

**RESPONSE TO THE BIOETHICS ADVISORY COMMITTEE'S
CONSULTATION PAPER ENTITLED, 'HUMAN-ANIMAL
COMBINATIONS FOR BIOMEDICAL RESEARCH' BY THE NATIONAL
COUNCIL OF CHURCHES IN SINGAPORE**

INTRODUCTION

The National Council of Churches (NCCS) appreciates the invitation by the Bioethics Advisory Committee (BAC) to respond to its consultation paper entitled, 'Human-Animal Combinations for Biomedical Research'. The NCCS is also appreciative of the care and sensitivity with which the BAC has presented its position on this complex and controversial topic, and the extended time that it has given for the public to debate the issue.

This paper is divided into three parts. In Part One, we briefly respond to some of the points raised in the BAC consultation paper. As many of the issues raised by the consultation paper will be addressed in the main body of this paper (i.e., Parts Two and Three), the first part of the paper is necessarily brief. In Part Two, we present some general ethical concerns concerning some forms of chimera research from the standpoint of the Christian Faith. These concerns have to do mainly with human uniqueness and dignity and with the integrity of the created order that certain forms of research involving human-animal mixtures may violate. Part Two examines the ethical concerns of the different forms of research involving human-animal mixtures. This approach is necessary for two reasons. The first is that not every type of chimera research poses the same ethical concerns from the Christian standpoint. The second reason for this approach is to address what we perceive to be a weakness in the BAC's presentation. While the consultation paper is very lucid and tightly argued, at the same time it suffers the disadvantage of being too general. Because there are many different types of chimera research, it is not only profitable but it is indeed necessary to evaluate the ethics of each. Only when this is done will a clearer and fairer picture emerge.

At the outset, it is important to state that the NCCS is not opposed to all forms of induced chimeras or biomedical research involving human-animal mixtures. For example, the NCCS maintains that there are no strong ethical objections to xenografts where the heart valve of a pig is transplanted to a human patient. Neither do we object to the transfer of most types of differentiated human stem cells into the hearts or kidneys of mice, pigs or even non-human primates for the purpose of research because this is not likely to result in the emergence of chimeric beings with the capacity to think, feel and act like humans. In this sense, we agree with the view forwarded by the BAC that the contrary to nature argument does not succeed. If it were to succeed, then we would have to stop all interspecies procedures like xenotransplantation, and the manufacture of insulin and erythropoietin. But there are many forms of chimera research, for example the transferring of human neural stem cells into prenatal non-human hosts (especially primates), which we maintain are ethically questionable and should therefore be prohibited.

In many ways, this paper goes beyond a point-by-point response to the BAC's consultation paper. It also aims to present the positions of the NCCS on the different forms of human-animal combinations. Some of the procedures addressed in this paper have not been actually carried out, and are already prohibited by many significant international bodies. For other procedures addressed in this paper, experiments have already been undertaken, although assessments on the ethical problems or concerns they pose have been varied. The NCCS would like to present its views on these procedures as well as the reasons that informed and shaped these views. This paper therefore addresses many issues that are not specifically discussed in the BAC consultation.

PART ONE: GENERAL COMMENTS ON CONSULTATION PAPER

The purpose of the first part of this paper is to interact directly with the consultation paper presented by the BAC. In particular, attention will be directed at those points or issues raised by the consultation paper that will not be addressed in Parts Two and Three of this paper. The discussion in Part One will include general observations and comments about the consultation paper as well as some of the specific issues it raises. Because most of the main issues will be taken up in Parts Two and Three of this paper, the discussion here will be brief.

As we have mentioned in the introduction, while the consultation paper is well-written and lucid, it suffers from being too sweeping and in some sense abstract. While the paper has done a fine job in defining chimera and hybrids and describing some of the potential benefits of such research, it fails to examine the different types of chimera research, especially those involving human-animal mixtures. This approach in our opinion has compromised the discussion because it implies that all forms of research involving human-animal mixtures present the same ethical concerns when this in fact is not the case. This approach also can potentially lead the reader who is unfamiliar with the ethical issues surrounding such research to think that once the ethical objections (discussed in pages 19-27) are examined and rebutted, all chimera research should be allowed. But in reality this is not the case at all. For a clearer, comprehensive and fairer discussion of research involving human-animal mixtures it is imperative that the different types of research are discussed and the ethical concerns that attend to each of them are assessed.

