A. Mason and K. Frasch (2011). "Keeping women in the science pipeline." Annals of the American Academy of Political and Social Science **638**(1): 141-162.

Granovetter, M. (1983). "The Strength of Weak Ties: A Network Theory Revisited." Sociological Theory: 201.

Hakim, C. (2000). Work-Lifestyle Choices in the 21st Century: Preference Theory. New York, Oxford University Press.

Harding, S. G. (1987). Feminism and methodology social science issues. Milton Keynes, Open University Press.

Hargis, M. B. and D. B. Bradley Iii (2011). "Strategic human resource management in small and growing firms: Aligning valuable resources." Academy of Strategic Management Journal **10**(2): 105-125.

Hart, R. and J. E. Roberts. (2011). "British Women in Science and Engineering: The Problem of Employment Loss Rates."   Retrieved 16/10/2014, 2014, from http://www.royalsoced.org.uk/1013_Data.html.

Healy, J. and M. P. Kidd (2013). "Gender-based undervaluation and the equal remuneration powers of Fair Work Australia." Journal of Industrial Relations **55**(5): 760-782.

Hearn, J. (2003). "Organization violations in practice: a case study in a university setting." Culture & Organization **9**(4): 253-273.

Heilbronner, N. N. (2013). "The STEM Pathway for Women: What Has Changed?" Gifted Child Quarterly **57**(1): 39-55.

Heneman, R. L. (2003). Job and Work Evaluation: A Literature Review. Public Personnel Management, International Public Management Association for Human Resources. **32:** 47.

Herman, C. and S. Lewis (2012). "Entitled to a sustainable career? Motherhood in science, engineering, and technology." Journal of Social Issues **68**(4): 767-789.

Heron, A. and S. Charlesworth (2012). "Working Time and Managing Care under Labor: Whose Flexibility?" Australian Bulletin of Labour **38**(3): 214-233.

Herpin, T. F., H. Karuso and J. E. Foley (2005). Australian biotech companies: Navigating the maze. Journal of Commercial Biotechnology, ThinkBiotech, LLC. **11:** 111-120.

Hesse-Biber, S. (2012). "Feminist Approaches to Triangulation: Uncovering Subjugated Knowledge and Fostering Social Change in Mixed Methods Research." Journal of Mixed Methods Research **6**(2): 137-146.

Hesse-Biber, S. and P. Leavy (2011). The Practice of Qualitative Research. Thousand Oaks California, Sage.

Hewlett, S. A. (2002). "Executive Women and the Myth of Having It All." Harvard Business Review **80**(4): 66-73.

Higgins, M. C. and R. Gulati (2003). "Getting off to a good start: The effects of upper echelon affiliations on underwriter prestige." Organization Science **14**(3): 244-263.

Hill, E. (2007). "Budgeting for Work--Life Balance The Ideology and Politics of Work and Family Policy in Australia." Australian Bulletin of Labour **33**(2): 226-245.

Hipp, L. and S. Stuth (2013). "Management und Teilzeit? - Eine empirische Analyse zur Verbreitung von Teilzeitarbeit unter Managerinnen und Managern in Europa. (German)." Being a part-time manager?: An empirical analysis of the use of part-time work among managers in Europe. (English) **65**(1): 101-128.

Holland, J. L. (1996). "Exploring careers with a typology: What we have learned and some new directions." American Psychologist **51**(4): 397-406.

Holt, H. and S. Lewis (2011). "'You Can Stand on Your Head and Still End Up with Lower Pay': Gliding Segregation and Gendered Work Practices in Danish 'Family-friendly' Workplaces." Gender, Work & Organization **18**: e202-e221.

Holter, O. G. (2005). Social Theories for Researching Men and Masculinities, Direct Gender Hierarchy and Structural Inequality. Handbook of Studies on Men & Masculinities. H. J. Connell R W, Kimmel M S. Thousand Oaks, Sage Publications.

Hook, J. L. (2006). "Care in Context: Men's Unpaid Work in 20 Countries, 1965–2003." American Sociological Review **71**(4): 639-660.

Huault, I., V. Perret and A. Spicer (2014). "Beyond macro- and micro- emancipation: Rethinking emancipation in organization studies." Organization **21**(1): 22-49.

Hyde, J. S. (2005). "The Gender Similarities Hypothesis." American Psychologist **60**(6): 581-592.

Ingster, B. (2008). Job Analysis, Documentation, and Job Evaluation. The Compensation Handbook: A State-of-the-Art Guide to Compensation Strategy and Design. L. A. Berger and D. R. Berger. New York, McGraw Hill.

Irvine, L. and J. R. Vermilya (2010). "Gender Work in a Feminized Profession: The Case of Veterinary Medicine." Gender & Society **24**(1): 56-82.

Jacobs, J. A. (1999). The sex segregation of occupations: Prospects for the 21st century. Handbook of Gender and Work. G. N. Powell. Thousand Oaks CA, Sage.

Jacobs, J. A. and K. Gerson (2006). Chapter 35: The Time Divide, Perseus Books Group**:** 295-300.

Jacobsen, J. P. (2007). "Occupational Segregation and the Tipping Phenomenon: The Contrary Case of Court Reporting in the USA." Gender, Work & Organization **14**(2): 130-161.

Jarman, J., R. M. Blackburn and G. Racko (2012). "The dimensions of occupational gender segregation in industrial countries." Sociology **46**(6): 1003-1019.

Johnson, R. B. and A. J. Onwuegbuzie (2004). "Mixed Methods Research: A Research Paradigm Whose Time Has Come." Educational Researcher **33**(7): 14-26.

Johnston, S. and J. Teicher (2010). "Is Diversity Management Past its 'use-by Date' for Professional and Managerial Women?" International Journal of Employment Studies **18**(1): 34-62.

Johnstone, M. and C. Lee (2009). "Young Australian women's aspirations for work and family: individual and sociocultural differences." Sex Roles **61**(3/4): 204-220.

Jong, S. (2008). "Academic organizations and new industrial fields: Berkeley and Stanford after the rise of biotechnology." Research Policy **37**(8): 1267-1282.

Kan, M. Y., O. Sullivan and J. Gershuny (2011). "Gender convergence in domestic work: Discerning the effects of interactional and institutional barriers from large-scale data." Sociology **45**(2): 234-251.

Kang, S. C. and S. A. Snell (2009). "Intellectual Capital Architectures and Ambidextrous Learning: A Framework for Human Resource Management." Journal of Management Studies **46**(1): 65-92.

Kangas, O. and T. Rostgaard (2007). "Preferences or institutions? Work-family life opportunities in seven European countries." Journal of European Social Policy **17**(3): 240-256.

Kelly, G., M. Mastroeni, E. Conway, K. Monks, K. Truss, P. Flood and E. Hannon (2011). "Combining diverse knowledge: Knowledge workers' experience of specialist and generalist roles." Personnel Review **40**(5): 607-624.

Klocker, N. and D. Drozdzewski (2012). "Career Progress Relative to Opportunity: How Many Papers Is a Baby 'Worth'? Commentary." Environment and Planning A **44**(6): 1271-1277.

Kossek, E. E., B. A. Lautsch and S. C. Eaton (2005). Flexibility Enactment Theory: Implications of Flexibility Type, Control, and Boundary Management for Work-Family Effectiveness. Work and life integration: Organizational, cultural, and individual perspectives. E. E. Kossek and S. J. Lambert. Mahwah, NJ US, Lawrence Erlbaum Associates Publishers: 243-261.

