Introduction

In recent months, the very public airing of the possibility of spectacular cures for various acute injuries and chronic degenerative diseases, such cures arising out of embryonic stem cell research has led to the Federal Government introducing legislation into the Parliament to permit embryonic stem cell experimentation and therefore the destruction of embryos, whilst at the same time to ban human cloning, whether for so called therapeutic or reproductive purposes.

The Government's proposal for embryonic stem cell experimentation is linked to the presence of 70,000 frozen embryos associated with the various IVF programmes in Australia and the argument that there is no moral distinction between letting a spare embryo die naturally and using it for research.

This paper canvases the issues involved and represents **a plea that embryonic stem cell research not be permitted**, largely, but not exclusively upon ethical grounds. The paper also draws attention to the possibility for cures based on the alternative, ethical acceptable research based on adult stem cells.

It must be clearly stated at the outset that the author works within Christian tradition of the God given value of human life from the very moment of conception and the equally strong conviction that the end, however worthy, never justifies the means employed to achieve a particular end.

Whilst great hopes are expressed by its protagonists for the benefits of embryonic stem cell research in terms of cures for various tragic illnesses and injuries, the destruction of human embryos involved in the process, as I will argue, is totally unacceptable. Furthermore, the strong possibility that cloning will be required to overcome rejection problems of embryonic stem cell therapies by the patient's immune system must also be regarded with consternation, to say the very least.

The considerable and over charged hyperbole around stem cells research, and especially embryonic stem cell research disguises the fact that the science and application of stem cells and cloning is in its infancy (if not "embryonic" stage) with broad sweeps of uncharted and turbulent waters to be crossed, and at what cost and for what precise gain?

Without wishing to impugn motives, Australia has a powerful lobby for embryonic stem cell research with its world leading IVF programme embryologists/scientists and others from related disciplines leading the

charge[a], supported by private research companies in which scientists, as suggested in Federal Parliament, may have a stake, and therefore an entitlement to profit financially[b].

We have the spectacle of people who will go to great lengths to win Government approval and funding for their research, even to the quite outrageous extent of wheeling in pathetic cases[c] of sorely afflicted individuals displaying the visible effects of terrible disease and illnesses despite the actual likelihood of cures for the individuals concerned based on embryonic stem cell research being remote[d]. The danger is that these people will gain the necessary approvals and funding at the expense of other less spectacular, but ultimately more beneficial research.As has happened previously with the IVF programme, we have the scientists rushing ahead, brushing aside or trivialising ethical concerns, minimising the difficulties and risks involved, overstating the potential benefits and manipulating the broader Australian community to accept that the end justifies the means however distasteful and unethical those means may be. Too often, the scientists are allowed to drive the ethics. As Sydney's Anglican Archbishop, Dr Jensen has said, "(t)he

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[I] "leading the charge" is not overstating the case – John McBain of the Melbourne IVF group is on record as saying that the reproductive debate was "hijacked by the conservative wing of the Catholic Church. It gives comfort to our local Taliban – religious extremists who will do anything to have their way" (Reported p7 of Saltshakers Christian Ethics Journal, April 2002)

[II] Senator Boswell has raised this issue in a speech on the money side of embryo research given in the Senate on the 15th May 2002 (posted on www.anglicanmediasydney.asn.au/2002/200.htm, see also Christopher Pearson's opinion piece, "Howard should rethink on Embryonic Stem Cell research", The Age, 25th June 2002. "All we have been told so far is that embryo research is about some struggling, noble scientists who want to help sick people, yet it is so much more than that". Senator Boswell then goes on to demonstrate what well may become a multibillion dollar business based on embryo research, with the main protagonists (and he names Prof Alan Trounson with his commercial links) being beneficiaries.

[III] An example of this kind of cruel and manipulative association, possibly raised unintentionally, involved a 19 year old paraplegic woman and is discussed further on in this paper.