While the BAC is generally correct when it states that a person who has received a pig heart valve through xenotransplantation and a person who has had blood transfusion are technically speaking chimeras, its failure to differentiate such examples from the chimeras that scientists have produced or intend to produce can be misleading. This presentation may lead the reader to conclude that since there are no strong ethical objections to the 'creation' of such chimeras (e.g., through transplantation) there should also be no strong objections to the 'creation' of other forms of chimera in the laboratory. But using a pig's valve to replace the diseased heart valve of a human patient is very different from injecting undifferentiated human stem cells into a nonhuman zygote. If discussion on the ethical implications of human-animal chimera research is to be conducted in such a way that members of the public are able to make a reasoned evaluation, this distinction must be discussed and

even emphasised. This is especially when people with no background in biological science or ethics are invited to participate in the consultation.

In its discussion on the concept of ‘Playing God’ forwarded by some Christians, the consultation paper asks, ‘How do we know what divine plans are when it comes to scientific knowledge and practice? Is it not possible that stem cell research is part of those plans?’ A fuller response to the BAC’s interpretation of this concept is given below (See section entitled ‘Playing God’ in Part Two). Briefly, the concept ‘Playing God’ should not be abstracted from its original theological framework in the Judeo-Christian tradition. According to that tradition, God has called human beings to serve as stewards of his creation. When Christians say that human beings should not ‘play God’ they mean that they should not act in ways that transgress the will of God and his intentions for humankind and the created order. One of the ways in which scientists ‘play God’ is when they see human lives as having only instrumental and not intrinsic worth. Such an approach would violate the dignity that God himself has accorded to human beings. Not all stem cell research is a violation of human dignity. In the view of the NCCS, human embryonic stem cell research, which results in the destruction of the human embryo, is a violation of human dignity because the early embryo is a human being worthy of respect. Thus, we know that certain forms of embryonic stem cell research is not part of the divine plan because it results in the destruction of human beings created to be bearers of God’s image.

The question of the moral status quo that separates humans from animals is important for Christians. The BAC has argued that change in this moral status quo is not necessarily a ‘bad thing in the long run’ (p. 24). It provides as examples the emancipation of slaves and the women’s liberation movement to substantiate its point. The NCCS maintains that changes in perception of the moral status of humans and animals should not be confused with the changing social norms concerning women or slaves. For the Christian, the special moral status of human beings is not a social construct that may be subjected to deconstruction. The distinction between human beings and animals is deeply rooted in our understanding of ourselves and the other animal species. It is from this profound self-understanding that human beings develop their attitude to the world and the other animal species. No civilised society would countenance a shift in social norms in which farm animals, for instance, are valued more highly than human infants because of their economic worth and potential. Such a change in the moral status quo or social norm is profoundly harmful to human society. The moral status of human beings is discussed at greater depth in Part Two of this paper.

Finally, we wish to comment briefly on the ‘wisdom of repugnance’ and the slippery slope argument which in our opinion the BAC paper dismisses too quickly. The NCCS agrees that the feeling of repugnance towards a particular research should not be the sole reason for rejecting it. The feeling of repugnance does not constitute an ethical argument, and those who appeal to it have never presented it as such. But repugnance (i.e., things that one finds ‘repulsive’, ‘distasteful’ and ‘offensive’) should not be dismissed simply because it is not a reasoned ethical argument because such reactions often point to deeper realities. Leon Kass explains:

In this age in which everything is held to be permissible so long as it is freely done, in which our given human nature no longer commands

respect, in which our bodies are regarded as mere instruments of our autonomous rational wills, repugnance may be the only voice left that speaks up to defend the central core of our humanity. Shallow are the souls that have forgotten how to shudder.¹

Those who see repugnance only as irrational emotion fail to understand that human emotions are complex, laced through and through with thought. This is especially so when it is the collective response of members of a community. Repugnance, of course, is not the end of the matter but simply the beginning. The point is that we must take these reactions seriously enough to submit them to rigorous reflection. In similar vein, although it is true that the ‘slippery slope’ argument cannot be the sole or main factor in ethics, it is nonetheless important because it alerts us to the fact that our actions have consequences and it compels us to pause and reflect deeply on these consequences.

PART TWO: THEOLOGICAL AND MORAL FRAMEWORK

Research involving the combination of human and animals present serious and complex ethical concerns not just for the Christian community but also for society in general. The novel situation that results from the creation of animal-human mixtures presents such an immense challenge to society that the responses have often been visceral and mixed. Some would support such research because of their therapeutic potentials while others would find such research, which unnaturally induces interspecies genetic combinations that causes the emergence of chimeric entities, repugnant and repulsive.

