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Understanding Australians' Perceptions Of Controversial Scientific Research

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Abstract

This research examines perceptions of stem cell research among a representative sample of 1013 Australians and five focus groups. The results suggest that the majority of Australians were comfortable with the research using adult cells, but were not comfortable with scientists using cells created by cloning. The sample was however divided in relation to the use of embryonic stem cells. The use of structural equation modelling found that this division was strongly associated with the level of social trust in the scientific organisations conducting the research via anti-intellectual beliefs and the perceived value of science. Higher comfort was demonstrated among those with higher levels of social trust because of a commitment to the intellectual freedom of science and a perception that the products of science are valuable. Religious individuals were less likely to support stem cell research due to stronger anti-intellectual beliefs, but demonstrated similar levels of social trust and beliefs in the value of science to the non-religious. Finally, among both religious and non-religious groups, support for stem cell research was found to be much less likely if conducted in private compared to publicly funded organisations. The implications of the results for the perception of science are discussed, as well as the consequences for social trust if the increasing move towards tying scientific enquiry to private rather than public interests continues.

Key Words: stem cell research, social trust, anti-intellectualism, values

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Understanding Australians' Perceptions' Of Controversial Research: The Influence Of Social Trust, Religiosity And Anti-Intellectualism On Opposition To Stem Cell Research

In 1998 a United State's biologist Dr. James A. Thomson and his colleagues isolated the master cells responsible for human physiological development (Thomson, Itskovitz-Eldor & Shapiro, 1998). The discovery has been described as one of the most important scientific achievements of the decade, with the prestigious journal Science defining it as the breakthrough of the year. These master cells, or human embryonic stem cells, are theoretically able to transform into an unlimited number of specialised human cells that can eventually develop into various types of human tissue. Scientists have demonstrated that the cells can be transplanted into diseased or damaged organs, replace injured tissue, and restore the function of an ailing organ. This has been successfully demonstrated in both animal (e.g., Chu et al., 2004; McDonald et al., 1999; Wickelgren, 1999) and human studies (for example, Lee & Makkar, 2004; Newman et al., 2004; Peterson, 2004), leading scientists to believe that stem cell research has the potential to cure a broad range of pernicious, and at present untreatable, diseases and injuries, including diabetes, cancer, cystic fibrosis, multiple sclerosis, and Parkinson's disease. It is generally believed within the scientific community that the discovery has the potential to revolutionise medicine, where amazing advances such as reversing catastrophic spinal cord injury and growing our own organs for future transplantation are theoretically possible.

Not surprisingly, the implications of this research have received considerable world-wide media attention and debate. The debate centres primarily around how the research is conducted, or more specifically, around the development, use, and consequent destruction of the human embryos (Nisbet, 2004; Nisbet, Brossard & Kroepsch, 2003). While stem cells are present in human adults, the cells derived from early foetal tissue are viewed by scientists as the most promising. Cells obtained from a fully developed organism are multipotent, meaning they can only develop into certain types of body tissue. For example, nerve tissue has been grown using blood cells derived from adult bone marrow (Tran et al., 2003), but these cells may not grow into heart muscle. On the other hand, pluripotent stem cells derived from early embryonic tissue are theoretically able to develop into any type of human tissue. As the embryo develops however, the cell's pluripotent character declines as the cells start to develop into more complex cells. The peak potency of the stem cells is at one day after fertilisation, which means they need to be extracted quickly, a procedure that ultimately destroys the developing embryo.

Scientists argue therefore, that the benefits resulting from stem cell research will be significantly hastened if they can use human fetal tissue. Stem cell researchers have used the tissue from unwanted embryos obtained at fertility clinics and invitro fertilization (IVF) programs (Moran, 2003), and have also claimed to have created human embryonic stem cells via the use of cloning (Asia Pacific Biotech News 2004). The moral implications of both these sources of stem cells have concerned ethicists, feminists, philosophers and governments, and have outraged moral conservative groups. Using human embryos for research purposes is viewed by these groups as potentially leading to the death of a human being, the exploitation of women, dehumanizing humanity, and even encouraging women to terminate their pregnancies for medical research. Creating human embryos via cloning has also generated anger and concern, with religious groups accusing scientists of going too far by trespassing on God's exclusive right to control life and death.

According to many scientists and biotechnology companies, governments in both Australia and the US reacted prematurely to the extreme views without adequate review of the complexities involved and consideration of the potential benefits stem cell research has for millions of people world-wide (American Association for the Advancement of Science, 2002). While the British government has allowed the use of therapeutic cloning for stem cell research under tight regulations, the US and Australian Governments have banned its use altogether, only allowing scientists to use existing embryos. Not surprisingly, many scientists are unhappy that governments have significantly restricted their supply of stem cells, and are not confident that even this source will remain. Both the Australian and US governments have threatened to overturn the decision allowing the use of discarded embryos, and there is continued, and increasing, pressure from powerful anti-abortion and religious groups for a total ban on the use of all embryos. Both President Bush and Howard government ministers have publicly announced their own personal agreement with the conservative position (Seelve 2001; ABC, 2002).

The stem cell debate could thus be described as being hijacked by two opposing groups with different vested interests. On the one hand there are the conservative 'pro-life' groups who oppose what they term as a violation to every human being's right to life, and on the other, there are patient groups, scientific organisations and biotechnology industries who threaten that bans will precipitate yet another brain drain of talented scientists, and send medical science back into the dark ages (Holland, Lebacqz & Zoloth, 2001). What appears to be missing from this debate is the view of the general community, the ultimate beneficiaries of stem cell research. If one reads press reports over the last two years or peruses the many web sites outlining the ethics of stem cell research, the impression conveyed seems to be that the community is divided along similar lines to the conservative and scientific voices.

However it is not yet known whether or not this is actually the case. Apart from two studies, there are at present no published Australian empirical data that examines comprehensively the extent of the opposition to stem cell research within the Australian community. There is also limited reliable data available that directly examines the underlying reasons for opposition to, or support for, stem cell research. The majority of research assumes, and does not directly examine, that opposition to stem cell research is primarily dependent upon strong moral or religious beliefs. Only a handful of Australian market research studies have been completed examining community approval or disapproval of stem cell research, and the majority have been conducted by organisations with a vested interest (that is, patient, scientific and religious groups). In addition, the results of the available market research are limited methodologically, with variations in levels of support often being associated with the different wording of questions used across samples. Little is therefore known as to whether Australians do support or oppose stem cell research, and what are the reasons underlying their position.

Aims of the research

The objectives of this research were threefold. First, attempts were made to assess quantitatively the level of support for stem cell research among a representative sample of the Australian population. The second aim was to elucidate the reasons underlying an individual's support or opposition to stem cell research using both quantitative and qualitative data. We argued that predictors of attitudes towards stem cell research are far more complex than just the result of religiosity or moral and ethical beliefs. As displayed in Figure 1 and outlined further below, we specifically hypothesised that opposition to stem cell research would in fact be associated with religiosity, but that it would also be dependent upon the level

of trust in the institutions and scientists that conduct the research, beliefs in the value of the products of science, and an anti-intellectual orientation characterised by the idea that science is out of control, has gone too far, and should be under tighter control. Further, through the use of focus groups, we investigated these and other spontaneous reasons given for an individual's support or opposition to stem cell research among groups that differed in terms of gender, age, religion and being a direct beneficiary of stem cell research (that is, those with an incurable medical condition).