[IV] According to the Weekend Australian, June 29-30, 2002, Professor Colin Masters of Melbourne University's Pathology Department considers claims of cures for Alzheimers via stem cell research, "a joke".

ethical outcomes should always be the prior discussion before a scientific leap

forward, not a minor sideshow limping slowly behind the scientific rush"[1].

There is a very significant "slippery slope" involved in the approval of embryonic stem cell research which will be addressed in a conclusion to this paper.

The irony in the proposed approval of embryonic stem cell research is that adult stem cell work and other treatments are more likely of success in providing cures for the chronic degenerative diseases, such as Parkinsons disease and Alzheimers disease.

It is instructive to note how both the reduction in babies for adoption through the widespread practice of abortion and the deferral of having children until women are well into their thirties, if not forties, has fuelled the extremely costly IVF programme with all its medical intrusions and heartaches, and then further to note how the IVF establishment now wants to drive our already overtaxed health system into yet another extremely costly programme with very uncertain outcomes. And all of this when there is so much competition for Government funding of education, welfare, hospitals, defence and national security, environmental protection measures, and national infrastructure renewal and development.

Stem Cell Research: What's all the Fuss?In recent months there has been a flurry of reports in the media on stem cell research and to a lesser degree on human cloning, with the Federal Government introducing legislation into Parliament on the 27th June to govern the conditions under which such research may proceed.

On one side of the debate are the scientists, their supporters in the media and State Premiers arguing for as little regulation as possible, whilst on the other side are Christian spokespersons (such as Dr Jensen, noted above, the Catholic bishops and various ginger groups such as Saltshakers, Australian Family Association, etc), together with a few ethically aware scientists, doctors and public commentators, arguing the very real ethical dangers in what is being proposed.

Also present on the side of those expressing caution are scientists not necessarily bothered by the ethics of destroying embryos, but more concerned about how realistic the hopes of cures based on stem cell research really are. Thus Professor Colin Masters has assessed the current hope of producing cures for the degenerative diseases based on stem cell research as "science fiction", being based on misunderstandings of the basic diseases[2].

Both the Coalition and Labor parties are reported to be giving their

parliamentarians a free conscience vote on the subject, when the Bill comes up for debate, possibly in August 2002.

What are Stem Cells?

Stem Cells are a special type of cell, initially found in embryos. From these stem cells all 210 different kinds of tissue found in the human body originate. They are also special in that they can replicate themselves indefinitely, unlike other cells in the body[3].

In November 1998, scientists reported that they had successfully isolated and cultured embryonic stem cells in the Laboratory[4].

There are other sources of stem cells, other than from embryos, and the range of these alternative so called "adult" stem cell sources appears to be increasing all the time. Scientists are discovering adult stem cells in virtually every part of the body they investigate, both children and adults, even infants, including not only bone marrow, placentas and skin, but also blood, brains, spinal cords, dental pulp, muscles, blood vessels, corneas, retinas, livers, pancreases and Lipo suctioned fat – in other words, a inexhaustible supply[5].

Why all the interest in Stem Cells?

The interest arises from the ability of stem cells to turn into other cell types. The scientists hope they will be able to control the process in the laboratory and then use them in medical treatments for the treatment of currently incurable diseases and severe injuries. The list includes blindness, Parkinson's disease, Alzheimer's disease, spinal injuries, heart disease, blood disorders, and diabetes, just to name a few[6] – a very worthy list indeed.

This is the way NSW Premier, Bob Carr[7] has expressed the hope:

> "…uniquely, these (embryonic stem) cells have the capacity to develop into every cell type in the human body. Once crafted or modified in a laboratory, stem cells could be transplanted to a damaged organ to give it strength; into the pancreas to encourage it to start producing insulin or into a damaged spine to heal injury."

Why in particular the Interest in Embryonic Stem Cells rather than Adult Stem Cells?