While the Christian scriptures have very little to say directly about such research, it does provide a broad theological framework within which members of the Christian community could reflect responsibly on their ethical implications. For instance, because such research involves genetic and other materials that are taken from humans and combined with that of animals, the question of the uniqueness and dignity of the human being becomes a pressing one. This question also relates to the status of the early embryo, which is often used in such research. Questions concerning the use of animals for research and the biomedical risks associated with such research must also be addressed. The ability to create chimeric entities through genetic engineering and other forms of biotechnology has fascinated scientists. But the technological imperative which silently albeit powerfully drives such research must be critiqued. This is where the notion of ‘Playing God’, which has been variously utilised by theologians, ethicists and scientists, must be examined more closely.

A. Human Uniqueness

The Christian faith teaches that human beings are created in the image of God and therefore must be distinguished from the other species in the animal kingdom. There are many ways in which the concept of the divine image has been interpreted in the Christian tradition. All these various interpretations point to the general idea that because human beings are created sufficiently like God they have the capacity to

¹ Leon R. Kass, ‘The Wisdom of Repugnance’, *New Republic*, Vol.216, Issue 22 (June 2, 1997).

relate to him. In other words, the communion between God and human beings is made possible by the fact that human beings bear the divine image. Human beings therefore are accorded a special moral status among God's creatures. This of course does not imply that other animal species are denied moral standing. But as bearers of the divine image, human beings are conferred a special place in the moral universe.

The view that human beings enjoy a special moral status and must therefore be treated differently from other animal species is not exclusively a Christian one but is shared by many. This is seen in a number of cultural and ethical conventions. For example, in most societies, killing a human being requires a quite different moral justification than taking the lives of other animal species. Many would also find the suggestion to use members of our own species to serve our own ends morally unjustifiable. The restrictions to the use of animals are not as stringent as those that apply to our treatment and use of human. And finally, human flourishing is deemed as more important than animal flourishing, and consequently the lives of humans are worth greater sacrifices to protect and support than the lives of animals.

Different attempts have been made to point to that which distinguishes humans and other animals. It is important to note that because the human being is such a rich and complex arrangement of powers and qualities it is impossible to isolate a single property or *differentia* that distinguishes it from the other animal species. There are, however, a number of qualities that make human beings different from the other animal species. Some of these qualities are language, conceptual thought, moral understanding, morally responsible behaviour, and second-order beliefs (i.e., beliefs about one's beliefs). The list can be expanded. Some thinkers have argued that humans are different from animals because they have 'meaning-producing abilities'. That is to say, humans, unlike the animals do not simply live their lives. They seek to interpret their lives, make sense of it, and search for the ultimate meaning of their existence.

This account of what it means to be human calls to question all anthropological reductionism, whether they are inspired by Darwinian evolutionism or genetic determinism. Although the human being is profoundly related to other animal species it cannot be simply reduced to them. And although the genotype of the human being does contribute to its phenotype, human abilities and behaviour cannot be reduced to genetics as some philosophers and scientists have suggested. The biblical image of Adam being formed from the soil and then given vitality through the spirit points to the irreducible complexity of what it means to be human. The language of *soil* and *spirit* helps us to understand the true nature of humankind, which is at once similar and dissimilar with that of the other animals.

The special status that human beings enjoy is accompanied with special responsibilities. Chief among these responsibilities are caring for God's creation, respecting the *telos* of animal and plants, and the humane treatment of fellow human beings. Some philosophers and theologians have rightly described humankind as the 'servant species' that is commissioned to exercise self-sacrificial priesthood for members of its own species and for all sentient creatures. As God's special creatures and bearers of God's image human beings must not only care for their own kind but also for the whole creation, including the preservation of the delicate order of nature. Needless to say, this insight has profound implications on our scientific activities.

B. Human Dignity

Discussion on the special moral status of the human being would not be complete without reference to human dignity. This concept is undoubtedly very prominent in the discussion of bioethical issues and has played a key role in the constitutions of countries as politically diverse as Afghanistan, Germany, Italy Nicaragua, Peru and Korea – to name just a few. Human dignity is also prominent in many international documents like the United Nations' Universal Declaration of Human Rights in 1948 and the so-called International Bill of Rights of 1966. Much of the modern discourse in human dignity has become *decontextualised*: whereas such discourse used to be a part of the Christian understanding of what it means to be human, this context is now largely ignored.