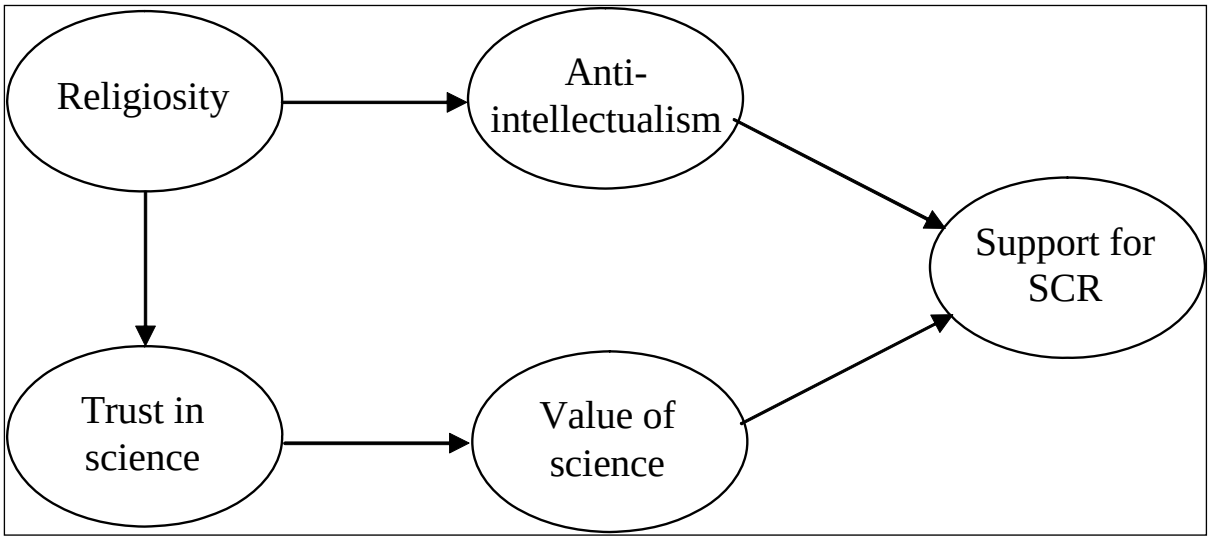

Figure 1. Theoretical model predicting comfort with stem cell research.

Note: SCR = Stem cell research

Given that the stem cell and cloning debates are occurring within a political and economic context that is increasingly placing scientific enquiry into the hands of private rather than public interests, the third aim of this research was to examine whether the Australian public would be more comfortable with stem cell research being conducted in private or public organisations. At present, stem cell research in Australia is being conducted in both private biotechnology companies and publicly funded institutions such as Universities. Many have highlighted that one of the costs of privatising scientific and academic enquiry may be a decrease in the perceived quality of the research and trust in the claimed benefits of the research to the community (for example, Coady, 2000; King & Stabinsky, 1999). If, for example, an individual perceives that a private research company's primary goal is to increase profit for its shareholders, scientists working within this context may be perceived to be motivated more by individualistic and self-serving factors rather than by a desire to engage in the search for truth or to produce products or knowledge for the public good. Pressure to increase profits and personal gain could result in increased pressure to cut corners or engage in unethical research practices, which may decrease the public's trust in science and/or the quality of the scientist's work.

Is the public really divided?

Market research opinion surveys have suggested that media claims of a community polarised in its support for stem cell research may not be entirely correct. For example the results of a survey completed by Roy Morgan International in mid 2001 suggests that the

majority of Australian (72%, n=1,298), New Zealand (65%, n=561), British (63%, n=466) and US (63%, n=501) citizens approve of stem cell research using human embryos to treat diseases. However, approval was lower across all countries when participants were asked about the use of therapeutic cloning (Australian, 52%, New Zealand, 44%, British, 43%, US, 40%). A year later, an Australian study conducted by Evans, Zanjani and Kelley (2002) also found wide spread support for the general use of foetal tissue in scientific research among a representative sample of 7,387 Australians. The US public also appears to support stem cell research. A survey conducted in May of 2001 by the US Coalition for the Advancement of Medical Research found that 77% of 1,010 respondents gave initial support for the use of stem cells from fertilised eggs, and 70% remained supportive after being presented with both sides of the debate. Another national US survey conducted by the Alliance for Aging Research, found that 62% (n=1000) of people agreed that scientists should be able to use stem cells obtained from early human embryos to find cures for serious diseases such as Alzheimer's and Parkinson's. Fifty-two percent approved of stem cells being extracted from the foetal tissue of abortions to find cures for serious diseases (Alliance for Aging Research, 2001).

Some research to date therefore suggests that the majority in Western industrialised nations do in fact support stem cell research. However, as Nisbet (2004) points out, careful attention should be paid to the vested interests of the organisations conducting the research and to the wording of the questions being asked before this conclusion can be made. In his review of the US research, he concluded that the level of reported support for stem cell research was dependent upon the wording of questions, which varied again according to the organisation conducting the poll. Questions are often accompanied with, or omit important information that may bias the actual opinion expressed. For example questions that ask, "Scientists should be able to use stem cells obtained from early human embryos to find cures for serious diseases such as Alzheimer's and Parkinson's?" (62% support; Alliance for Aging Research, 2001) have been shown to elicit increased support compared to questions such as, "…live embryos will be destroyed in their first week of development to obtain these cells. Do you support or oppose using your federal tax dollars for such experiments?" (30% support; National Council of Catholic Bishops, 2001).

Nisbet's (2004) review of the literature suggests that US public support for stem cell research varies widely according to the source of the cells highlighted in survey questions. Overall, the public was significantly more comfortable with research using adult stem cells than those from embryos, with much greater support evidenced for cells from discarded or unused embryos than those that are created through cloning. Nisbet's (2004) conclusions are however, derived from a number of different surveys with varying survey questions and samples. It is therefore difficult to conclude whether the varying support can be directly tied to the different sources of stem cells or to the respondents' sensitivity to the various wording effects present within the framing of questions. Research needs to therefore look at the variation in opinion across sources of cells within the one sample (that is, a within group design) and to standardise the framing of questions across studies.

At present the Swinburne National Technology and Society Monitor (SNTSM) is the only Australian research which has examined comfort with stem cell research across different cell contexts using a within group design (ACETS 2003). It found that among a sample of 1025 Australians support was higher for the use of adult tissue compared with the use of stem cells left over from IVF procedures. In response to the questions asking participants how comfortable they were with stem cell research using left over IVF embryos or using tissue from adults, Gilding and Critchley (2003), in reporting these data, found evidence to suggest that

Australian public opinion was indeed polarised, but only in relation to the use of left over IVF embryos. On a scale of 0 to 10, where 10 was 'very comfortable' and 0 was 'not at all comfortable', the mean score was 5.7, with the most popular response being very comfortable (17.5% of the sample), and the second most popular response being not at all comfortable (16.2% of the sample). Comfort with stem cell research using adult tissue was higher, and was not polarised. The mean score was 6.8, with 21.2% of the sample being very comfortable, and only 6.3% indicating that they were not at all comfortable. Thus Australians' support for stem cell research appears to be polarised, but only under certain conditions. The present research builds upon the SNTSM research, by similarly comparing support for stem cell research using left over IVF embryos and adult stem cells, with the addition of stem cells derived from cloning.

Reasons for the support of, or opposition to, controversial scientific research

Though limited, the available results suggests that the context in which questions are asked about stem cell research can have a significant influence on the amount of support or approval expressed among respondents. The question remains however, why these differences in support for stem cell research exist. As already pointed out, the picture presently being painted within the media, the political arena and from biotechnology companies, is that reactions to stem cell research are primarily dependent upon the ethical and moral concerns over the destruction of human embryos. However, this conclusion cannot yet be drawn given that empirical research examining the underlying reasons for opposition or support is sparse. One exception is a recent Australian study which found that opposition to stem cell research was associated with a range of factors, in addition to strong moral beliefs that is, belief in evolution, religiosity, views on abortion and euthanasia. For example, distrust in scientists and uncertainty that foetal tissue research would in fact lead to a cure for diseases was also significantly associated with increased opposition (Evans, Zanjani & Kelley 2002). While there were some methodological problems with this study (for example, questions relating to trust were not specifically tied to stem cell research or those conducting the research), the results do coincide with the more general literature on the relationship between social trust and support for new technologies.