This question arises from the obsession with embryonic stem cells in the media as against the relatively poor and slanted exposure given to adult stem work. This in turn relates to the high profile given the IVF programme in countries like Australia and its leading scientists

(embryologists) in Melbourne and Sydney[e]. As noted, most of the lobbying for stem cell research has come from these men and others in related fields. By virtue of their involvement, whether in the IVF programme or in genetic engineering involving animals, their field of expertise lies in working with embryos. It is not unreasonable for them,

a) given their expertise,

b) the presence of some (surplus) 70,000 embryos in the freezers of their laboratories, and

c) the pressing need for medical solutions to incurable diseases and injuries,

that they should press for research into possible cures utilising the stem cells of these surplus embryos.

When highly reputable, high profile scientists appear in public with sufferers of various incurable diseases in tow, offering the potential of marvellous cures together with the assertion of the superiority of embryonic stem cells over adult stem cells on the basis of presumed greater adaptability into other cell types, many politicians and most of the media fall over themselves to embrace the latest world first advances for Australian medical science.

A good example of this phenomenon may be found in the opinion piece given by Bob Carr noted above, in which he likens opponents of embryonic stem cell research to Galileo's opponents back in the 16th century(!) and then links the despairing image of a 19 year old women paralysed from the neck down to embryonic stem cell research "expediting such cures, helping our fellow humans sooner rather than later." Premier Carr goes on to acknowledge the arguments of those who prefer research based on adult stem cells but in effect minimises the potential of adult stem cells with the assertion, "(m)ost scientists … believe that adult stem cells could only be developed into a limited number of stem cells and are not capable of making the specific stem cell types required for certain treatments." This assertion is plainly wrong and I will come back to it later.

It really is quite outrageous the way in which supporters of cures based on embryonic stem cell research wheel out these currently incurable cases to tug at our heart strings when in fact there is no plausible evidence for any such cures. In other words, we are presented with nothing more than hopes and that only on the basis of Governments providing very large amounts of money.

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[e] Australia is a world leader in embryonic cell research.

For a reasonably well argued case in favour of embryonic stem cell research, one that interacts with the legislative framework in Britain, see the opinion piece by Lord Robert May from the UK National Academy of Science in The Australian, 26th June 2002[8]. May's article however is yet another example of the false hope that is offered by the focus on embryos. "Parliament has been given the chance to unite and alleviate the suffering of millions", he says in relation to the proposed Bill. The whole argument is built on the potential – as yet unrealized – of embryonic stem cells curing the incurable. Such arguments are not founded in solid scientific research, and minimise the importance of the results achieved so far by adult stem cells. And again, in common with embryonic stem cell research protagonists, it is interesting and instructive to see how the encouraging results from the recent University of Minnesota study on adult stem cells (see later) is played down by Robert May. **What is the Australian Government Proposing?**

After meeting with the Premiers on the 4th April 2002, the Prime Minister announced that the Government would bring in legislation:

- to limit research to the use of 70,000 "spare" human embryos with donor consent required
- to ban all forms of human cloning, including so called "therapeutic" cloning (see below)

At the time, Mr Howard said future spare embryos were being excluded because "it could well be difficult to really determine in some cases whether the embryo was brought into being for the purposes of research, or for the purposes of reproduction"[9].

This decision was greeted with less than full enthusiasm by the State Premiers and the research community as being unduly restrictive, both in respect of the need to gain donor approval as well as the embargo on the use of future "spare" embryos.

Mr Howard justified the decision to release up to potentially 70,000 embryos for research on the basis that he could not see a moral distinction between letting a spare embryo die naturally and using it for research.

Interestingly, the Government initially proposed a moratorium on embryonic stem cell research, as has the United States. A major determining factor in changing the Prime Minister's mind on the issue, has not been the overwhelming success of embryonic stem cell therapies, but the economic benefits for the Australian biotechnology industry. 'If we don't do it, somebody else will' seems to be the reasoning of the day, with the potential economic benefits far

outweighing any serious ethical issue at stake.

On the 30th May 2002, the Federal Government announced that it had awarded $46 million to the Monash based Centre for Stem Cells and Human Tissue Repair, headed by Alan Trounson, for human embryo stem cell research (matched by a further $10 million from the Victorian State Government). This decision by the Commonwealth and State Governments is quite intolerable and shocking given that the legislation permitting such research has not even passed through Parliament[f].