In many ways the modern secular understanding of human dignity is beholden to the Enlightenment philosopher Immanuel Kant, who locates human dignity in morality and autonomy. In *Groundwork of the Metaphysics of Morals* Kant famously asserted that 'morality, and humanity so far as it is capable of morality, is the only dignity'.² And since, for Kant, morality is not possible without the autonomous will, he is led to the conclusion that 'autonomy is therefore the ground of the dignity of human nature'.³ This means that human beings are accorded dignity not because they are human beings but because they have the capacity for morality and autonomy. This view of human dignity suffers from a profound weakness. Because dignity is rooted in human rationality and freedom, it cannot be comprehensively applied to all human beings. In other words, if having human dignity requires the ability to exercise autonomy, then those who are unable to do this – people with mental disabilities, the comatose and the human foetus – do not have human dignity even though they are recognised as humans.

Understanding human dignity in light of human characteristics, however, is not an entirely misdirected approach. The Judeo-Christian tradition also refers to certain characteristics, especially mental capacities, when it discusses human dignity.⁴ There are, however, profound differences between the Judeo-Christian and secular accounts. Firstly, the Judeo-Christian tradition does not privilege particular characteristics like autonomy and root human dignity in them. Rather it considers the whole complex of characteristics and human capabilities as an inseparable whole that provides the basis for human dignity. But the most important difference between the Christian understanding of human dignity and secular accounts is that according to the former human dignity belongs inalienably to human beings because of the sort of creatures they are. Put differently, dignity is not accorded only to human beings who display certain characteristics like sentience or moral judgement. Human dignity belongs to human beings *qua* human beings.⁵ Thus people with severe mental disabilities, the

² Immanuel Kant, *Groundwork of the Metaphysics of Morals*, trans. H.J. Paton (New York: Harper and Row, 1964 [1785]), 102.

³ Kant, *Groundwork*, 107.

⁴ These include: the ability to feel pleasure or pain; the use of language; rationality; the possibility of forming rich and meaningful relationships; the potential to have complex emotions, and unparalleled ability to imagine a future and remember the past.

⁵ In addition, it must be pointed out that according to the theological anthropology that we have been developing, there can be no distinction between being a human and being a person. Personhood is intrinsically bound up with

comatose and the human embryo must be accorded the dignity that belongs to all human beings.

Human dignity is undermined when human worth is called to question when human beings are inappropriately *used, forced or injured*. Human dignity requires that human beings be treated as having intrinsic and not just instrumental worth. Human beings should not be used. In the same way, they should not be forced because dignity demands that their wills should be respected. And finally, human beings should not be injured because their wellbeing should be preserved. In bioethics, it is generally agreed that respect for human dignity must be given priority. In human experimentation for instance, it is imperative that participants give their informed consent, lest their dignity is violated when something is done to them against their wishes. With regard to embryonic stem cell research, if the embryo is seen as a human being worthy of respect, its use for research and its subsequent destruction would be tantamount to the grave violation of its human dignity. This would also include the cytoplasmic hybrid embryo that is 99% human.

When it comes to the production of animal-human chimeras, the core concerns raised by the human dignity argument have to do with the diminution or destruction of human dignity-related capacities like rationality. Cynthia Cohen explains:

... it would be wrong to encase within an animal's body those physical components of human that are necessary for exercising the cluster of capacities associated with human dignity because this would eliminate or diminish those very capacities. The torturer or enslaver of human beings wrongs them, not only because he or she harms them but also because he or she denies them the option of exercising many of the capacities associated with human dignity. The creator of the human-non-human chimera would do even worse – he or she would obliterate or enfeeble those very capacities.⁶

For example, it would be wrong to introduce substantial numbers of specialised human neural stem cells into a nonhuman host in which the stem cells could form functional connectivity within the host brain and modulate its functions. Such an experiment would violate human dignity because the resulting chimera would not be able to exercise its distinctively human capacities as its brain is imprisoned in an animal-like body. In the same way, it would be wrong to insert undifferentiated human embryonic stem cells into an animal embryo. The pluripotent human stem cells may integrate into the brain of the animal embryo resulting in a human-animal chimera acquiring human-like brain functions.

In their article entitled, 'Chimeras and "Human Dignity"', Josephine Johnston and Christopher Eliot argue that the creation of chimeras that possess compromised humanness can be said to be ethically problematic:

our humanity. We would therefore reject the view that makes a distinction between being a person and being a human proposed by thinkers such as Peter Singer, where personhood is tied to certain characteristics like rationality and consciousness. This approach has led Singer to conclude that the gorilla Koko is a person, although she is not human. See Peter Singer, *Rethinking Life and Death: The Collapse of Our Traditional Ethics* (Oxford: Oxford University Press, 1995), 181.