Kotter, J. P. (1990). A force for change: how leadership differs from management. New York, The Free Press.

Kotterman, J. (2006). "Leadership Versus Management: What's the Difference?" Journal for Quality & Participation **29**(2): 13-17.

Krenn, M. (2013). "Strategic Human Resource Management in Emergent and Developing Small Entrepreneurial Firms." Franklin Business & Law Journal **2013**(4).

Lam, A. (2005). "Work Roles and Careers of R&D Scientists in Network Organizations." Industrial Relations **44**(2): 242-275.

Lam, A. (2010). "From 'Ivory Tower Traditionalists' to 'Entrepreneurial Scientists'? Academic Scientists in Fuzzy University--Industry Boundaries." Social Studies of Science (Sage Publications, Ltd.) **40**: 307-340.

Lawler III, E. E. (1986). "What's Wrong with Point-Factor Job Evaluation?" Management Review **75**(11): 44.

Leadbeater, C. (1999). Towards the Knowledge Society. New Statesman, New Statesman Ltd.

Leung, A. (2003). "Different Ties for Different Needs: Recruitment Practices of Entrepreneurial Firms at Different Developmental Phases." Human Resource Management **42**(4): 303-320.

Lewis, J. and S. Giullari (2005). "The Adult Worker Model Family, Gender Equality and Care: The Search for New Policy Principles and the Possibilities and Problems of a Capabilities Approach." Economy and Society **34**(1): 76-104.

Lewis, P. (2006). "The Quest for Invisibility: Female Entrepreneurs and the Masculine Norm of Entrepreneurship." Gender, Work & Organization **13**(5): 453-469.

Lewis, S. and L. Humbert (2010). "Discourse or reality?"Work-life balance", flexible working policies and the gendered organization." Equality, Diversity & Inclusion **29**(3): 239-254.

Liff, S. and J. Wajcman (1996). "'Sameness' and 'Difference' Revisited: Which Way Forward for Equal Opportunity Initiatives?" Journal of Management Studies **33**(1): 79-94.

Liff, S. and K. Ward (2001). "Distorted Views Through the Glass Ceiling: The Construction of Women's Understandings of Promotion and Senior Management Positions." Gender, Work & Organization **8**(1): 19.

Lindsay, J. and D. Dempsey (2009). Families, Relationships and Intimate Life. Melbourne, Oxford University Press.

Lovejoy, M. and P. Stone (2012). "Opting Back In: The Influence of Time at Home on Professional Women's Career Redirection after Opting Out." Gender, Work & Organization **19**(6): 631-653.

Magretta, J. (2002). Why Business Models Matter. Harvard Business Review, Harvard Business School Publication Corp. **80:** 86-92.

Marginson, S., R. Tytler, B. Freeman and K. Roberts. (2013). "STEM: Country Comparisons. Report for the Australian Council of Learned Academies (ACOLA)." Retrieved 17/10/2014 from www.acola.org.

Martin, J. (2012). Does gender inequality ever disappear? Handbook of Gender, Work and Organisation. E. L. Jeanes, D. Knights and P. Y. Martin. Chichester, Wiley-Blackwell.

Martin, P. Y. (2006). "Practising Gender at Work: Further Thoughts on Reflexivity." Gender, Work & Organization **13**(3): 254-276.

Mason, M. A. and M. Goulden (2002). "Do Babies Matter?" Academe **88**(6): 21.

Mason, M. A. and M. Goulden (2004). "Do Babies Matter (Part II)?" Academe **90**(6): 10-15.

Mauthner, N. S. and A. Doucet (2003). "Reflexive Accounts and Accounts of Reflexivity in Qualitative Data Analysis." Sociology **37**(3): 413-431.

Mavriplis, C., R. Heller, C. Beil, K. Dam, N. Yassinskaya, M. Shaw and C. Sorensen (2010). "Mind the Gap: Women in STEM Career Breaks." Journal of Technology Management & Innovation **5**(1): 140-151.

McCauley, C. M. (2006). "Talent Management in the 21st Century: Help Your Company Find, Develop, and Keep its Strongest Workers." Journal for Quality & Participation **29**(4): 4.

McCook, A. (2013). "Women in biotechnology: Barred from the boardroom." Nature **495**(7439): 25-27.

McDonald, P., L. Bradley and K. Brown (2009). "'Full-time is a given here': Part-time versus full-time job quality." British Journal of Management **20**(2): 143-157.

McDonald, P. K., L. M. Bradley and D. Guthrie (2006). "Challenging the Rhetoric of Choice in Maternal Labour-Force Participation: Preferred Versus Contracted Work Hours." Gender, Work and Organization **13**(5): 470-491.

McEvoy, P. and D. Richards (2006). A critical realist rationale for using a combination of quantitative and qualitative methods. Journal of Research in Nursing. US, Sage Publications. **11:** 66-78.

McRae, S. (2003). "Constraints and choices in mothers' employment careers: a consideration of Hakim's Preference Theory." British Journal of Sociology **54**(3): 317.

Merton, R. K. (1957). "Priorities in Scientific Discovery: A Chapter in the Sociology of Science." American Sociological Review **22**(6): 635-659.

Merton, R. K. (1968). "The Matthew Effect in Science." Science **159**(3810): 56-63.

Merton, R. K. (1973[1942]). The Normative Structure of Science. The Sociology of Science. R. K. Merton. Chicago, University of Chicago Press: 267-278.

Merton, R. K. (1995). "The Thomas Theorem and The Matthew Effect." Social Forces **74**(2): 379-422.

Meyerson, D. E. and D. M. Kolb (2000). "Moving out of the 'Armchair': Developing a Framework to Bridge the Gap between Feminist Theory and Practice." Organization **7**(4): 553.

Meyerson, D. E. and M. A. Scully (1995). "Tempered radicalism and the politics of ambivalence and change." Organization Science **6**(5): 585-600.

Mintzberg, H. (1980). "Structure in 5's: A Synthesis of the Research On Organisation Design." Management Science **26**(3): 322-341.

Misra, J., J. H. Lundquist, E. Holmes and S. Agiomavritis (2011). "The Ivory Ceiling of Service Work." Academe **97**(1): 22-26.

Moen, P. (2011). "From 'work-family' to the 'gendered life course' and 'fit': Five challenges to the field." Community, Work & Family **14**(1): 81-96.

Moen, P., J. Lam, S. Ammons and E. L. Kelly (2013). "Time Work by Overworked Professionals: Strategies in Response to the Stress of Higher Status." Work & Occupations **40**(2): 79-114.

Moen, P. and P. Roehling (2005). The career mystique: Cracks in the American dream. Lanham, MD, US, Rowman & Littlefield.

Morgan, G. A., N. L. Leech, G. W. Gloeckner and K. C. Barrett (2011). IBM SPSS for Introductory Statistics. New York, Routledge.

National Health and Medical Research Council (NHMRC). (2010). "NHMRC CEO Newsletter 10th December 2010." Retrieved 22/9/2012 from http://www.nhmrc.gov.au/media/newsletters/rgms-updates/2010/rgms-update-10-december-2010.

National Health and Medical Research Council (NHMRC) (2013a). NHMRC Research Funding Facts Book 2012, Australian Government.