Siegrist and his colleagues (for example, Siegrist, 2000; Siegrist & Cvetkovich, 2000; Siegrist, Cvetkovich & Roth, 2000) have consistently found that support for new technologies are associated with the level of social trust an individual places within the organisation and/or the individuals who have created them. According to Siegrist, Cvetkovich and Roth (2000) "social trust is the willingness to rely on those who have the responsibility for making decisions and taking actions related to the management of technology, the environment, medicine, or other realms of public health and safety" (p 354). Because the public generally has limited information, the ability or the time to understand the complexities of new or advanced technologies, they tend to rely on the information obtained from experts, and the contexts within which they are developed. Acceptance of a new or complex technology will therefore be dependent upon the level of trust the public has in companies, scientists, governments or organisations who are associated with developing and regulating the technology. In a study examining the acceptance of genetic engineering among Swiss citizens, Siegrist (2000) found that support for genetically modified food was strongly associated with the public's reported trust in scientists and researchers at universities, and in pharmaceutical, agricultural and food companies. Other research has also found this association with a range of technologies, including the acceptance of food irradiation (Bord &

O'Connor, 1990), nuclear power (Slovic, Flynn & Layman, 1991), artificial sweeteners and pesticides (Siegrist, Cvetkovich & Roth, 2000).

Siegrist and his colleagues (for example, Siegrist, 2000; Siegrist, Cvetkovich & Roth, 2000) have also consistently found that the perceived benefits and costs of a particular technology mediate the relationship between social trust and support. That is, if an individual trusts the organisations associated with the technology, they will be more likely to believe that the perceived outcomes of the technology will be beneficial rather than detrimental, and in turn, report increasing support. Thus, social trust leads to acceptance or support because the individual is more likely to perceive that the technology produces valuable outcomes. Given the general support for Siegrist's model, in combination with the results of Evans, Zanjani and Kelley's (2002) research, the present research hypothesised that acceptance of stem cell research may also be dependent upon a belief that science is valuable, which is in turn dependent upon the level of social trust. Stem cell research is both a new and complex procedure that, surprisingly, has not been shown to be elusive to the public (Nisbet, 2004). Thus, support for its continuation could be dependent upon the trust in the scientists conducting the research in much the same way as the technologies examined by Siegrist. As shown in Figure 1, it was expected in line with Siegrist's work, that increased levels of trust in the organisations associated with stem cell research (that is, scientists, universities, the Commonwealth Scientific and Industrial Research Organisation [CSIRO], and hospitals) would lead to stronger comfort with stem cell research, because of a stronger belief that the products of science are valuable.

Figure 1 also suggests that trust in science and the perceived benefits of science would be associated with religious orientation. Within the attitudes towards science and anti-intellectualism literature, negative attitudes towards scientific enquiry, fear of science and a lack of trust in science are often found in those who place high importance in religious faith (for example, Francis & Greer, 2001; Fulljames, 1996). Siegrist and his colleagues (for example, Siegrist, Cvetkovich & Roth, 2000) have found that value similarity is significantly associated with social trust. Individuals who perceive that they have similar values to the organisations associated with a particular technology (that is, high value similarity) will be more likely to trust those organisations than those who perceive an organisation's values to be opposed to their own. Given that the values of science have long been perceived to be in conflict with those of religion (Fulljames, 1996), it is expected that those who are high in religious orientation would be less likely than those who are not, to trust organisations that are engaged in scientific activities. As suggested by Siegrist, this should lead to stronger reported opposition to stem cell research via social trust and values of science. Thus, this research does expect that religion will be associated with opposition to stem cell research, but opposition will be because of a general distrust in science and its products as well as moral or ethical beliefs relating to concern for the human embryo.

Further, figure 1 suggests that religious orientation will also be associated with ant-intellectual beliefs. Various writers in the area of anti-intellectualism, have long highlighted the role of anti-rationalist and anti-science attitudes among religious leaders and organisations (for example, Hofstader, 1963; Rigney, 1991). Throughout history, there are numerous examples of how the need to maintain religious faith has resulted in attacks against scientists, academics, artists and other intellectuals (Hofstader, 1963). It is often argued that opposition to rational thought, including scientific enquiry, arises from a need to protect the self against threats to religious or ideological faith, and to protect the legitimacy of actions sanctioned by these beliefs. Thus those with a religious orientation would be expected to demonstrate a belief that science has gone too far and should be strictly

regulated, rather than that scientists should be given a free reign to pursue the search for truth. Because the destruction of human embryos by scientists and especially the creation of human embryos through cloning are often viewed as crossing the boundaries of what is acceptable scientific practice, anti-intellectual beliefs should be associated with opposition to stem cell research. Stem cell research should therefore be opposed by those who believe that science is out of control and has gone too far and moreover, that this should occur regardless of whether or not science is perceived to produce valuable products. In sum, the model proposed by this research in Figure 1 suggests that religion will have two independent pathways to support or lack of support for stem cell research. That is, those with a religious orientation will oppose stem cell research because they perceive that science has gone too far, and because they distrust science in general and the products its produces.

Summary

In summary, there is contradictory evidence as to the extent of support or opposition to stem cell research, and there is a dearth of information related to explaining why or why not an individual may support stem cell or other controversial scientific research. The current research attempted to fill these gaps in the literature in three ways. First, the level of support for stem cell research and the reasons underlying support were determined using the quantitative responses of a representative sample of Australians. Second, quantitative data was also used to assess whether support for this research is significantly higher when it is conducted in a public compared to a private organisation. Third, to assess the reasons individuals give for their support or opposition to stem cell research, six focus groups were run consisting of four general public groups, one patient and one religious group.

It was expected that the focus groups would elicit a number of reasons in addition to the destruction of embryos, for explaining the level of support for stem cell research. Specifically it was expected that trust in scientists, anti-intellectual beliefs in wanting to restrict and control scientists, and whether or not the results of stem cell research would be of benefit or not, would be also important themes resulting from the discussions.

Method

Participants and procedure

Quantitative sample.

The quantitative responses were derived from a random sample of 1013 Australians over the age of 18 years who were interviewed via telephone as part of the Swinburne National Technology and Society Monitor (SNTSM). The SNTSM is conducted on an annual basis to monitor public perceptions of advances in science and technology. The results reported here were obtained in May 2004. Overall, the sample was representative of all Australian states and territories as measured by the 2001 Census. It was also representative in terms of gender, age, country of birth, income, education and marital status. There were equal numbers of males (506) and females (507) in the survey, and ages ranged from being born in the decade 1910s (1.1%) to the 1980s (8.1%). The majority of the sample was born in the 1960s (22.2%) and 1950s (20.9%), followed by the 1940s (19.2%) and the 1970s (14.2%). Seventy-six percent of the respondents were Australian born, with the others being born in 36 other countries. Of these, most were born in the UK (9.4%) and NZ (2.4%). The majority were receiving a gross annual income of between $15,600 and $41,599 (33.3%), followed by 26.2% receiving between $41,600 and $77,999. Twenty one percent received an annual

income of less than $15, 599 per year, and 9.5% more than $78,000. A total of 1.9% reported receiving no annual income and 8.0% refused to answer this question.

Most of the sample had obtained a university degree (28.3%) or less than 12 years of secondary education (26.9%). Twenty-two percent had completed 12 years of secondary education, 14.4% had a TAFE diploma or certificate, and 8.1% had a post graduate degree. The majority of the sample was currently in a relationship (married 53.5%, defacto 6.9%), 19.3% were never married, 12.0% were divorced or separated, and 6.0% were widowed. Most of the sample were employees (42.0%), owned their own business (18.0%) or retired (19.2%). Only 2.0% of the sample was unemployed which is lower than the current national rate of around 6.0%. Approximately nine percent (8.8%) were engaged in home duties and 6.9% were students.

Qualitative samples

To gain a more detailed understanding of public perceptions of stem cell research, the survey was followed-up with six focus group interviews. The groups were divided along three dimensions: age, gender and religion. Since age and gender have been found to be significant variables in other attitudinal studies related to technology (e.g., Gilding & Critchley, 2003; Siegrist, 1998; Turney et al., 2003), two focus groups, one each of men and women, consisted of adults under the age of thirty and another two of men and women over the age of sixty. Participants in these four groups were members of the general public, recruited independently through a commercial polling company. All of these groups were interviewed in a face-to-face format.