⁶ Cynthia Cohen, *Renewing the Stuff of Life: Stem Cells, Ethics and Public Policy* (Oxford: Oxford University Press, 2007), 126.

1. Intentionally creating compromised human beings or part-human beings is cruel to the creature. For example, it is cruel to create a laboratory subject for the purposes of experimentation, which is able to exercise only compromised human faculties, likely to be kept in a cage, and perhaps not able to fend for itself.
2. Intentionally creating compromised human beings or part-human beings reflects badly both on those who create the chimera and on those societies or governments allowing its creation. What kind of an institutional intention do we exhibit when we create compromised human beings or part-human beings for laboratory use?
3. Finally intentionally creating compromised human beings or part-human beings might appear to “all the world” to be using another human or part-human, as a means to an end rather than as an end in itself, a use that has been confirmed as morally unacceptable since at least the Declaration of Helsinki.⁷

C. Moral Status of the Human Embryo

Discussion on research involving the creation of human-animal hybrid embryos cannot avoid the issue of the moral status of the human embryo. Here, the NCCS must reiterate its position that human life begins at conception and that the early embryo is a human being worthy of special respect. This means that the NCCS is opposed to all research that would inflict harm to or cause the destruction of human embryos. In light of the discussion on human dignity, the NCCS would also oppose all research and experimentation that uses the human embryo merely as a means to achieve an end, regardless how noble that end may be. Because the human embryo is a human being worthy of special respect, it should never be treated this way. This would include the cytoplasmic hybrid embryo which is 99% human.

Theologically, the view that the human embryo, from the time of conception, is a human being worthy of respect is based on the premise that in Scripture achievement and potential are placed in one unbroken continuum. This means that Scripture prevents us from concluding that the early embryo is only a potential human being and therefore should not be accorded the same kind of respect and protection that an adult human being deserves. Various passages in Scripture allude to this (e.g., Psalm 139:13-16; Jeremiah 1:5). It is in the doctrine of the incarnation that this view receives its most profound theological justification. The incarnate Son of God did not take on human flesh at birth, but at the moment of conception. In the incarnation, therefore, the Son of God identified with and redeemed all of human life, from the darkness of the womb to the darkness of the tomb.

Philosophically, we argue that the zygote of human parentage bears the nature of its parents. The zygote of human parentage cannot articulate itself into another animal. To those who argue that the zygote does not look like a human being, we answer that that is exactly what we look like – what you and I look like – at that stage of

⁷ Josephine Johnston and Christopher Eliot, “Chimeras and “Human Dignity””, *American Journal of Law and Medicine*, Summer 2003, 3 (3): W7.

development. Put differently, at fertilisation the zygote is an individual identity⁸ whose genome directs the multiplication of its cells and the direction of the development of its tissues. The zygote and its newly constituted genome organises itself into an embryo, foetus, infant, child and adult without ceasing to be one and the same living being.

There are many established embryologists and scientists who hold that human life begins at conception. ‘Development of the embryo begins at Stage 1’, writes Marjorie England, ‘when a sperm fertilises an oocyte and together they form a zygote’.⁹ In similar vein Keith Moore maintains that ‘human development begins after the union of male and female gametes or germ cells during a process known as fertilisation (conception)’.¹⁰ In *Cloning Human Beings*, a report of the National Bioethics Advisory Commission, an embryo is defined as ‘the developing organism from the time of fertilisation until significant differentiation has occurred, when the organism becomes known as a fetus’.¹¹

William Larsen describes the zero point of embryonic development thus: ‘The chromosomes of the oocyte and sperm are ... respectively enclosed within female and male pronuclei. These pronuclei fuse with each other to produce the single, diploid, 2N nucleus of the fertilised zygote. This moment of zygote formation may be taken as the beginning or zero time point of embryonic development’.¹² ‘If it’s not an embryo’, Jonathan Van Blerkom, the embryologist at University of Colorado asks with reference to the early embryo, ‘what is it?’¹³ And finally, in *Human Embryology & Teratology*, Ronan O’Rahilly and Fabiola Müller contend that ‘although life is a continuous process, fertilisation is a critical landmark because, under ordinary circumstances, a new genetically human organism is thereby formed ... The combination of 23 chromosomes present in each pronucleus results in 46 chromosomes in the zygote. Thus the diploid number is restored and the embryonic genome is formed. The embryo now exists as a genetic unity’¹⁴. This textbook describes ‘pre-embryo’ as ‘ill-defined and inaccurate’ and lists it among ‘discarded and replaced terms’.¹⁵