The "Research involving Embryos and Prohibition of Human Cloning" Bill was introduced into the Federal Parliament on the 27th June 2002 and will be debated sometime mid to late August 2002.

It needs pointing out that the Bill as it stands will allow destructive research on human embryos not only for stem cell research, but also for improving cell culture techniques, drug testing and toxicological research, so long as the proposed research can be shown to "improve knowledge", a very broad definition indeed.

What is the Concern over Embryonic Stem Cell Research?

There are two main concerns with embryonic stem cell research.

1. The stem cells are removed from the embryo approximately 5 to 7 days after implantation of the sperm cell into the egg cell. In the process the embryo is destroyed and therefore discarded, i.e. **embryonic stem cell extraction involves the killing of human embryos**. The ethical issue is that every human being was once an embryo. Life is a continuum from fertilisation to death. It is biologically true that the entire potential for a human being rests in the embryo. For everyone of us there was a point in our existence when we were just like one of these embryos to be destroyed[10].

   Research on embryonic stem cells replaces the potential of a human being for the potential of a desired research outcome[11]. Those currently involved in the IVF programme are proposing to move from forming embryos for the purpose of producing babies to forming the same embryos for research on embryonic stem cells, in the process destroying life.

V It is reported that Trounson confirmed that he was already importing embryonic stem cell lines from overseas (under a loophole in the legislation) and that the research effort would continue using this material. (Article by Metherell and Smith, "Stem Cell scientists given $46 million ahead of ban vote", Sydney Morning Herald, 31st May 2002)

The scientists in favour of embryonic stem cell research argue that the embryo is not a human That however, only lands them in the morass of trying to decide when is a human, human, a question they would much rather avoid answering. At a recent press conference a certain (US) Senator, one Senator Arlen Specter, when asked by a reporter, in the context of human cloning, “when does life begin?”, replied, “I haven’t found it helpful to get into the details”[12].

Others argue that it is actually wrong to protect a few embryos even though they can develop into adults, if so doing will prevent the treatment of a much larger group of people who suffer terribly. It was on the basis of this kind of thinking that awful medical experiments occurred in Nazi Germany. In other words, it is being proposed that we will sacrifice one class of human beings (the innocent embryonic) in order to benefit others (those suffering)[13].

Scripture (Ps 139:13-16) shows us that the unborn are known and valued by God (see also Job 10:8-12, Job 31:15, Isaiah 49:1, Jeremiah 1:5). Genesis 9:6 prohibits the killing of fellow human beings who are made in the image of God (Genesis 1:26,27). It is unethical to sacrifice one group of humans, even unborn, to benefit another. Scripture warns us against this utilitarian approach to ethics, that is, doing evil so that good may result (Romans 3:8)[14].

2. There is a second and serious **problem of rejection when cells from a source other than the patient, such as those derived from an embryo, are injected into the patient**. The rejection arises because the genetic makeup of the embryo will differ from that of the patient, and if injected, will be identified by the body as foreign and attacked by the body’s immune system[15]. The scientists entertain hopes of overcoming this problem. **One of the proposed solutions, perhaps the only one, is to make a clone of the patient** so that the resultant embryo can have its stem cells extracted at 6 days (once again, destroying the embryo), these stem cells then being processed into the desired cell type and injected into the patient without the threat of rejection. This type of cloning is termed “therapeutic” cloning as distinct from “reproductive” cloning.

So, explain Therapeutic Cloning and why call it “Therapeutic”?

Therapeutic cloning occurs in the laboratory when the nuclear material in the donated egg cell from a female is removed (i.e. the DNA

of the egg is removed) and replaced by donated nuclear material which can be drawn from any cell in the donor who may be male or female. The resultant cloned embryo is then genetically identical to the donor.

The word "therapeutic" is added to distinguish the process from "reproductive" cloning, because in this way, it is claimed, a therapy for a particular disease can be developed[16].