The remaining groups comprised religious participants with strongly held views on abortion and a group of people with an incurable condition that might be improved or cured by the outputs of stem cell research. The religious participants were recruited though direct contact with a Pentecostal Church member and conducted face-to-face. Patient group participants were recruited through email and the posting of notices on relevant online sites and chat groups and conducted online. The total number of participants was 47, with eight participants in each group, except for 6 in the young men's group and 9 in the patient group.

Measures

Religiosity

Three questions in the SNTSM that relate to religiosity were used to obtain an overall indicator of a person's commitment to organised religion. These included religious type, frequency of church attendance and the level of trust an individual reported in the church. Including the category 'no religion', there were 21 different religions stated by respondents. Each of the categories were classified into the following groups, no religion (30.2%), Non-Catholic Christian (38.3%), Catholic (23.1%), Non-Christian (2.5%) and other (4.3%). Religious groups that fell into the other category were, self defined as other (3.6%) or 'new age' (0.7%). A total of 12 (1.2%) refused to state their religion and (.05%) were unsure. Religious frequency was obtained by asking respondents how often they attend church or religious functions apart from baptisms, weddings and funerals. Most indicated never (scored 1, 44.4%), followed by several times a year (scored 4, 18.3%), at least once a year (scored 3, 13.7%), less than once a year (scored 2, 11.0%), and finally at least once a week (scored 5, 12.4%). Trust in the church was obtained by asking respondents on a five-point scale (where 0 = 'Don't trust at all' and 4 = 'Trust a very great deal') how much they trusted the

churches. Only 1.5% of the sample was unsure of their trust in the churches, the mean trust score was 2.41 (SD = 1.44), and the modal response was 3.

As would be expected, those who were classified as Catholics (M = 2.89, SD = 1.30), Non-Catholic Christians (M = 2.79, SD = 1.31) and other religious groups (M = 2.52, SD = 1.64) were significantly more likely to trust the churches than those respondents with no religion (M = 1.64, SD = 1.34) and Non-Christians (M = 1.64, SD = 1.35), $F(4,977) = 42.70$, $p<.001$, $\eta^2 = .15$. Also those who stated they had no religion (M = 1.35, SD = .78) were much less likely to attend religious services than all other religious categories (M = 3.01, SD = 1.56). Trust in the church was also significantly associated with the frequency of religious attendance ($r = .43$, $p<.001$). Those who reported higher levels of trust in the church were also more likely to attend religious services more frequently. The strong relationships found between the three variables suggest good construct validity, in that evidence was obtained that the three questions were capturing a respondent's religious orientation.

To obtain an overall indicator of a respondent's religiosity, frequency of church attendance, religious type and trust in the churches were subjected to a latent class cluster analysis[1] (Goodman, 1974) using LatentGold Version 3.0.1 (Vermunt & Magidson, 2000). The results suggested two clear clusters of respondents (2-cluster solution: BIC = 8327.82, $L^2 = 215.69$, $p<.001$, df = 129, classification error = .09; 3-cluster solution: BIC = 8333.36, $L^2 = 173.04$, $p<.003$, df = 122, classification error = .17). All religious groups apart from 'no religion' were significantly more likely to be in cluster one, while those with no religion were more likely to be classified in cluster two (WALD = 17.98, $p<.005$, $R^2 = .19$). Those who attended church more frequently (WALD = 112.48, $p<.001$, $R^2 = .52$) and who placed higher trust in the church (WALD = 124.80, $p<.001$, $R^2 = .26$) were also more likely to be classified into cluster one and less likely to be in cluster two. Cluster one was therefore strongly representative of religious individuals.

Support for stem cell research

To assess support for stem cell research, respondents were asked to rate on an 11-point scale (where 0 = 'Not at all comfortable', and 10 = 'Very comfortable') how comfortable they were with the following scenarios:

1. Stem cell research using left over IVF embryos
2. Stem cell research using adult stem cells
3. Stem cell research using cloned human embryos
4. Stem Cell research being conducted in publicly funded Australian Universities
5. Stem Cell research being conducted in private Australian companies

The first three questions were constructed to assess comfort with stem cell research resulting from the three different sources of cells currently used by scientists in research. Questions 4 and 5 were constructed to reflect the different contexts in which stem cell research takes place, namely public and private scientific organisations. Questions were randomised along with 11 other questions relating to comfort with other new technologies (for example, DNA testing, genetically modified animals for food) not reported here (for a description of these questions and responses to them see Gilding & Critchley [2003]). Thus, each respondent was presented with a different order of the 5 questions among a total of 16 questions reducing the influence of any order effects on responses to the items. Since 'don't

know' responses were minimal for all five items, these responses were treated as missing (see Table 1).

Trust in scientific organisations

To assess trust in science, respondents were asked to rate how much they trusted scientists as well as three institutions where Australian scientific research takes place; that is, universities, hospitals and the CSIRO. Responses were recorded on a five-point scale where 0 = 'Don't trust at all' and 4 = 'Trust a very great deal'. Participants were also asked their level of trust in nine additional organisations which were not reported here (see Gilding & Critchley [2003]). Unsure responses to these questions were treated as missing (see Table 2).

Anti-intellectual beliefs and value of science

Three questions were used to assess an individual's anti-intellectual beliefs, and two were used to measure the value of science. In this research, anti-intellectual beliefs were defined as an opposition to the free and unrestrained search for truth through the advancement of science (Hofsteder, 1963). Three questions were asked which related to an individual's feeling that 'Scientists have too much control over nature', 'Science and technology are out of control, and beyond the control of governments', and 'It is important for governments to regulate new technologies'. The value of science was defined as beliefs relating to the utility of science. The questions asked were 'Science and technology can solve most problems faced by human beings' and 'Science and technology are continuously improving our quality of life'. Respondents were asked the extent of their agreement with each of five questions, where 0 = Strongly disagree and 10 = Strongly agree. Thus a high score on each of the three anti-intellectual items represented a strong belief that science should be constrained and a low score indicated that it should be allowed to occur freely. High scores on the two value questions indicated a belief that science is valuable, and a low score that it is of little or no value. Unsure responses were treated as missing (See Table 2).

Qualitative questions

The focus group participants were asked open-ended questions about: their perceptions of the benefits and negative aspects of stem cell research in general; and, the specific use of different sources of stem cells – adult stem cells, left over IVF embryos and cloned embryos – for research. Case scenarios were used to enhance comprehension of the source and application of these three different forms of stem cell research. Participants were also asked two questions about whether their attitudes differed depending on the context in which the stem cell research was conducted. The first asked if it mattered whether the research was conducted in publicly funded universities or by private, for-profit companies. The second was related to the context of their individual lives, whether their opinions would change if someone close to them had a serious condition for which there was no medical cure, but could possibly be helped by stem cell technology. All groups were given the opportunity at the end to add any views, opinions or attitudes not covered.

Results and Discussion

Level of support for stem cell research

As Table 1 and Figure 2 show, support for stem cell research varied significantly according to the context. In relation to the source of cell material scientists use, on average, respondents

were significantly more comfortable with stem cell research using adult cells, followed by cells used from embryos left over from IVF procedures and then cloning, $F_{context}(2, 1694) = 410.58$, $p<.001$, $\eta^2 = .33$. Further, as shown in Figure 2, both the religious and nonreligious cluster showed the same pattern of means, suggesting that the differences in the levels of comfort between each context did not differ due to religiosity, $F_{contet\ x\ group}(2, 1694) = 1.44$, $p>.05$, $\eta^2 = .002$. Thus, religiosity was not responsible for the differences in comfort found between the cell source contexts. However, averaged over all contexts, religious respondents (M = 4.97, SD = 3.04) were significantly less likely than non religious respondents (M = 5.54, SD = 3.12) to approve of stem cell research, $F_{group}(1, 847) = 11.31$, $p<.005$, $\eta^2 = .01$. As shown in Table 1, religious respondents were less comfortable with stem cell research using embryos left over from IVF procedures and cloning, but the two groups reported similar levels of comfort towards stem cell research using adult cells.