National Health and Medical Research Council (NHMRC). (2013b). "2013 Funding Outcomes by Gender." Retrieved 5/10/2014 from https://www.nhmrc.gov.au/research/women-health-science/2013-funding-outcomes-gender-summary-findings.

National Health and Medical Research Council (NHMRC). (2014). "Institutional Gender Equity Policies." Retrieved 5/10/2014 from https://www.nhmrc.gov.au/research/women-health-science/institutional-gender-equity-policies.

Nicol, D., J. Liddicoat and C. Critchley (2013). "A role for virtual biotechnology companies in drug discovery and development?" Journal of Commercial Biotechnology **19**(3): 10-19.

North-Samardzic, A. and S. Gregson (2011). "Commitment or Even Compliance? An Australian University's Approach to Equal Employment Opportunity." **66**: 279-301.

O'Brien, K. R. and K. P. Hapgood (2012). "The academic jungle: ecosystem modelling reveals why women are driven out of research." Oikos **121**(7): 999-1004.

Office of the Chief Scientist (OCS) (2014). Science, Technology, Engineering and Mathmatics: Australia's Future. Canberra.

Owen-Smith, J. and W. W. Powell (2004). "Knowledge Networks as Channels and Conduits: The Effects of Spillovers in the Boston Biotechnology Community." Organization Science **15**(1): 5-21.

Parsons, E. and V. Priola (2013). "Agents for change and changed agents: The micro-politics of change and feminism in the academy." Gender, Work and Organization **20**(5): 580-598.

Peetz, D., G. Strachan and C. Troup (2014). Discipline, Change and Gender in the Academic Workforce: A report from the Work and Careers in Australian

Universities Project. 28th AIRAANZ conference, Association of Industrial Relations Academics of Australia and New Zealand. Melbourne, Griffith University.

Pierson, D., K. Koziara and R. Johannesson (1984). A Policy-Capturing Application in a Union Setting. Comparable Worth and Wage Discrimination: Technical Possibilities and Political Realities. H. Remick. Philadelphia, Temple University Press.

Pocock, B. (2005). "Work/Care Regimes: Institutions, Culture and Behaviour and the Australian Case." Gender, Work and Organization **12**(1): 32-49.

Pocock, B. (2012). Managing the managers. The Saturday Age 22/9/2012 Melbourne, John Fairfax Publications**:** 23.

Pocock, B., S. Charlesworth and J. Chapman (2013). "Work-family and work-life pressures in Australia: advancing gender equality in "good times"?" International Journal of Sociology & Social Policy **33**(9/10): 594-612.

Pocock, B., N. Skinner and P. Williams (2012). Time Bomb: Work, Rest and Play in Australia Today. Sydney, NewSouth Books.

Powell, W. W. (1990). Neither Market Nor Hierarchy: Network Forms of Organization. Research in Organizational Behaviour. L. L. Cummings and B. Shaw. Greenwich, Conn, JAI Press. **12:** 295-336.

Powell, W. W. (2001). The capitalist firm in the twenty-first century: emerging patterns in western enterprise. The Twenty-First Century Firm: Changing Economic Organisation in International Perspective. P. J. DiMaggio. Princeton, N. J., Princeton University Press.

Powell, W. W., K. W. Koput and L. Smith-Doerr (1996). "Interorganizational collaboration and the locus of innovation: networks of learning in biotechnology." Administrative Science Quarterly **v41**(n1): p116(130).

Powell, W. W., J. Owen-Smith and L. Smith-Doerr (2011). Sociology and the Science of Science Policy. The Science of Science Policy: A Handbook. K. Husbands Fealing, J. I. Lane, J. H. Marburger, III and S. S. Shipp, Innovation and Technology in the World

Economy series. Stanford: Stanford University Press, Stanford Business Books: 56-84.

Powell, W. W., K. Packalen and K. Whittington (2012). Organizational and Institutional Genesis. The Emergence of Organizations and Markets. J. F. Padgett and W. W. Powell. New Jersey, Princeton University Press: 434-465.

Powell, W. W. and K. Sandholtz (2012). Chance, Necessite, et Naivete. The Emergence of Organizations and Markets. J. F. Padgett and P. W. New Jersey, Princeton University Press: 379-433.

Powell, W. W., D. R. White, K. W. Koput and J. Owen-Smith (2005). Network Dynamics and Field Evolution: The Growth of Interorganizational Collaboration in the Life Sciences. American Journal of Sociology, University of Chicago Press. **110:** 1132-1205.

Poynton, A. and L. Rolland (2013). Untapped opportunity :The role of women in unlocking Australia's productivity potential, Ernst & Young, Australia.

Preston, A. E. (2004). "Plugging the Leaks in the Scientific Workforce." Issues in Science & Technology **20**(4): 69-74.

Probert, B. (2005). "'I Just Couldn't Fit It In': Gender and Unequal Outcomes in Academic Careers." Gender, Work and Organization **12**(1): 50-72.

Raley, S., S. M. Bianchi and W. Wang (2012). "When Do Fathers Care? Mothers' Economic Contribution and Fathers' Involvement in Child Care." American Journal of Sociology **117**(5): 1422-1459.

Ram, M. (2000). "Investors in People in small firms." Personnel Review **29**(1/2): 69-87.

Rapoport, R., Bailyn, Lotte, Fletcher, Joyce K, Pruitt, Bettye H (2002). Beyond Work-Family Balance: Advancing Gender Equity and Workplace Performance. Books 24x7, Jossey-Bass.

Rees, T. (2001). "Mainstreaming Gender Equality in Science in the European Union: the 'ETAN Report'." Gender & Education **13**(3): 243-260.

Rees, T. (2011). "The Gendered Construction of Scientific Excellence." Interdisciplinary Science Reviews **36**(2): 133-145.

Reid, E. M. (2011). "Passing as Superman: The Ideal Worker and Men's Professional Identities." Academy of Management Annual Meeting Proceedings **2011**(1): 1-6.

Remick, H. (1981). "The Comparable Worth Controversy." Public Personnel Management Journal **10**: 371-383.

Remick, H. (1984). Major Issues in *a priori* Applications. Comparable Worth and Wage Discrimination: Technical Possibilities and Political Realities. H. Remick. Philadelphia, Temple University Press**:** 99-117.

Reskin, B. (2005). "unconsciousness raising." Regional Review **14**(3): 32-37.

Reskin, B. F. and D. D. Bielby (2005). "A Sociological Perspective on Gender and Career Outcomes." Journal of Economic Perspectives **19**(1): 71-86.

Reskin, B. F. and M. L. Maroto (2011). "What trends? Whose choices?: Comment on England." Gender & Society **25**(1): 81-87.

Reskin, B. F. and D. B. McBrier (2000). "Why not ascription? Organizations' employment of male and female managers." American Sociological Review **65**(2): 210-233.

Reskin, B. F. and P. A. Roos (1990). Job Queues, Gender Queues: Explaining Women's Inroads into Male Occupations. Philadelphia, PA, Temple University Press.

Ridgeway, C. (2011). Framed by Gender : How Gender Inequality Persists in the Modern World. New York, Oxford University Press.

Ross, C. (2006). "Separate Spheres or Shared Dominions?" Transformation (02653788) **23**(4): 228-235.