The members of the President’s Council on Bioethics have also expressed this view with eloquence and force:

The fertilised egg is human organism in its germinal stage. It is not just a ‘clump of cells’ but an integrated, self-developing whole, capable (if all goes well) of the continued organic development characteristic of human beings. To be sure, the embryo does not yet have, except in potential, the full range of characteristics that distinguish the human species from others, but one need not have those characteristics in

⁸ In the case of twinning which takes place in the initial fourteenth day period, it must be stated that before this time it is possible that the early embryo is a being that is not confined to only *one* individual.

⁹ Marjorie England, *A Life Before Birth*. (England: Mosby-Wolf, 1996), 31.

¹⁰ Keith Moore, *Essentials of Human Embryology*. (Toronto: B.C. Decker Inc., 1988), 2.

¹¹ *Cloning Human Beings*. Report and Recommendations of the National Bioethics Advisory Commission, (Rockville, MD: GOP, 1992), Appencic 2.

¹² William J. Larsen, *Human Embryology*. 2nd Edition. (New York: Churchill Livingstone, 1997), 17.

¹³ *American Medical News*, February 23, 1998, 32.

¹⁴ Ronan O’Rahilly and Fabiola Müller, *Human Embryology & Teratology*. 2nd Edition. (New York: Wiley-Liss, 1999), 8, 29.

¹⁵ O’Rahilly, *Human Embryology and Teratology*, 12.

evidence in order to belong to the species ... The embryo is in fact fully 'one of us': a human life in process, and equal member of the species *Homo sapiens* in the embryonic stage of his or her natural development.¹⁶

This is not the place to respond to the objections raised by those who advocate the fourteenth day view. The purpose of this brief sub-section is to state again the view of the NCCS and to show that although this view is informed by a certain reading of Scripture, it can be defended philosophically and has received support from some texts on human embryology and a panel of experts. This chorus of voices should at least caution against regarding too hastily what appears to be an abstract and arbitrary distinction (i.e., between 'pre-embryo' and 'embryo') as a dogma that has achieved widespread consensus among members of the scientific community.

D. The Moral Status of the Human-Animal Chimera

One of the challenges confronting the ethicist is to ascertain the moral status of animal-human mixtures created for research. Those who work within the evolutionary framework may argue that species distinctions are arbitrary constructs and therefore the emergence of animal-human mixtures pose no serious moral problems. For Christians, however, the concept of the uniqueness of the human being implies that animal-human mixtures that either compromise the humanness of the human subject or 'humanise' the animal subject poses serious ethical problems. It is impossible, then, for Christians to sidestep the issue of the moral status of the human-animal chimera. The view that 'only if and when there are enough entities of this type [referring to the 'humouse'] proliferating as naturally living entities will we have to start thinking about the practical implications of their moral status, not when they are merely laboratory specimens'¹⁷ is simply unacceptable.

A possible approach in addressing the problem of the moral status of the human-animal chimera has in a sense already been alluded to in the preceding sub-section. The crucial issue here has to do with the change of identity of the chimeric creature that is produced through the introduction of human stem cells or other human genetic material. This is clearly spelt out by the Pontifical Academy for Life in their document concerning xenotransplantation:

...in general, the implantation of a foreign organ into a human body finds an ethical limit in the degree of change that it may entail in the identity of the person who receives it.¹⁸

By 'personal identity' the Pontifical Academy of Life means the essential core of the being of a person, his 'unrepeatability'. It also refers to the being of the person (ontological level) and the feeling that he is a person (psychological level).

¹⁶ President's Council on Bioethics, *Human Cloning and Human Dignity* (New York: Public Affairs, 2002), 173-175.

¹⁷ BAC, *Human-Animal Combinations for Biomedical Research*, 26.

¹⁸ Pontifical Academy for Life, *Prospects for Xenotransplantation: Scientific Aspects and Ethical Considerations* (September 26, 2001), n. 10.