Table 1. Descriptive statistics for comfort with stem cell research questions by religious group.

Context		M	SD	Median	Mode	%Unsure
Left over IVF embryos	Religious	5.37*	3.23	6	8	3.4%
	Non Religious	6.09	3.12	7	10	3.3%
	Total	5.68	3.20	6	5	3.6%
Adult stem cells	Religious	6.39	2.86	7	8	7.5%
	Non Religious	6.74	2.87	7	10	10.8%
	Total	6.53	2.87	7	8	9.3%
Cloned human embryos	Religious	3.13*	3.04	3	0	4.0%
	Non Religious	3.76	3.28	3	0	5.0%
	Total	3.39	3.16	3	0	4.7%
Publicly funded Australian Universities	Religious	6.21*	2.76	7	8	5.9%
	Non Religious	6.92	2.75	8	10	3.3%
	Total	6.56	2.78	7	8	5.0%
Conducted in private Australian companies	Religious	4.51	3.05	5	5	5.5%
	Non Religious	4.72	3.10	5	5	4.4%
	Total	4.61	3.08	5	5	5.3%

Note: Comfort scores ranged from 0 – 10, * = Group means were significantly different across religious groups at the p<.005 level.

Table 2. Descriptive statistics for social trust, anti-intellectual beliefs and value of science questions.

	M	SD	Median	Mode	%Unsure
Social trust					
Universities	3.66	0.98	4	4	1.6%
Scientists	3.37	1.04	3	3	2.0%
CSIRO	3.68	1.06	4	4	3.4%
Hospitals	3.51	1.09	4	4	0.7%
Anti-intellectual beliefs					
Scientists have too much control over nature.	4.99	2.64	5	5	2.7%
It is important for governments to regulate new technologies.	7.51	2.37	8	10	0.7%
Science and technology are out of control, and beyond the control of governments.	4.55	2.63	5	5	0.7%
Value of science					
Science and technology can solve most problems faced by human beings.	5.16	2.59	5	5	1.4%
Science and technology are continuously improving our quality of life.	7.12	2.17	7	8	3.3%

Note: Trust scores ranged from 0 – 5. Anti-intellectual beliefs and value scores ranged from 0 – 10.

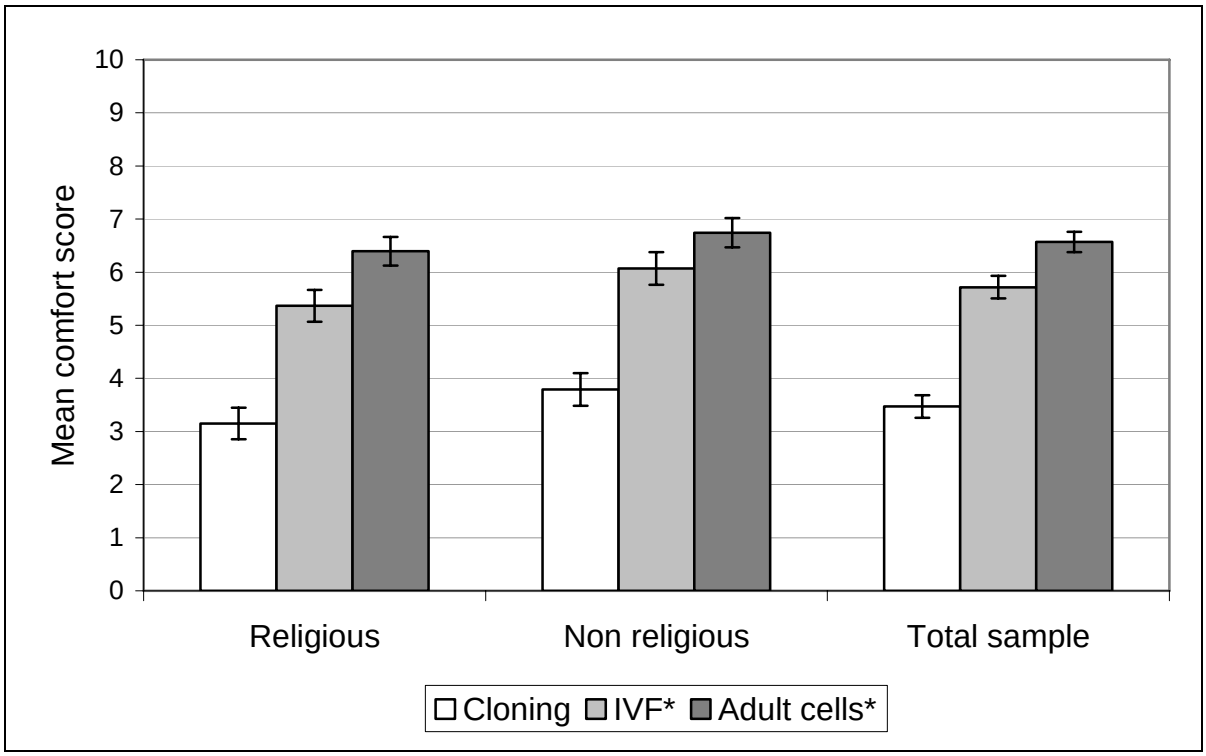

Figure 2. Mean comfort with stem cell research scores by cell context and religious group.

Note: * = Mean score was significantly different from the previous context. Bars represent standard errors of the mean.

The descriptive statistics in Table 1 reveal that the sample was not divided in terms of its support for stem cell research using cloned embryos or adult stem cells. Almost 30% of the sample was not at all comfortable with using cloned embryos, and the majority of the sample (63.4%) scored under the mid point (i.e. 5). Given this, and that the mean score for cloning was well below five and the modal response was zero (see Table 1), there was good evidence to conclude that the Australian public do not feel comfortable with scientists cloning human embryos for research purposes.

Concern was expressed about cloning research in all focus groups. The young women were specifically worried about the deliberate nature of the process of "creating something to kill it", of not only creating a human life but scientists going on to destroy that creation. Cloning research was also seen to be problematic because it "involves cloning ourselves"; that is, making an exact copy of ourselves which was seen to alter what it means to be human. We lose our uniqueness as someone separate and distinct from other human beings.

> [T]he whole cloning thing, the reason people don't like it is that what makes us human is our individuality and the fact that we are all completely unique. And the minute you start talking about cloning, that takes away that concept, we're no longer unique, we can be cloned. (Rebecca – younger woman)

The situation seemed to be reversed in relation to stem cell research using adult cells, where the majority of respondents scored over five (66.2%), indicating they were comfortable with this research. Although some (14.6%) sat on the fence regarding adult cells (that is, gave a response of 5), only 19.3% scored under five. The modal response was also high for this question (that is, 8), with the second most frequent response being 10. Hence the results in

this research suggest that public support for stem cell research using adult cells was not polarized and was found to be high.

There was however some evidence that comfort with stem cell research using embryos left over from IVF procedures was more polarized. As shown in Table 1, the modal response was five (15.7%). This was closely followed by eight (15.0%), ten (13.8%) and then zero (11.8%). A total of 53.5% of respondents scored over five and 30.8% scored under five. Thus although the majority indicated that they would be comfortable with using left over IVF embryos, a large proportion were at or under the mid point (46.5%).

Support for research using adult cells and ambiguity around IVF embryos were also themes in the focus groups. Using cells from adults was viewed by all groups as similar to other well-used and successful medical technologies such as "organ", "bone marrow" and "blood" donation. The support for using adult stem cells came through particularly strongly in the patient and the general public groups. Support was based on the altruistic notion of donating stem cells as a "gift" from one "adult helping another adult" to "improve [their] health" and to "create a liveable life".