What is the Concern about Therapeutic Cloning[17]?

The distinction between "therapeutic" and "reproductive" cloning is largely semantic, a mirage in fact. The only difference is that the development of the embryo is stopped at the "blastocyst" stage (i.e. at 6 days) in the case of "therapeutic" cloning whilst in "reproductive" cloning the blastocyst is allowed to continue to develop and is implanted in the uterus and a complete, cloned organism allowed to develop. "Dolly", the first cloned sheep was produced by this method, and here is the basis for the widespread fear that the same method that is used for "therapeutic" cloning can also be used for the selective breeding of humans. The fact that the same embryologists who run our IVF programmes are the ones pushing for work on embryonic stem cells only heightens this fear.

There are other concerns with cloning:

1. The **danger of tumours** – this is a major problem with embryonic stem cells, both normal and cloned. The problem of tumours and other defects for Dolly have been well documented.
2. The **danger of genetic instability** – whilst cloned animals have given the appearance of full health, the probability of their having numerous genetic defects is very high – most cloned animals die before birth, and of those born alive, not even half survive for three weeks – a success rate, rated at best, of 3-4%.
3. Cloning by nuclear transfer does not actually produce an identical reproduction genetically since **some of the genetic material from the body cell** (de-nucleated ova) **steals into the new fusion of cells.**
4. There are serious question marks around the **availability of donor eggs**[g] and the **viability of a large scale cloning operation** given the technical issues involved such as the low efficiency of nuclear transfer procedure[18].

What potential do Adult Stem Cells have as an alternative to Embryonic Stem Cells?

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[1] i.e. which women and class of women will provide the eggs and upon what basis?

Considerable, judging by the most recent edition of the scientific journal Nature[19] in which a University of Minnesota study of the use of adult stem cells was reported: "(the University of Minnesota) team has compelling evidence that they have isolated a stem cell from adult human bone marrow that can produce all the tissue types in the body, from blood to muscle to nerve". The research team "have all but settled that debate (whether adult stem cells could, like embryonic ones, make every tissue type) by identifying an adult cell that can grow into any other cell type". They isolated a particular, and common cell type in bone marrow from mouse, rat and human. They injected the mouse cells into mouse embryos and then found the cells' descendants turning up in all three major body cell types - bone, muscle and fat. In fact, some of the mice were stated to be 40% derived from the bone marrow stem cells. It is further said that whilst this research will need to be duplicated and extended as well as compared to research based on embryonic stem cells, "it is most encouraging".

There is a growing body of literature on the **successful application of adult stem cell research**[20]. To date there have been some 45 successful documented human clinical trials[21]. The web site, www.stemcellresearch.org, maintains an up to date listing of successful applications. Particularly note worthy are:

a. the use of the patient's own adult neural stem cells at the Cedars-Sinai Medical Centre in Los Angeles achieving a total reversal of symptoms in the first Parkinson's patient treated, and this two years after the patient was first treated[22];
b. the successful and replicated many times treatment of patients who have lost their blood forming tissue through radiation or high dose chemotherapy by retransplanting previously removed bone marrow stem cells[23];
c. the successful treatment in 2001 of a cardiac infarct patient with stem cells from pelvic bone marrow[24] and other reports of successful treatments with adult stem cells in cases of Crohn's disease (chronic infection of the gut), thalassemia (a blood disease) in a little Singaporean boy and a rare skin disease[25].
d. In another twist, evidence has been offered by a joint Norwegian/US team of human skin cells made to act as immune system cells and even nerve cells[26].

In contrast to all of the above, **reports of successful conversions of embryonic stem cells are very infrequent and cautious** and as for cures based on embryonic stem cells, **there has not been one single cure or application established anywhere[27]**. However it

would be unwise to count on this as a continuing state of affairs as demonstrated by a second report in the edition of Nature noted above, of the reversal of the symptoms of Parkinson's disease in rats using modified stem cells from mouse embryos without recourse to therapeutic cloning.