Rosser, S. V. (2004). The Science Glass Ceiling : Academic Women Scientist and the Struggle to Succeed. Hoboken, Taylor and Francis.

Roth, W. D. and G. Sonnert (2011). "The costs and benefits of ‘red tape’: Anti-bureaucratic structure and gender inequity in a science research organization." **41**: 385-409.

Rubin, H. J. and I. S. Rubin (2012). Qualitative Interviewing: The Art of Hearing Data. Thousand Oaks California, Sage.

Rudman, L. A. and K. Mescher (2013). "Penalizing men who request a family leave: Is flexibility stigma a femininity stigma?" Journal of Social Issues **69**(2): 322-340.

Ryan, M. K. and S. A. Haslam (2005). "The Glass Cliff: Evidence that Women are Over-Represented in Precarious Leadership Positions." British Journal of Management **16**(2): 81-90.

Ryan, M. K., S. A. Haslam, M. D. Hersby and R. Bongiomo (2011). "Think Crisis-Think Female: The Glass Cliff and Contextual Variation in the Think Manager-Think Male Stereotype." Journal of Applied Psychology **96**(3): 470-484.

Sabatier, V., V. Mangematin and T. Rousselle (2010). "From Recipe to Dinner: Business Model Portfolios in the European Biopharmaceutical Industry." Long Range Planning **43**(2-3): 431-447.

Sayer, A. (1999). Realism and Social Science. London, SAGE Publications.

Schacherl, I. (2006). Chapter 8. Disparities between Men's and Women's Careers in Scientific Research: The Case of Austria. OECD, Women in Scientific Careers: Unleashing the Potential

Schwartz, F. N. (1989). Management Women and the New Facts of Life. Harvard Business Journal. **Jan-Feb 1989**.

Sennett, R. (2006). The Culture of the New Capitalism. Yale University Press, New Haven.

Simonet, D. V. and R. P. Tett (2013). "Five perspectives on the leadership-management relationship: A competency-based evaluation and integration." Journal of Leadership and Organizational Studies **20**(2): 199-213.

Skinner, D. (1999). "The reality of equal opportunities: The expectations and experiences of part-time staff and their managers." Personnel Review **28**(5-6): 425-438.

Skinner, N., J. Elton, J. Auer and B. Pocock (2014). "Understanding and managing work–life interaction across the life course: A qualitative study." Asia Pacific Journal of Human Resources **52**(1): 93-109.

Skinner, N., C. Hutchinson and B. Pocock (2012). The Big Squeeze: Work, Life and Care in 2012 - The Australian Work and Life Index, University of South Australia.

Skinner, N. and B. Pocock (2008). "Work-life conflict: Is work time or work overload more important?" Asia Pacific Journal of Human Resources **46**(3): 303-315.

Skinner, N. and B. Pocock (2010). "Work, Life, Flexibility And Workplace Culture in Australia: Results of the 2008 Australian Work And Life Index (AWALI) Survey." Australian Bulletin of Labour **36**(2): 133-153.

Skinner, N. and B. Pocock (2011). "Flexibility and Work-Life Interference in Australia." Journal of Industrial Relations **53**(1): 65-82.

Smith-Doerr, L. (2004). Women's Work Gender Equality vs. Hierarchy in the Life Sciences. Boulder, Colorado, Lynne Rienner Publishers.

Smith-Doerr, L. (2005). "Institutionalizing the network form: How life scientists legitimate work in the biotechnology industry." Sociological Forum **20**(2): 271-299.

Smith-Doerr, L., G. Kemekliene, R. Teutonico, L. Lange, L. Villa-Komaroff, L. Matthiessen-Guyader and F. Murray (2011). "A global need for women's biotech leadership." Nature Biotechnology **29**(10): 948-949.

Smith-Doerr, L. and W. W. Powell (2005). Chapter 17: Networks and Economic Life. Handbook of Economic Sociology. N. J. Smelser and R. Swedberg, Princeton University Press: 379-402.

Steiber, N. and B. Haas (2012). "Advances in explaining women's employment patterns." Socio-Economic Review **10**(2): 343-367.

Steinmetz, K. and E. Spack (2009). "The basics of preclinical drug development for neurodegenerative disease indications." BMC Neurology **9**(1): S1-S2.

Stone, P. and L. A. Hernandez (2013). "The all-or-nothing workplace: Flexibility stigma and 'opting out' among professional-managerial women." Journal of Social Issues **69**(2): 235-256.

Stone, P. and M. Lovejoy (2004). "Fast-Track Women and the 'Choice' to Stay Home." Annals of the American Academy of Political and Social Science **596**: 62-83.

Strachan, G., C. Troup, D. Peetz, G. Whitehouse, K. Broadbent and J. Bailey (2012). Work and Careers in Australian Universities: Report on Australian Survey. Australia, Centre for Work, Organisation and Wellbeing, Griffith University Australia.

Sullivan, O. (2010). "Changing differences by educational attainment in fathers' domestic labour and child care." Sociology **44**(4): 716-733.

Symonds, M. R. E., N. J. Gemmell, T. L. Braisher, K. L. Gorringe and M. A. Elgar (2006). "Gender Differences in Publication Output: Towards an Unbiased Metric of Research Performance." PLoS ONE **1**: p. e127.

Teddlie, C. and A. Tashakkori (2009). Foundations of Mixed Methods Research: Integrating Quantitative and Qualitative Approaches in the Social and Behavioural Sciences. Thousand Oaks California, Sage.

Thoms, P. and J. K. Pinto (1999). "Project Leadership: A Question of Timing." Project Management Journal **30**(1): 19.

Tomlinson, J. and S. Durbin (2010). "Female part-time managersWork-life balance, aspirations and career mobility." Equality, Diversity & Inclusion **29**(3): 255-270.

Toor, S. U. R. (2011). "Differentiating leadership from management: An empirical investigation of leaders and managers." Leadership and Management in Engineering **11**(4): 310-320.

Treiman, D. J. and H. I. Hartmann (1981). Women, Work and Wages: Equal Pay for Jobs of Equal Value. Washington DC, National Academy Press.

Valian, V. (2005). "Beyond Gender Schemas: Improving the Advancement of Women in Academia." Hypatia: A Journal of Feminist Philosophy **20**(3): 198-213.

Van den Brink, M., Y. Benschop and W. Jansen (2010). "Transparency in Academic Recruitment: A Problematic Tool for Gender Equality?" Organization Studies (01708406) **31**(11): 1459-1483.

Van Egmond, M., J. Baxter, S. Buchler and M. Western (2010). "A stalled revolution? Gender role attitudes in Australia, 1986-2005." Journal of Population Research **27**(3): 147-168.

van Wanrooy, B. (2009). "Women at Work in Australia: Bargaining a Better Position?" Australian Bulletin of Labour **35**(4): 611-628.

van Wanrooy, B. and S. Wilson (2006). "Convincing the toilers? Dilemmas of long working hours in Australia." Work, Employment and Society **20**(2): 349-368.

Vickery, A. (1993). "Golden age to separate spheres? A review of the categories and chronology of English women's." Historical Journal **36**(2): 383.

Victorian Department of Innovation Industry and Regional Development (VDoIIRD) (2011). Victorian Biotechnology Action Plan 2011, Victorian Department of Innovation, Industry and Regional Development.

Wajcman, J. (1999). Managing like a man: Women and men in corporate management. St Leonards NSW, Allen and Unwin.