> What would be the difference [between using stem cells] and taking your blood and using your blood to cure somebody else? {Michael, Tom and Paul all agree}. I mean you're taking a body fluid basically and using it to improve somebody else's health. (Richard – older man)

Participants in all groups, including the fundamentalist religious group, agreed that research using adult stem cells was "not controversial" and posed no moral or ethical issues above the norm for any other medical procedure. As long as donor and recipient were "well informed and educated", were "aware of the dangers" and freely gave their consent and the "cells are not traded" there was no foreseeable ethical problems with this research. The older male and patient group were the most supportive of adult stem cell research because they could personally see a benefit for themselves. They reported not being able to "see any downside" mainly because the use of adult stem cells avoids "rejection problems" because "they are the person's own cells".

An insight into the polarised view on stem cell research using left over embryos was provided by the older women, whose views were quite divided on the issue. Several, who expressed being comfortable with using superfluous IVF embryos, took the view that the use of the term "embryo" for early stage fertilised cell division was problematic because what scientists were using for their research was simply "four cells which are past their use by date, which would then have to simply be thrown into the incinerator or the rubbish bin or whatever". The argument then was "semantic" because people's responses to the question of using left over embryos would differ depending on the terminology used and most people, especially women and mothers, would think of an "embryo" as "an incipient child".

> [What you call it] doesn't make a difference to me… no difference. If it's past its used by date, it's rubbish which ever way you look at it and, if that can be turned into [or] recycled into research for the good of mankind, I'm all for that. (Margaret – older woman)

One of the women in favour of this type of stem cell research argued that left over IVF "cells" had been kept in a frozen state of "icy stasis" for five years and, being past their useful life, "nobody in their right mind takes a risk by, by re-implanting them". This gave rise to a discussion of the issues that were troubling others in the group. They were concerned about the experimental nature of using "old" genetic material that was well "past its use by date" and the extreme "risks" scientists were taking with human life because they "do not know

enough" about the long term effects of the introduction of potentially faulty cells into the body. This research conjures up images of "Frankenstein's monster" or brings to mind the scientific mistake of transmitting "AIDS in blood transfusions".

> Yes, I think [scientists] have got a long way to go. And I'd like them to keep working on [stem cell research] and not be to be grandiose on how they do the experiments, because I think there's a lot of things moving around our bodies that we really [don't know about]… Whoever would have thought of AIDS? You see, AIDS is a terrible thing and it's decimating parts of the world. And you know you'd only have to make one little mistake in the beginning… (Diane – older woman)

The older women were also concerned with the whole process associated with IVF embryos frozen in a state of limbo over a period of years for two main reasons. In the first instance, the suspension of human life, through the long term storage of embryos "in the deep freeze", was seen as repugnant. The second reason was their sense of foreboding over the loss of something natural and human, which was expressed in terms of the "the romantics" of reproduction.

> I mean [the long term storage of embryos] is just mind boggling to me… It's playing God, well and truly, it really is… [Hearing about a particular case] made me feel quite sick. (Pat – older woman)

> I don't think it's got anything to do with ethics… It's just I can't see the romantics of it. …I don't know, I mean, I personally wouldn't do it, full stop… [Y]ou get married, you fall pregnant … but to store something for… years and then... I just personally couldn't imagine getting married and waiting twenty-one years or even thirty years and suddenly--- Look I don't know, to me it's like storing something in the fridge or deep freeze, where it might come in handy [it's "like buying shares or something"]. (Leah – older woman)

Public versus private context

In relation to the context of where the research takes place, the means in Table 1 reveal that the sample was much more comfortable with stem cell research being conducted in publicly funded Universities than in private research organizations, $F(1, 947) = 472.72$, $p<.001$, $\eta^2 = .33$. Only 19.2% of the respondents were not supportive (that is, scored under 5) of stem cell research being conducted in public universities, compared to 45.8% being not comfortable with it in private organisations. Only 36.1% were comfortable with the research in private organisations, while 65.9% of the sample were supportive of a public context. Thus the findings suggest that while the Australian public appears to be supportive of scientists working in publicly funded universities, they do not approve of stem cell research being undertaken in private organizations.

The focus groups also generally supported this position. Private companies were seen to be self interested, "all about money", "maximising profits", and exploiting ill health for the sake of gain. They were seen as not operating in the best interests of the general public. Research outcomes in the form of therapy and cure were likely to be "only available to those who can afford it". So the skepticism about the motivations of private companies meant that most participants considered unequal access to be one of the biggest problems because "the availability of the eventual cure would only be for those with the most money". Participants were also concerned to ensure that government be involved in "monitoring" and regulation of

the industry, in particular private companies who would "not be subject to legislation [and] can go offshore" where "life is cheap".

> Of course because then we've got public access to it, everybody else can get in and actually investigate it themselves. If too much private goes into it then it'll get twisted into something that will be less effective but make them more money because there's no point private companies making something that works that they don't make money out of. So they're going to make it work less effectively and make more money. (Danielle – younger woman)

> I definitely agree with Sam… about, about the intellectual property of any developments, because it is an issue, especially these days with large American companies creating drugs and then selling them at exorbitant prices, you know, before the government can take steps to counteract that. At the moment this sort of research that we're talking about could have large benefits that a lot of us don't know about ... So it's the sort of thing that you might want to put safeguards in place so that the knowledge gained from it could stay in the public realm. (Rick – younger man – with agreement from other group members).

Explaining comfort with stem cell research

To test the theoretical model in Figure 1, Structural Equation Modelling (SEM) using EQS for Windows was used (Bentler, 1995). The tested model contained four latent variables (represented by ellipses) and one measured variable (represented by a rectangle), to represent the constructs, anti-intellectual beliefs, trust, comfort with stem cell research and religiosity. As shown in Figure 3, the latent variable comfort with stem cell research was indicated by the five measured comfort with stem cell questions. Trust was indicated by the four trust in organisation items, anti-intellectual beliefs by the three belief questions, and value of science by the two value questions. Religiosity was the only measured variable (apart from indicators) and represented the probability of being in the religious group.

The tested model was identical to the model shown in Figure 1 and the results showed that it was a reasonable fit with the patterns in the actual data, Satorra-Bentler χ^2 (86) = 258.84, Comparative Fit index = .92 (CFI; Bentler, 1988), Incremental Fit index = .92 (IFI; Bollen, 1989), Standardised Root Mean Residual = .07 (SRMR; Sörbom & Jöreskog, 1982). However, the Langrange Multiplier test (LM test; Lee & Bentler, 1980) suggested the model would be improved significantly if a path from trust to anti-intellectual beliefs was included (χ^2 = 47.47, p<.001). This modification was made along with removing a non-significant path from religiosity to trust, and the model was resubmitted. The final best fitting model was a reasonably good fit with the data, χ^2 (86) = 216.42, CFI = .94, IFI = .94, SRMR = .04, n = 764, and the results are shown in Figure 3.