In none of these assertions should it be assumed that it is all over bar the shouting for adult stem cell research – far from it. Lillge has reported on the many difficulties to be overcome with adult stem cell research[28]. The recent University of Minnesota research noted above will need to be replicated in other laboratories, while the leader of the research team has stated that continuing research is needed on both embryonic and adult cells, and further that the true nature of the cells she was working with was still "a mystery at this stage".

Is the Use of Adult Stem Cells ethical?

Yes. Adult stem cells do not require the killing of any human organism nor require therapeutic cloning.

Whether or not in the long run, embryonic stem cells provide as good as or even better treatments as adult stem cells, and clearly that is not the case at present, the ethical argument should prevail and therefore embryonic stem cell research should be banned with no funding given.

Where can I find good material to keep up to date on the Subject?

Read the newspapers, listen to the news on radio and television, though remember there has been a consistent bias in the media and the Australian scientific community in favour of embryonic stem cell research. Fairly typical is the reaction of Professor Martin Pera reported in The Age in regard to the University of Minnesota adult stem cell study "It is a pretty impressive and carefully conducted study", he said. "It in no way eliminates the need for embryonic stem cell research, which is the gold standard to which this would be compared.(italics added)" [29]. This bias may begin to change if adult stem cells continue to throw up encouraging results well in advance of those offered by embryonic stem cell research.

www.anglicanmediasydney.asn.au and www.stemcellresearch.org are two excellent web sites, reliable sources of information. Dr Megan Best from the Social Issues Executive of the Anglican Diocese of Sydney has written(www.anglicanmediasydney.asn.au/socialissues/index.html),

helpful summaries also an article in The Briefing June 2002, “When are we human?”.

Also helpful on the broad range of bioethical issues is John Ling’s little book, “Responding to the Culture of Death” (ISBN 1 903087 26-0). John Ling writes in the context of the British “Human Fertilisation and Embryology Act 1990 as follows:

> “First, we have publicly accepted, for the first time, that human beings can be the subject of research and experimentation that is not for their own benefit, and without their consent. This is a very frightening departure from traditional medical ethics. Second, ……(this point relates to a peculiar aspect of the British legislation). Third, we have created a new race of human beings. They are created in laboratories, and they are killed in laboratories. Is this not the last word in exploitation and manipulation of human life?”

Indeed!

Conclusions

There are substantial and over riding ethical issues as to why not only human cloning but embryonic stem cell research should be banned.

There have been very far fetched claims made for the benefits of embryonic stem cell research, not at all assisted by the minimal progress in the application of embryonic stem cell research. It may well be that these claims have been made as much for the benefit of the careers of those involved in the research , and the biotechnology industry as a whole, as for the cure of those recently paraded in support of requests for funding and the approval of embryonic stem cell research.

There are very real concerns that in approving embryonic stem cell research, a veritable pandora’s box will be opened

- thus, the 70,000 embryos are unlikely to be anywhere near enough for research purposes if experimentation is restricted to the current stocks of frozen embryos, a situation that will be exacerbated by the likely poor response of donors to requests to surrender up their frozen embryos for research purposes and therefore destruction[h]. As a consequence of these considerations, there will certainly be a tremendous push to allow ongoing surplus embryos from the IVF programme to be

[1] All this of course raises uncomfortable questions about the IVF programme and why there are all these 70,000 frozen embryos in storage.

made available for research

- It is then not difficult seeing arguments being brought forward subsequently, as an incremental subsequent step, for harvesting of embryos specifically for stem cell research. Margaret Wertheim has made the point that harvesting human eggs is a very “invasive procedure” and a “traumatic experience” for women and the side effects are not yet known[30].
- whilst it is confidently predicted that the need for cloning will be brushed under the carpet in order to achieve passage of the Government’s current legislation, the problem of rejection of cells derived from embryos means that cloning (under its artificial, but soothing description, “therapeutic” cloning), will be resurrected at a later date once the principle of, and funding for, embryonic stem cell research has been secured.
- So called therapeutic cloning is simply reproductive cloning terminated at Day 6 - where will the process stop?
- and what other parts of the health industry will pay for experiments in stem cells and human cloning and on what basis will any benefits arising be apportioned across a needy community - will there be a cut off age?