Wajcman, J. (2008). "Life in the fast lane? Towards a sociology of technology and time." British Journal of Sociology **59**(1): 59-77.

Walby, S. (2011). "Is the Knowledge Society Gendered?" Gender, Work & Organization **18**(1): 1-29.

Waters, M. A. and E. A. Bardoel (2006). "Work-family policies in the context of higher education: Useful or symbolic?" Asia Pacific Journal of Human Resources **44**(1): 67-82.

Watson, I. (2010). "Decomposing the Gender Pay Gap in the Australian Managerial Labour Market." Australian Journal of Labour Economics **13**(1): 49-79.

Webber, G. and C. Williams (2008). "Mothers in 'good' and 'bad' part-time jobs: Different problems, same results." Gender & Society **22**(6): 752-777.

Wellington, S., M. B. Kropf and P. R. Gerkovich (2003). "What's Holding Women Back?" Harvard Business Review **81**(6): 18-19.

West, C. and D. H. Zimmerman (1987). "Doing Gender." Gender & Society **1**(2): 125-151.

West, R. and P. Rich (2012). "Rigor, Impact and Prestige: A Proposed Framework for Evaluating Scholarly Publications." Innovative Higher Education **37**(5): 359-371.

Whittington, K. B. (2011). Mothers of invention? Gender, motherhood, and new dimensions of productivity in the science profession. Work and Occupations. US, Sage Publications. **38:** 417-456.

Willemstein, L., T. van der Valk and M. T. H. Meeus (2007). Dynamics in business models: An empirical analysis of medical biotechnology firms in the Netherlands. Technovation. **27:** 221-232.

Williams, J. C. (2000). Unbending gender: Why family and work conflict and what to do about it. New York, Oxford University Press.

Williams, J. C. (2010). Reshaping the Work-Family Debate: Why Men and Class Matter. Cambridge Massachusetts, Harvard University Press.

Williams, J. C., M. Blair-Loy and J. L. Berdahl (2013). "Cultural Schemas, Social Class, and the Flexibility Stigma." Journal of Social Issues **69**(2): 209-234.

Wood, G. J. and J. Newton (2006). "Childlessness and women managers: 'Choice', context and discourses." Gender, Work and Organization **13**(4): 338-358.

Wu, D. and K. Passerini (2013). "Uncovering knowledge-based time management practicesImplications for project management." International Journal of Managing Projects in Business **6**(2): 332-348.

Wu, N., N. Bacon and K. Hoque (2014). "The adoption of high performance work practices in small businesses: the influence of markets, business characteristics and HR expertise." International Journal of Human Resource Management **25**(8): 1149-1169.

Xie, Y. and K. Shauman (2003). Women in Science. Massachusetts, Harvard University Press.

Appendices

Appendix 4.1 Questionnaire for biotech firms

Part 1: The Biotechnology Organisation

Eligibility for this survey:

1. The biotechnology organisation must be dedicated (more than 50% of activity) to research and/or development in the area of human therapeutics, preventatives or diagnostics.
2. The "organisation" may be a stand-alone company or research institute, or a division of a larger organisation, for example the biotech department of a univerisity, reseach institute or pharmaceutical company. (Note data is not required for the whole university or pharmaceutical company, only the relevant department.)

Instructions:

Please enter your organisation data in shaded boxes. For details of data required, please refer to explanatory notes in cells
Following completion, please go to worksheet 2. *'Biotech Managers'*

1. How many staff were employed/engaged by your organisation as at 30/6/2010 (excluding Non-Exec Directors & Students)?

Total staff employed *directly*						Total staff employed *indirectly*						Total staff engaged as contractors					
Male employees		Female employees		Total direct employees		Male indirect employees		Female indirect employees		Total indirect employees		Male contractors		Female contractors		Total contractors	
Headcount		Headcount		Headcount	0	Headcount		Headcount		Headcount	0	Headcount		Headcount		Headcount	0
EFT		EFT		EFT	0	EFT		EFT		EFT	0	EFT		EFT		EFT	0

2. Of the total staff employed/engaged by your organisation (stated above), how many <u>are not</u> scientific staff (i.e. do not have a science qualification and/or do not need one for their job)?

Non-scientific staff employed *directly*						Non-scientific staff employed *indirectly*						Non-scientific staff engaged as contractors					
Male employees		Female employees		Total direct employees		Male indirect employees		Female indirect employees		Total indirect employees		Male contractors		Female contractors		Total contractors	
Headcount		Headcount		Headcount	0	Headcount		Headcount		Headcount	0	Headcount		Headcount		Headcount	0
EFT		EFT		EFT	0	EFT		EFT		EFT	0	EFT		EFT		EFT	0

Any comments?

Part 2: Biotechnology Managers

Eligibility for this survey:

1. The biotechnology manager must work in a role for which a science or medical&health science qualification is a prerequisite (any scientific qualification, not necessarily PhD, and not limited to life sciences)
2. The biotechnology manager must work (as at 30/6/2010) as an employee, contractor or consultant, on at least one day per week, in a management role that reports into the biotechnology organisation participating in this survey
   a. The manager does not qualify for this survey if he/she reports into a central service shared across a whole university or larger company
   b. The manager may be based outside Australia, but only qualifies if his/her direct reporting line is to the biotechnology organisation participating in this survey
3. The biotechnology manager must have a supervisory or strategic management role
   a. The manager must directly supervise at least one person within the organisation; **or**
   b. The manager must directly supervise the performance of, and manage the budget for, at least one outsourced provider of contract or clinical research services (i.e. CRO); **or**
   c. The manager must be the immediate or higher level line manager for anyone who qualifies under 3a or 3b above; **or**
   d. The manager must work as part of the senior management team for the organisation

Instructions:

Please complete shaded area (separate row for each eligible manager). For details of data required, please refer to explanatory notes in cells at top of each column. Some cells have drop down menus (available to Excel 2010 users only).
After you have completed both worksheet 1 *The Biotech Org* & this worksheet 2 *Biotech Managers*, please email, together with the completed *Informed Consent Form* to:
<u>jpickering@swin.edu.au</u>
Thank-you

Manager no.	Manager's position title	Is manager on senior management team? (yes/no)	Number of direct reports	Total number reporting through to this position	Number of contracts managed	Size of budget (Select code or use drop down menu)	Gender (M/F)	Highest qualification	Employment type (Select code or use drop down menu)	Employment term (Select code or use drop down menu)	State equivalent full-time hours (EFT)	Salary/Fees (Select code or use drop down menu)	Is the manager eligible for equity based payments? (yes/no)	Details of equity based payments
1														
2														
3														
etc.														

Any comments?

Appendix 4.2 Questionnaire for academic biotech organisations

Part 1: The Biotechnology Organisation

Eligibility for this survey:

1. The biotechnology organisation must be dedicated (more than 50% of activity) to research and/or development in the area of human therapeutics, preventatives or diagnostics.
2. The "organisation" may be a stand-alone company or research institute, or a division of a larger organisation, for example the biotech department of a university, research institute or pharmaceutical company. (Note data is not required for the whole university or pharmaceutical company, only the relevant department.)