Once the recipient animal into which human pluripotent cells are inserted begins to acquire or display human capacities like thought and feeling, there is a change in the identity of the recipient animal. This must result in the corresponding change in its moral status. Whereas before the emergence of these capacities the animal in question enjoys the moral status accorded to animals, after these abilities appear it must be accorded the moral status of humans, even if these capacities are severely compromised in the developing creature. It is the view of some scientists and ethicists that some organs in the human or mammalian body (especially that of primates) like the encephalon (brain) and the gonads (ovaries and testes) are linked to the identities of the creature because of their specific function.

Although this general guideline is to some extent helpful, it is difficult to ascertain if and when the change in the identity of the animal has taken place. As we shall see below, although scientists maintain that inserting certain amounts of dissociated human neural stem cells in the brains of prenatal animals have not resulted in the changes in the brains of those animals as to warrant the belief that they have developed human capacities, it is extremely difficult to be certain where to draw the line. In addition, these capacities may not be evident in the duration of the experiment. The absence of evidence, however, does not mean that there has not been a significant change in the chimera that warrants special respect to be shown to it.¹⁹

E. Playing God

We turn finally to the questions whether in the utilisation of certain technologies for research and whether in the pursuit of those research themselves human beings are ‘playing God’. Although some ethicists maintain that this idea is too ambiguous to be helpful, we maintain that if understood clearly it provides the broad parameters that would govern our scientific pursuits. This idea is grounded in the Judeo-Christian tradition that sees the specific role of human beings as God’s stewards, taking care of and tending the creation. At its most basic level, this idea alerts us to the fact that we must learn and respect our roles as creatures and to bear in mind that science and medicine are meant to serve human life. Far from being Luddites, those who speak against playing God maintain that science would achieve its noblest goals only when it is directed at human flourishing.

Some thinkers have extracted this phrase from its proper theological context and grafted it onto a fundamentally utilitarian understanding of science and medicine. The ethicist Joseph Fletcher presents this form of utilitarianism in his book *The Ethics of*

¹⁹ The question concerning the use of animals for the good of human beings must be briefly addressed. The Christian tradition maintains that animals as God creatures have their own specific values which human beings must recognise and respect. However, human beings enjoy a unique and higher dignity since they are created in the image of God. Animals are given for the service of human beings in order that they may achieve their fullest potential. Human beings have always used animals for their good, either to provide food, clothing or transport. With the advances in technology, the ‘service’ that animals can render to human beings takes a different form. In the biomedical field, animals perform a special service to human beings through xenotransplantation. We therefore agree with the Pontifical Academy for Life in its statement that the sacrifice of animals can be justified if it is required ‘to achieve an important benefit for man, as is the case with xenotransplantation of organs or tissues to man, even when this involves experiments on animals and/or genetically modifying them’.

*Genetic Control*²⁰ where he boldly suggests that we must ‘play God’.²¹ Fletcher’s secularism is unmistakably wedded to his utilitarianism. Since for him ‘the old God’²² is dead, and since the world is no longer ‘run from outside by God’s will’,²³ we must steal the ‘powers from the gods’²⁴ by invading God’s privileges and prerogatives²⁵ and take control of the world. Fletcher could therefore write: ‘As we learn to direct mutations medically we should do so. Not to control when we can is immoral’.²⁶ Thus, Fletcher’s enthusiasm for the creation of human-nonhuman chimeras could hardly be concealed when he wrote:

Chimeras or parahumans might legitimately be fashioned to do dangerous or demeaning jobs. As it is now, low-grade work is shoved off on moronic ... individuals, the victims of uncontrolled reproduction. Should we not ‘program’ such workers thoughtfully instead of accidentally, by means of hybridisation?²⁷

In our view there are echoes of this form of utilitarianism in the argument that is so well formulated in the BAC Consultation paper that ‘If research involving human-animal combinations can save life, then to stop the research is to “play God” with respect to those whose lives could be saved’. To argue in this way is to miss the theological assumptions behind the idea of ‘playing God’. These assumptions must be given serious consideration if we are to understand how the concept of ‘playing God’ serves as a check even to some forms of humanitarianism.

For Paul Ramsey, who used this phrase in the context of his discussion on procreation, ‘playing God’ serves as a critique of modern science and medicine in two ways. Firstly, it reminds us that there are things which we can do but which we ought not do. In other words, ‘playing God’ puts a check on our technological and scientific prowess by insisting that our scientific initiatives must be governed by ethics. Thus with eloquence and force Ramsey wrote: ‘I do not believe men should enslave themselves to an acknowledged minority of scientific saviours, or any man himself willing to reduce another fellow man to a “thing in the world” over whom benefits are to be “wrought”, while unfurling the banner of man’s triumph over natural forces’.²⁸ An example of the commodification of human beings, i.e., of treating a fellow human being as a ‘thing in the world’ is the creation, use and destruction of the human embryo or the human-bovine cytoplasmic hybrid embryo.