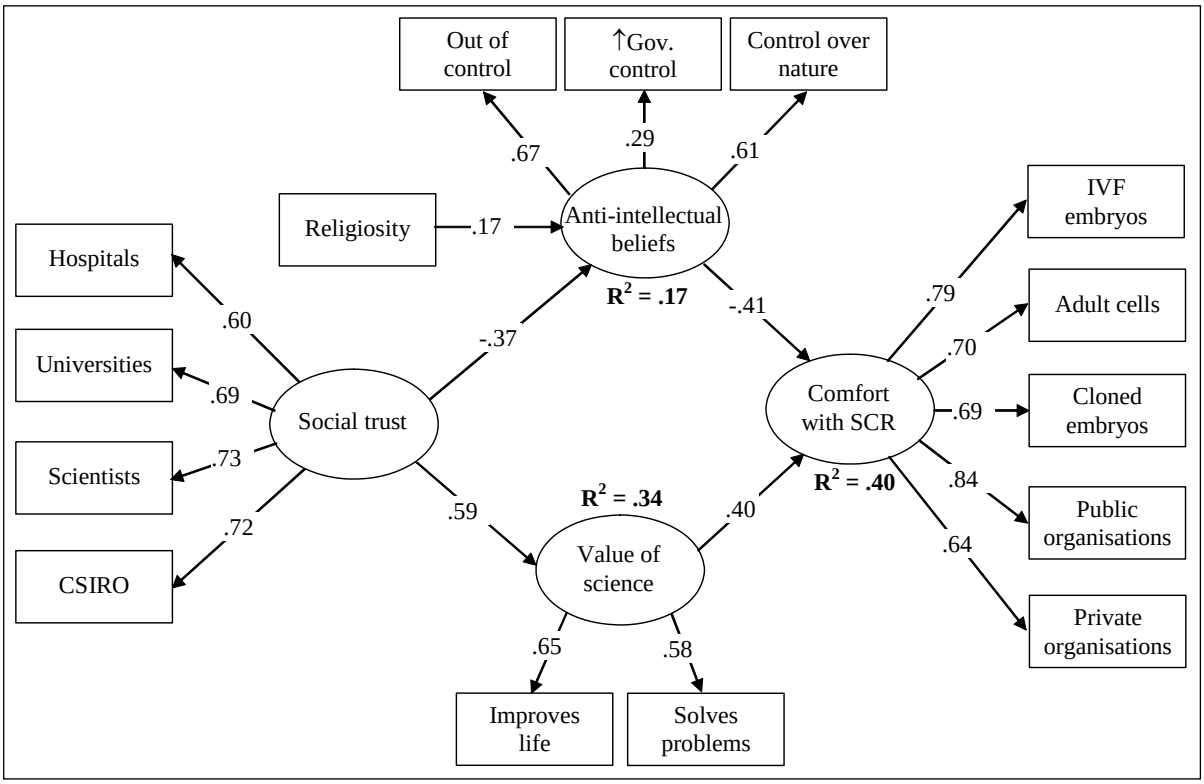

Figure 3. Best fitting model predicting comfort with stem cell research.

Note: All paths are significant at or above p<.05.

The arrows in Figure 3 represent the significant relationships found between each variable, and the standardised regression weights (SRW's) represent the strength of the relationship between the two variables. Standardised regression weights can range between 0-1, where 0 corresponds to no relationship between two variables, and 1 is a perfect linear relationship. Thus, higher values indicate stronger relationships between variables. Where there are no links between variables in the model, a zero relationship is assumed. The SRW's from a latent variable to a measured variable provide an indication of how much the variable has in common with the other indicator variables. Thus, the variable trust in hospitals shares 36.0% (i.e., $.60^2$) of its variance with the other three trust variables. Because the values of all four trust SRW's are significant, this means that as trust in hospitals increase, so does trust in Universities, scientists, and the CSIRO. The latent variable trust is thus composed of the variance shared across the four trust questions, and is assumed to reflect a theoretical representation of 'social trust'. The significant and strong paths for all of the latent variables suggest good internal consistency across individual questions, and thus provide evidence for the reliability and validity of the measures (Bollen, 1989).

The results in Figure 3 suggest that higher comfort in stem cell research was directly associated with anti-intellectual beliefs and the value of science. Individuals who were more likely to believe that scientific enquiry should not be restrained and that science produces valuable products were more likely to be comfortable with stem cell research. These two variables were able to explain a substantial 40% of the variance in comfort with stem cell research, indicating that the relationships between anti-intellectual beliefs and value in science were reasonably strong. Interestingly the modification indices (that is, the LM test) did not suggest a direct relationship between any of the predictor variables and the individual comfort with stem cell questions. Thus the relationship between comfort with stem cell

research and beliefs and value was not directly dependent upon the type of material used for stem cell research.

The model shows that, as expected and in line with the findings of Siegrist and his colleagues (Siegrist, 2000; Siegrist, Cvetkovich & Roth, 2000), social trust was strongly related to belief in the value of science. The stronger the trust in those institutions associated with science, the stronger the belief that science is valuable. Also supporting the work of Siegrist, the indirect effect of trust on comfort with stem cell research via values was strong and significant (Indirect effect = .24, $p<.001$). This suggests that those with higher levels of trust were more comfortable with stem cell research because they believe that science is more valuable.

Interestingly, lower levels of trust were also associated with stronger anti-intellectual beliefs. Higher social trust was associated with a belief that science is not out of control. The indirect effect of social trust on comfort with stem cell research via anti-intellectual beliefs was also significant (Indirect effect = .15, $p<.001$). This suggests that high social trust was also associated with comfort with stem cell research due to a belief that science is not out of control. Thus social trust impacted upon comfort with stem cell research in two independent ways, via beliefs in the value of science and also anti-intellectual beliefs. Overall, if Australians trust the organisations where stem cell research takes place, they are more likely to be comfortable with it because they believe that science is not out of control and is producing products that improve the quality of life.

These themes were also present in the focus groups. The men's groups in particular illustrated this point in their discussion. Many believed that stem cell researchers should be given a free hand to conduct their research, which unquestioningly was for the betterment of mankind. Medical science was seen as having served us well in improving our health and "if science never improved, we'd still be in the dark ages".

> I think first things first, the researchers into stem cell – they should have an open hand to really go ahead and research as far as they think is necessary. And the best results would come out of the research. (Joe – older man)
>
> Well I go along with that because all medical research, regardless of what medical research it was, has improved the standard of living for the people in the world, regardless of what sort of research it was [agreement from some other group members]. All this hoo-ha about stem cell research… (Richard – older man)

As expected, Figure 3 shows that those who were more likely to be religious were also significantly more likely to adhere to anti-intellectual beliefs. Religious individuals in this research were therefore more likely to see science as going too far and needing to be regulated. The indirect effect of religion on comfort with stem cell research via anti-intellectual beliefs was also significant though small (Indirect effect = .07, $p<.001$). This means that those who were more likely to be religious were less comfortable with stem cell research because they believe science has gone too far, has too much control over nature and should be regulated. The lack of a significant direct path between religiosity and the other variables means that religious individuals were not less likely to trust scientific organisations and devalue the products of science than non religious respondents. Thus the hypothesis generated from Siegrist's work, that religious people would be uncomfortable with stem cell research because they do not trust scientific institutions was not supported.

The results of the focus groups also did not suggest themes relating to trust in scientific institutions. Instead, like those in the survey, fundamentalist religious participants were

concerned that science had gone too far and was out of control. The reasons participants in the religious focus group gave for their extreme discomfort with stem cell research were clearly related to their religious beliefs and can be summarised into three main themes: the intrinsic value of human life; absolute faith in a divine God; and, belief in an afterlife.

Religious group participants' objection to stem cell research using embryos was strongly related to their belief in the intrinsic value of human life. They saw human life beginning when "the sperm and the egg come together" and, whether it is a "thing in a Petri dish", "a genome" "an embryo" or "a stem cell", the thing is "far more than just one or two cells". They considered all of these forms to be equivalent to a baby or a sentient individual who needs to be valued and protected because "every life is precious". Stem cell research using leftover IVF embryos and cloned stem cells for them involves "actually killing", "taking a life" and, as humans, "we have no right to take somebody's life or take a chance from them". To use left over IVF embryos that might otherwise be discarded simply "condones one evil over another evil, that is IVF itself, when, in fact, "they're both wrong". Stem cell research was seen to be premised on uncertainty, with scientific "trials" engaged in the wilful "wastage of human life". Curing disease does not justify "taking a life from the stem cell".

> I am just thinking, okay, you're a paraplegic but you can get through that. I don't see why you have to kill off clones and ultimately babies just so you can walk again. You've still got your arms and you've still got your brain and you've still got loved ones around. Just because you can't walk or it may affect what you loved to do at one stage, but I don't see why babies have to die for that. They may not think of it as babies but they could become babies if they let them. (Heather – religious – Debbie and Carl nod in agreement)

The second key theme that was a driving force enabling all participants in the religious group to formulate a clear position against stem cell research involving embryos or therapeutic cloning was a strong belief in a divine God and the "Divine Way". For them God provides "absolutes" that enable them to make a clear binary distinction between good and evil: "God is all good all loving, all wonderful in every way" and, standing in stark contrast, there is also this "sick and twisted" world which is "evil". God, through the teachings of the Bible, tells them His "intentions" and demarcates the clear lines over which humans should not cross. Life, death, suffering and healing are the preserve of God.