Instructions:

Please enter your organisation data in shaded boxes.
Following completion, please go to worksheet 2. *'Biotech Managers'*

1. How many staff are employed/engaged by your organisation as at 30/6/2010? (Please do not include casual staff or students - see question 3 below)

Total male employees		Total female employees		Total employees	
Headcount		**Headcount**		**Headcount**	0
EFT		**EFT**		**EFT**	0

2. Of the total staff employed/engaged by your organisation (stated above), how many are not scientific staff (i.e. do not have a science qualification and/or do not need one for their job)?

Total male employees (non-scientific)		Total female employees (non-scientific)		Total non-scientific employees	
Headcount		**Headcount**		**Headcount**	0
EFT		**EFT**		**EFT**	0

3. How many students are supervised through your organisation?

PhD	
Masters	
Hons	
Other	
Total	0

Any comments?

Part 2: Biotechnology Managers

Eligibility for this survey:

1. The biotechnology manager must work in a role for which a science qualification is a prerequisite (incl quals in natural & physical sciences; medical & health sciences)
2. The biotechnology manager must work in a management role that reports into the biotechnology organisation participating in this survey
   a. The manager does not qualify for this survey if he/she is employed in a clinical role only (combined research and clinical role does qualify)
   b. The manager may be based outside Australia, but only qualifies if his/her direct reporting line is to the biotechnology organisation participating in this survey
3. The biotechnology manager must have a supervisory or strategic management role
   a. The manager must directly supervise (line management) at least one person within the organisation; **or**
   b. The manager must directly supervise the performance of, and manage the budget for, at least one outsourced provider of contract or clinical research services (i.e. CRO); **or**
   c. The manager must be the immediate or higher level line manager for anyone who qualifies under 3a or 3b above; **or**
   d. The manager must work as part of the senior management team for the organisation participating in this survey

Instructions:

Please complete shaded area (separate row for each eligible manager). For details of data required, please refer to explanatory notes in cells at top of each column. Some cells have drop down menus (available to Excel 2010 users only).
After you have completed both worksheet 1 *The Biotech Org* & this worksheet 2 *Biotech Managers*, please email, together with the completed *Informed Consent Form* to: jpickering@swin.edu.au
Thank-you

Manager no.	Manager's position title	Is manager on senior executive team? (yes/no)	Is the manager on other senior advisory or management committees? (yes/no)	Number of direct staff reports	Total number of staff reporting through to this position	Number of students directly supervised	Total number of students supervised through this position	Number of contracts managed	Size of budget (Select code or use drop down menu)	Gender (M/F)	Highest qualification	Employment term (Select code or use drop down menu)	State equivalent full-time hours (EFT) working for this organisation	Salary/Fees (Select code or use drop down menu)
1														
2														
3														
etc.														

Any comments?

Appendix 4.3 Letter of introduction for questionnaire (email)

Dear [Name]

Thank you for your time this morning, and especially your enthusiasm for my PhD project which is much appreciated. As discussed, my project involves an examination of gender dynamics in the management of Australian biotechnology organisations. There seems to be a general view that women are experiencing greater success in reaching management positions in biotechnology firms than in other organisations and sectors, and I am interested in finding out whether this is true, and if so, why.

Please find attached a consent information statement which provides a more detailed summary of the project and my obligations to you regarding confidentiality.

All participating biotech organisations will be sent a summary of the de-identified aggregated data from the questionnaires, on the basis that the information is kept confidential until published. Having worked in the biotech sector for many years, I'm aware that there is limited information available about the breadth of management responsibilities, salary levels, employment status and gender composition across the sector. Therefore I anticipate a 'snapshot' of this comparative data would be of value to most organisations and hope it will encourage [name of organisation] to participate. I will also send an electronic copy of any publications arising from this research.

Your participation in the project will involve:

1. Reading and completing the attached Informed Consent Statement;
2. Completing the attached Questionnaire - Excel spreadsheet (please complete both sheets); and
3. Returning both of the above by email to jpickering@swin.edu.au by [date], or calling me on 0419 248 776 if you wish to provide your answers over the phone or ask any questions.

The questionnaire has two parts; the first part requires some basic details about overall staff numbers, and the second part seeks more detailed information about the managers in your organisation. All information collected through this questionnaire will be kept confidential, and will be de-identified and aggregated to ensure that data cannot be attributed to any particular organisation.

Thank you in anticipation and please do not hesitate to contact me on 0419 248 776 if you wish to discuss.
Regards,

Janine Pickering
PhD Candidate, Swinburne University of Technology
Enc. Biotechnology Management Questionnaire (Excel Spread-sheet)
Consent Information Statement
Informed Consent Statement

Appendix 4.4 Information statement for questionnaire

(*issued on Swinburne University of Technology letterhead*)

PhD Project: Gender dynamics in the management of biotechnology organisations in Melbourne, Australia

Investigators:

1. **PhD Student**
   Ms Janine Pickering, PhD Candidate, Faculty of Life and Social Sciences, Swinburne University of Technology

2. **PhD Supervisor & First Investigator**
   Professor Michael Gilding, Deputy Dean (Research), Faculty of Life and Social Sciences, Swinburne University of Technology

What this project is about and why it is being undertaken

Consistent with trends worldwide, the Australian Equal Opportunity in the Workplace Agency (EOWA) 2010 Leadership Census showed that there is a huge gender gap in top jobs (EOWA 2010). Within science, the picture is no better, with Bell (2009) finding that women are seriously underrepresented in Australian science management roles. However, within a particular subset of Australian science – the pharmaceutical and biotechnology industry - there is a common perception that women are more likely to reach leadership positions. This perception relates primarily to the management of publicly listed companies, and is supported by some media commentary and data gathered from company annual reports by industry consultants (Kermond 2010). However, such evidence is fairly scant and doesn't examine in detail the level of responsibility or nature of those reported biotechnology management roles. Nor is there a comprehensive data set that covers the gender composition of managers across the biotechnology sector as a whole (including listed and unlisted companies, public research organisations and university departments). It is important to examine what is happening across the whole sector, to understand what factors contribute to women progressing to management roles – is it their profession as life scientists, or does it relate to the types of organisations they work in?

What participation will involve

Australian biotechnology organisations involved in human therapeutics, preventatives or diagnostics research and development will be invited to participate in this project. Organisations have been identified through publicly available records including the Ausbiotech directory and the National Health and Medical Research Council website.

Your participation will involve completing a brief questionnaire on behalf of your organisation. I anticipate this will take between 10 and 30 minutes for most organisations (longer for organisations with numerous managers). The purpose of the questionnaire is to gather basic data on the gender composition, job responsibilities and employment profiles of Australian biotechnology managers. There is no comprehensive Australian database with this information at present.

I would be happy to assist you in completing the questionnaire if you wish to discuss over the phone (0419 248 776), otherwise you may prefer to return the questionnaire to me by email.

As a participant in this research, you will be provided with a summary report of the de-identified aggregated data gathered through this questionnaire, on the basis that you keep this information confidential until it is published. I will email the summary to you once it has been prepared. I will also send you an electronic copy of any publications arising from this research at a later date.

Privacy & Confidentiality

The data collected through this questionnaire will be used for research purposes only, and will remain confidential both throughout and following completion of the research project. Once received via email, the data from questionnaires, including both organisation names and manager titles, will be de-identified, coded and entered into a database that is stored on my password-protected computer hard drive at Swinburne's Hawthorn campus. The list of participating organisations and their corresponding code number will be kept as a separate document.