These concerns cannot be lightly dismissed. In the article cited above, Margaret Wertheim, noted science writer, dismisses the ethical argument about destroying embryos, saying “(w)e’ve been throwing away embryos produced through IVF for 20 years and nobody’s kicked up much of a fuss about that”. What a perfect example of the slippery slope argument. We already destroy embryos in the IVF programme, so what’s the hangup about destroying embryos in stem cell research? It ought to be pointed out that Christians have opposed the IVF programme from the beginning on ethical grounds, though to no avail[31].

Another tragic example of the slippery slope it does well for us to remember, is how the case for abortion was argued back in the 1960's and 1970’s and to compare what was said then with the nearly 100,000 abortions performed each year in Australia[i].

This paper has benefited from review by Dr Mathew Piercy, MBBS, Mercy Hospital for Women, Est Melbourne and Professor DJW Milne,

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VI The Menhennitt ruling (Victorian Law Reform, 1969) stated that an abortion is not unlawful as described by the Crimes Act if the woman’s physical or psychological health is in serious danger by the pregnancy. The fact is that nearly all abortions performed today do not fulfill the legal requirement of the Menhennitt ruling, but are rather for personal and social convenience.

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20th July 2002

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3 Dr Megan Best, posted www.anglicanmediasydney.asn.au , week commencing 12.5.02

4 Stem Cell Research and "Therapeutic" Cloning", Linda K Bevington, see www.stemcellresearch.org.

5 Michael Fumento, "Stem Cell Political Science", see www.stemcellresearch.org

6 Editorial "Case for embryonic stem-cell research", Sydney Morning Herald, 4th April, 2002 www.smh.com.au

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[2] Dr Megan Best, posted www.anglicanmediasydney.asn.au , week commencing 12.5.02

[3] Wilfgang Lillge, "The Case for Adult Stem Cell Research", see www.stemcellresearch.org

[4] This section is largely taken from Wilfgang Lillge, "The Case for Adult Stem Cell Research". see www.stemcellresearch.org

[5] Wilfgang Lillge, "The Case for Adult Stem Cell Research". see www.stemcellresearch.org

[6] Helen Pearson, "Stem Cell Hopes Double", 21st June 2002 nature science update website www.nature.com. An informative summary of this research and reactions to it may be found in an article, ""Stem cell feat lauded by politicians awaits scientific blessing" written by Sharon Schmickle and published in the Star Tribune, 7th July 2002

[7] David A Prentice, "The Science of the Cloning Debate: Latest Developments", see www.stemcellresearch.org

[8] Joyce Howard Price, "Study supports versatility of adult stem cells" The Washington Times, 21st June 2002, see www.stemcellresearch.org

[9] BBC News, 9th April 2002, www.news.bbc.co.uk

[10] Wilfgang Lillge, "The Case for Adult Stem Cell Research". see www.stemcellresearch.org

[11] Wilfgang Lillge, "The Case for Adult Stem Cell Research". see www.stemcellresearch.org

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[13] Andrew Pollack, Method mat transform cells without change", New York Times, 1st May 2002, see www.nytimes.com

[14] Dr D van Gend reported in "Adult stem cells better for research than embryonic ones" by Lynne Stringer, published in The Queensland Baptist, 10th April 2002

[15] Wilfgang Lillge, "The Case for Adult Stem Cell Research". see www.stemcellresearch.org

[16] Tom Noble, The Age, 21st June 2002 "Adult stem cells show promise in producing organs"

30 Report in The Age, 6th July 2002, “Stem Cells and cloning may be the future of medicine, but will the public buy it?” written by Jane Sullivan.

31 See John Ling’s, “Responding to the Culture of Death” (ISBN 1 903087 26-0), pages 33-39