> As a few of us have been saying, you draw a line, and as far as I'm concerned anyway, that line doesn't move. I've had friends and a few loved ones pass away by incurable diseases. I don't see that as traumatic, it's what God intended. Something like Parkinson's I think that's one that is potentially helped by… stem cell research. But in the end, it doesn't sway my opinion on where life begins and I still wouldn't condone stem cell research in the hopes of attaining a cure for a disease. (Debbie – religious)

Participants reported feeling uncomfortable about scientists "acting like God" and "messing with life", and believed that individuals who want to avail themselves of the benefits of stem cell therapy are ultimately no better. They lose their humanity and 'disintegrate as humans". People do not have the right to "decide who should live and who should die".

> If we look at it from a purely biblical point of view, then [there] should be … no stem cell research; it should be that God gives life and He takes it away and He does it all in His timing. Our world is terrible, it's diseased, there's destruction everywhere, but He's the one that keeps everything in equilibrium; not for us, but

> for Him and for the ones He loves. (Luke – religious – with agreement from Debbie, Lydia and Tania).
>
> [T]he line is drawn in the sand and I believe in that line, I gave myself to that line in terms of my beliefs and I don't think I will let that slip. I'm just thinking how hurtful it would be if someone close was put in that situation [needing treatment from stem cell research]. But I think these principles, these truths, these absolutes that I hold onto are far more important to me, and to break them or compromise them would be a far greater loss for me. (Mark – religious)

The third main reason the religious group were opposed to stem cell research was the strong belief in an afterlife, and the sacrifices that had to be made to achieve "eternal life" pervaded their views. This life is seen as only temporary, a transitory "dream", in essence a testing ground for worthiness to attain "eternity" in "the presence of God" in "heaven". In this context injury, illness and suffering is good, a "part of life" to be embraced and celebrated rather than overcome or shunned. People who want a cure have it wrong; they have become "victims" who lack the strength of will to manage their suffering. To triumph and be "victorious" over ill-health or misfortune people need to embrace pain suffering and death and rise above it rather than wish it away. It is not death that is the "ultimate evil". Rather, evil is the abominations of man's desire to "mess with life".

> Yes, I think it just comes back to whether you do see illness as and death as the end of the road… If you fear death then obviously you are going to reach for a measure that you may not agree with, basically in desperation to save a life. But as Christians we don't value this life as much as we value our eternal life. Yes, so that's where it comes down to for me (Debbie – religious – Carl and Luke nod in agreement).
>
> Suffering is unfortunate, but it's a result of a broken will. But there's still a loving God who can give us the grace to live through any situation and circumstance with joy beyond belief. So as Christians, the line will never move because we know this life is a testing ground for an eternity that we will live in forever. So if you sacrifice an eternity in heaven for a life – the Bible describes the life of man as a breath of vapour that is there and vanishes. You sacrifice eternity for breath - and that doesn't make sense. (Carl – religious)

Conclusions

Taken together, the results of this research suggest that there may be a grain of truth in the media's portrayal of a community divided over stem cell research. However, this only appears to be the case when stem cells are derived from left over IVF procedures. In the case of adult stem cells and the use of cloning, the community does not appear to be divided. Instead, there was considerable support shown for the use of adult stem cells and substantial opposition to the use of cloning. Also supporting the assumptions made within the popular press, this research suggested that religiosity is one reason for a divided community. Religious compared to nonreligious Australians were less likely to support stem cell research, particularly when the cells were extracted from IVF embryos. This was particularly highlighted in the focus groups, where strong opposition was expressed towards creating or harming a human embryo under any circumstances, even if it meant saving the life of another human being.

The qualitative data showed that the views of a fundamentalist religious group's opposition to stem cell research was the result of their belief that embryos have the same rights as a fully

developed human being, and that science is a reflection of humanity's shameful desire to "mess with life". In the quantitative results, there was also a suggestion that anti-intellectual beliefs were the reason for the lower support for stem cell research among religious Australians. Supporting the general attitudes towards science literature (Francis & Greer, 2001; Fulljames, 1996), stem cell research was more likely to be opposed by religious individuals because they believed that science has gone too far, is out of control and needs to be restricted. This was despite religious and non-religious individuals reporting similar levels of social trust and value in the products of science. Opposition to stem cell research among religious Australians was therefore not due to a general disrespect for science and its products, but to a belief that the types of knowledge investigated by science should be restricted. As pointed out by the religious focus group participants, science should be particularly restricted in matters that are considered the preserve of God.

As expected, religiosity was not the sole predictor of opposition to stem cell research. Further, apart from the views of the extremely religious and homogenous focus group participants, religiosity as assessed in the more heterogeneous religious group within the survey data was relatively weakly associated with comfort with stem cell research. Support for stem cell research was more strongly associated with a combination of social trust, a perception that science is valuable, and beliefs in intellectual freedom. A high level of trust in the organisations where science is conducted was strongly associated with support for stem cell research for two reasons. First, coinciding with the findings with Siegrist (Siegrist, 2000; Siegrist, Cvetkovich & Roth, 2000), the results suggested that high levels of trust were associated with stronger support for stem cell research because science is believed to be generally beneficial to the community. The sentiments expressed in the non-religious focus groups echoed this finding. Trustworthy institutions were viewed to produce worthwhile outcomes, and since stem cell research is conducted in similar institutions, they were comfortable with it continuing. Second, social trust was also associated with support for stem cell research because of a belief that science should be free to examine what it needed to. This suggests that individuals were comfortable with allowing scientists intellectual freedom to use controversial methods to pursue knowledge, if they trusted the institutions in which the work was occurring. Although anti-intellectual beliefs were not directly associated with the value of science in the quantitative data, there was a suggestion in the focus groups that individuals believed that intellectual freedom is needed for science to produce valuable outcomes. Significant knowledge and findings were believed to be less likely if science was restricted in what it was allowed to examine. However, the results presented in Figure 3 clearly suggest that allowing such freedom would only be supported when the organisations housing the scientific work were perceived to be trustworthy.

Social trust was therefore the most important factor in determining the level of support for stem cell research in this research. There was also a suggestion that publicly funded organisations generated more social trust than private companies in relation to science. While a direct link between social trust and the public/private context cannot be made in the quantitative results, the survey data clearly suggested a strong preference for stem cell research to be conducted in publicly funded organisations rather than private companies. The focus group data also highlighted this preference, where private companies were viewed as being concerned primarily with self-interest and maximising profit rather than the pursuit of knowledge and improving the quality of life. There was also concern within the focus groups that any health benefits from stem cell research would only be available to those who could afford to pay. Thus concern relating to private companies conducting stem cell research appeared to be due to the likely access to the products of science rather than a perception

that the quality or value of the products would be different from within publicly funded Universities.

Overall, the findings presented here strongly suggest that social trust is an important factor in predicting the acceptance of new, complex and controversial technologies. Understanding the reasons behind this acceptance, in addition to the level of support for the research within the community has important implications for the future of Australian science. In a political environment where the public discourse on science and new technologies has been dominated by distinct vested interests, the results of this and any subsequent research will help to give the Australian community a voice in what should essentially be a democratic debate. Knowledge of the factors important in the formation of the acceptance of, or opposition to controversial scientific research will also aid policy makers and the scientific community to identify those issues which may need to be clarified in educating the community about the nature of complex research, and how, where and why it is being conducted. This is particularly pertinent given the forecasts made by many social and political commentators that the quality of scientific research, and eventually public perceptions of scientists, are likely to be eroded with increasing moves by governments to tie scientific and academic activity to private rather than public interests (Árnason & Árnason, 2004; King & Stabinsky, 1999). Future public opinion and attitude research should therefore examine directly the complex link between social trust, the methods used by scientists, and the context within which the research takes place.

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[1] Both frequency of religious attendance and trust in the churches were treated as ordinal variables.

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