De-identified, aggregated data will be used as a basis for my PhD, and may also be published in academic journals or used for academic or industry presentations. The names of participating organisations may be included in these publications and/or presentations, but particular data will not be attributable to any organisation or individual. Only sufficiently aggregated data and trends will be published or circulated.

Researcher Declaration

I intend to continue working as an independent Human Resources consultant on a part-time basis whilst studying for my PhD. I wish to emphasise that having worked as a consultant to many organisations in the biotechnology sector, I am used to working with commercial-in-confidence information and will apply a high standard of professional integrity to the management of data collected for this project.

Please note that participation is voluntary and you are free to withdraw the data you have contributed at any time without explanation.

If you would like further information about the project, please do not hesitate to contact:

Professor Michael Gilding, Deputy Dean (Research)
Faculty of Life and Social Sciences
Swinburne University of Technology, Hawthorn Campus
Phone (03) 9214 8102
Email mgilding@swin.edu.au

With thanks and regards,

Janine Pickering

PhD Candidate, Swinburne University of Technology
Faculty of Life and Social Sciences
Phone (03) 9214 4418 or 0419 248 776
Email jpickering@swin.edu.au

References

Bell S (2009) Women in science in Australia: Maximising productivity, diversity and innovation Report for Federation of Australian Scientific and Technological Societies

Equal Opportunity for Women in the Workplace Agency (EOWA) (2010) Australian Women in Leadership Census. From http://www.eowa.gov.au/Australian_Women_In_Leadership_Census/2010_Australian_Women_In_Leadership_Census/Media_kit/EOWA_2010_Census_Full.pdf, retrieved 13 October 2010

Kermond, C The Age Business Day p.3 Thursday April 1, 2010

This project has been approved by or on behalf of Swinburne's Human Research Ethics Committee (SUHREC) in line with the *National Statement on Ethical Conduct in Human Research*. If you have any concerns or complaints about the conduct of this project, you can contact Research Ethics Officer, Swinburne Research (H68), Swinburne University of Technology, P O Box 218, HAWTHORN VIC 3122. Tel (03) 9214 5218 or +61 3 9214 5218 or resethics@swin.edu.au

Appendix 4.5 Informed consent agreement to complete questionnaire

(*issued on Swinburne University of Technology letterhead*)

[Please mark check-boxes as appropriate. To do this, double-click on ☐ 'check box', then enter in Default Value as checked ☒]

Swinburne University of Technology

PhD Project Title: Gender dynamics in the management of biotechnology organisations in Australia.
Principal Investigator(s): Ms Janine Pickering, PhD candidate and Professor Michael Gilding, Deputy Dean (Research), Faculty of Life and Social Sciences, Swinburne University of Technology.

Prior to completion of the questionnaire, please confirm your informed consent by placing an 'x' in the following boxes.

1. I consent to participate in the project named above. I have been provided a copy of the project consent information statement to which this consent form relates and any questions have been answered to my satisfaction. ☐

2. I agree to, and have the authority to, complete this questionnaire about the staffing profile of the Biotechnology Organisation I represent and agree to make myself available for further information if required. ☐

3. I acknowledge that:

   a. my participation is voluntary and that I am free to withdraw from the project at any time without explanation; ☐

   b. the Swinburne project is for the purpose of research and not for profit; ☐

   c. any identifiable information about me, the organisation or its staff which is gathered in the course of and as the result of my participating in this project will be (i) collected and retained for the purpose of this project and (ii) accessed and analysed by the researcher(s) for the purpose of conducting this project ☐

   d. my anonymity and the anonymity of the organisation and its staff are preserved and will not be identified in publications or otherwise without my express written consent ☐

By returning this completed questionnaire I agree to participate in this project on the above terms.

Your Name and Title:

…………………………………………………………………………………**Date**………………………

Name of Organisation (and where relevant, department within larger organisation):

……………………………………………………………………………………………………

Appendix 4.6 Indicative interview questions

1. Firstly, I would like you to step me through your career 'story' – starting with the details of your qualifications (and year graduated), then each role you have held since university. I will interrupt you as we go (ask the following as appropriate):
    a. How did you get your first role;
    b. What responsibilities were included in the role;
    c. Was it a term position/how was the position funded;
    d. How was work organised (e.g. team-based or independent or hierarchical); supervisory arrangements; and was there any collaborations outside of your immediate work area or organisation;
    e. How were promotions decided? Did you get promoted? What kind of achievements/behaviours resulted in promotion in the organisation?
    f. Were women well-represented in senior roles?
    g. Why did you leave;
    h. What attracted you to your next role (or were there other roles you preferred but did not get);
    i. How you were recruited to the role (e.g. advertisement; networking); and
    j. What was the recruitment process (e.g. formal or informal, position description, selection criteria, interview panels).
2. You have worked in X different types of organisation – (choose from) biotech company; university; pharmaceutical company; research institute; other?
    a. Can you talk about the advantages and disadvantages of each in terms of your career development and progression?
    b. What have been your most career-enhancing experiences?
    c. Have you had any experiences/periods of time that you believe have limited your career development?
    d. Thinking about the biotechnology sector as a whole (biotechs; universities; research institutes; large pharma) – what would be your ideal job, and in what type of organisation?
3. Do you have primary carer responsibilities for children or others?
    a. Which of your workplaces has been the most or least accommodating of this? How? (e.g. policies, work practices or culture)
    b. Have you taken any time out of the workforce for family reasons? How do you think this affected your career advancement?
    c. Do you believe your family responsibilities have hindered your career development or progression? How?
    d. If no primary carer responsibilities, how did you see this working for others in each organisation?
4. Considering your current and past workplaces, do you think there were any differences in how management in the different organisations valued workplace diversity? (e.g. in terms of career development opportunities/promotions/pay?)
5. Do you have any other observations about gender diversity in the management of biotechnology organisations? Do you think this is a 'good' sector for women?

Appendix 4.7 Information statement for interviews

(*issued on Swinburne University of Technology letterhead*)

PhD Project: Gender dynamics in the management of biotechnology organisations in Melbourne, Australia

Investigators:

3. **PhD Student**
   Ms Janine Pickering, PhD Candidate, Faculty of Life and Social Sciences, Swinburne University of Technology

4. **PhD Supervisor & First Investigator**
   Professor Michael Gilding, Deputy Dean (Research), Faculty of Life and Social Sciences, Swinburne University of Technology

What this project is about and why it is being undertaken

Consistent with trends worldwide, the Australian Equal Opportunity in the Workplace Agency (EOWA) 2010 Leadership Census showed that there is a huge gender gap in top jobs (EOWA 2010). Within science, the picture is no better, with Bell (2009) finding that women are seriously underrepresented in Australian science management roles. However, within a particular subset of Australian science – the pharmaceutical and biotechnology industry - there is a common perception that women are more likely to reach leadership positions. This perception relates primarily to the management of publicly listed companies, and is supported by some media commentary and data gathered from company annual reports by industry consultants (Kermond 2010). However, such evidence is fairly scant and doesn't examine in detail the level of responsibility or nature of those reported biotechnology management roles. Nor is there a comprehensive data set that covers the gender composition of managers across the biotechnology sector as a whole (including listed and unlisted companies, public research organisations and university departments). It is important to examine what is happening across the whole sector, to understand what factors contribute to women progressing to management roles – is it their profession as life scientists, or does it relate to the types of organisations they work in?

What participation will involve

Approximately 30 Australian biotechnology managers will be invited to be interviewed for this project. The managers have been selected via a probability-based, stratified sampling technique to ensure representation from a range of different management roles in the sector. The managers work for biotechnology organisations identified through publicly available records including the Ausbiotech directory and the National Health and Medical Research Council website.

Your participation will involve an interview with me, covering such topics as your career history, current responsibilities, work environments, family responsibilities and career breaks, work conditions, how you were recruited to your current and previous positions, your use of career networks, organisational policies and practices that have affected your career, and your views about the attractiveness of a career in the biotechnology sector. I anticipate the interview will take between 1 and 1.5 hours at a location to be agreed between us.

The interview will be audio-digitally recorded for accuracy of transcribing. The transcripts will be destroyed once the information from the interview has been transcribed.

As a participant, I will send you an electronic copy of any publications arising from this research.

Privacy & Confidentiality

The information collected through interviews will be used for research purposes only, and will remain confidential both throughout and following completion of the research project. My interview notes and the signed consent forms will be stored in a locked filing cabinet at Swinburne Hawthorn campus during the study, and will be retained in a secure place for at least 5 years after the study. The audio digital recordings will be stored on the password-protected hard drive of my computer at Swinburne Hawthorn campus until the information has been transcribed, and then the recordings will be destroyed.

Interviewees will be de-identified on all database records by using code references (e.g. interviewee 1, 2, 3; manager level 1, 2, 3; from biotech co < 10 employees). Only sufficiently de-identified, aggregated data will be published or circulated. The information gathered from interviews will be used as a basis for my PhD, and may also be published in academic journals or used for academic or industry presentations.

Researcher Declaration

I intend to continue working as an independent HR consultant on a part-time basis whilst studying for my PhD. I wish to emphasise that having worked as a consultant to many organisations in the biotechnology sector, I am used to handling personal and confidential information and will apply a high standard of professional integrity to the management of your personal information.

Please note that participation is voluntary and you are free to withdraw the data you have contributed at any time without explanation.

If you would like further information about the project, please do not hesitate to contact:

Professor Michael Gilding, Deputy Dean (Research)
Faculty of Life and Social Sciences

Swinburne University of Technology, Hawthorn Campus
Phone (03) 9214 8102
Email mgilding@swin.edu.au

With thanks and regards,

Janine Pickering

PhD Candidate, Swinburne University of Technology
Faculty of Life and Social Sciences
Phone (03) 9214 4418 or 0419 248 776
Email jpickering@swin.edu.au

References

Bell S (2009) Women in science in Australia: Maximising productivity, diversity and innovation Report for Federation of Australian Scientific and Technological Societies

Equal Opportunity for Women in the Workplace Agency (EOWA) (2010) Australian Women in Leadership Census. From http://www.eowa.gov.au/Australian_Women_In_Leadership_Census/2010_Australian_Women_In_Leadership_Census/Media_kit/EOWA_2010_Census_Full.pdf, retrieved 13 October 2010

Kermond, C The Age Business Day p.3 Thursday April 1, 2010

This project has been approved by or on behalf of Swinburne's Human Research Ethics Committee (SUHREC) in line with the *National Statement on Ethical Conduct in Human Research*. If you have any concerns or complaints about the conduct of this project, you can contact Research Ethics Officer, Swinburne Research (H68), Swinburne University of Technology, P O Box 218, HAWTHORN VIC 3122. Tel (03) 9214 5218 or +61 3 9214 5218 or resethics@swin.edu.au

Appendix 4.8 Informed consent agreement to participate in interviews

(*issued on Swinburne University of Technology letterhead*)

PhD Project: Gender dynamics in the management of biotechnology organisations in Melbourne, Australia

Investigators:

PhD Student
Ms Janine Pickering, PhD Candidate, Faculty of Life and Social Sciences, Swinburne University of Technology
PhD Supervisor & First Investigator
Professor Michael Gilding, Deputy Dean (Research), Faculty of Life and Social Sciences, Swinburne University of Technology

1. I consent to participate in the project named above. I have been provided a copy of the project consent information statement to which this consent form relates and any questions I have asked have been answered to my satisfaction.

2. In relation to this project, please circle your response to the following:
   - I agree to be interviewed by the researcher
     Yes/No
   - I agree to allow the interview to be recorded by electronic device
     Yes/No
   - I agree to make myself available for further information if required
     Yes/No

3. I acknowledge that:
   (a) my participation is voluntary and that I am free to withdraw from the project at any time without explanation;
   (b) the Swinburne project is for the purpose of research and not for profit;
   (c) any identifiable information about me which is gathered in the course of and as the result of my participating in this project will be (i) collected and retained for the purpose of this project and (ii) accessed and analysed by the researcher(s) for the purpose of conducting this project;
   (d) my anonymity is preserved and I will not be identified in publications or otherwise without my express written consent. By signing this document I agree to participate in this project.

Name of Participant……………………………………………………………

Signature & Date: ……………………………………………………………

Appendix 4.9 Ethics clearance (email)

>>> Ann Gaeth 15/11/10 11:18 AM >>>
To: Prof Michael Gilding FLSS Ms Janine Pickering CC: Ms Robyn Watson Research Administration Coordinator

Dear Michael and Janine,

SUHREC Project 2010/262 Gender dynamics in the management of biotechnology organisations in Melbourne, Australia
Prof Michael Gilding FLSS Ms Janine Pickering
Approved duration 15/11/2010 To 15/11/2012 [Adjusted]

I refer to the ethical review of the above project protocol undertaken by Swinburne's Human Research Ethics Committee (SUHREC). Your response to the review, as e-mailed on 12 November 2010, was put to and approved by a SUHREC delegate.
I am pleased to advise that, as submitted to date, the project has approval to proceed in line with standard on-going ethics clearance conditions here outlined.

- All human research activity undertaken under Swinburne auspices must conform to Swinburne and external regulatory standards, including the National Statement on Ethical Conduct in Human Research and with respect to secure data use, retention and disposal.

- The named Swinburne Chief Investigator/Supervisor remains responsible for any personnel appointed to or associated with the project being made aware of ethics clearance conditions, including research and consent procedures or instruments approved. Any change in chief investigator/supervisor requires timely notification and SUHREC endorsement.

- The above project has been approved as submitted for ethical review by or on behalf of SUHREC. Amendments to approved procedures or instruments ordinarily require prior ethical appraisal/ clearance. SUHREC must be notified immediately or as soon as possible thereafter of (a) any serious or unexpected adverse effects on participants and any redress measures; (b) proposed changes in protocols; and (c) unforeseen events which might affect continued ethical acceptability of the project.

- At a minimum, an annual report on the progress of the project is required as well as at the conclusion (or abandonment) of the project.

- A duly authorised external or internal audit of the project may be undertaken at any time.

Please contact me if you have any queries about the ethical review process, citing the SUHREC project number. Copies of clearance emails should be retained as part of project record-keeping.

Best wishes for the project.
Yours sincerely

Ann Gaeth
for Keith Wilkins, Secretary, SUHREC

Ann Gaeth, PhD
Administrative Officer (Research Ethics)
Swinburne Research (H68)
Swinburne University of Technology
P.O. Box 218
HAWTHORN VIC 3122
Tel: +61 3 9214 5935
Fax: +61 3 9214 5267