Secondly, this phrase calls us to resist the march of blind technology. The Dutch philosopher Egbert Schuurman describes the pervasive ‘technicism’ in our culture well.

Technicism entails the pretension of human autonomy to control the whole of reality: man as master seeks victory over the future; he is to

²⁰ Joseph Fletcher, *The Ethics of Genetics Control: Ending Reproductive Roulette* (Garden City, N.Y.: Anchor Books, 1974).

²¹ *Ibid.*, 126.

²² *Ibid.*, 200.

²³ *Ibid.*, 127.

²⁴ *Ibid.*, 6.

²⁵ *Ibid.*, 200.

²⁶ *Ibid.*, 158.

²⁷ *Ibid.*, 173.

²⁸ Paul Ramsey, *Fabricated Man* (New Haven, Conn.: Yale University Press, 1970), 151.

have everything his way; he is to solve all problems, including the new problems caused by technicism; and to guarantee ... material progress ... One can argue that ... the main trend of Western philosophical thought is best characterised as thinking through technology. This means that science and rationality in general are distorted because they have been used as technical instruments in the service of technological powers.²⁹

Philosophers and even theologians – not just scientists – have championed what has been described as the Baconian project. But such unbridled optimism towards (faith in?) blind technology has quite serious consequences and repercussions. The caution against ‘playing God’ reminds us that ethics must always inform our scientific enterprises. It also calls to question the technological imperative that drives those enterprises. It is in this sense of the phrase ‘playing God’ that we are to understand Ramsey’s refrain: ‘Men ought not to play God before they learn to be men, and after they have learned to be men they will not play God’.³⁰

But the caution against ‘playing God’ in this sense is at the same time an injunction to play God in another sense – to play God in the correct way! Ramsey’s admonishment that we should not ‘play God’ presents some prohibitions. We are not to be the substitute for the absent God and try to ‘be’ God (Fletcher). But we are called to ‘imitate’ God, to follow his ways, to ‘be like’ God. To ‘play God’ the way God plays God is to promote life and its flourishing and never death and human suffering. It is to embrace the gift of wisdom that has allowed science and technology to be used to alleviate human suffering and treat diseases. It is to affirm the different forms of biomedical research that hold therapeutic potentials.

To play God the way God plays God, however, also means that certain enterprises cannot be countenanced.³¹ It means that experiments that make use of human beings in such a way that their dignity is violated cannot be countenanced. It means that the commodification of human beings must be resisted. It means that the ethic that sanctions the exploitation of the vulnerable, the minority, the poor or the voiceless for the sake of the majority and in the name of the ‘common good’ must be called to question and rejected. To play God the way God plays God means that ethics – the question whether certain researches ought to be pursued – must guide our decisions, and not simply scientific knowledge and technological capability. To play God the way God plays God is to conduct our scientific and therapeutic activities in concert with the intentions of the Creator. Abstracted from this theological context, ‘playing God’ becomes a vacuous phrase that can be easily exploited.

²⁹ Egbert Schuurman, *Perspectives on Technology and Culture* (Sioux Center, Iowa: Dordt College Press, 1995), 139-140.

³⁰ Ramsey, *Fabricated Man*, 138.

³¹ For the Christian the concept of ‘Playing God’ provokes the following questions in relation to our use of technology:

- a. Does the technology assist humankind in fulfilling its stewardship responsibilities?
- b. Does the technology result in the commodification or destruction of human life?
- c. Does the technology degrade, demean or debase individuals?
- d. Does the technology serve primarily to promote our narcissistic self-absorption?
- e. Does the technology promote technological or economic imperatives?
- f. Must we adapt to the technology or is the technology designed to adapt to human nature and human needs?

Allen Verhey summarises the discussion well:

We must, in stewardship and service, resist the power of the Baconian perspective in the culture and in the academy. We must, in stewardship and in service, resist the temptation to worship some God of the Gaps instead of the God of Scripture and creation. We must, in faith, refuse to pretend to substitute for an absent God – *etsi deus non daretur*. We must, in faithfulness, respond with all our powers and with all human powers to the cause of God made known in Christ. We must ‘play God’ as God plays God. God is God, and not us, but God has called us to follow where God leads, to imitate God’s works, to serve God’s cause.³²

PART THREE: ETHICAL CONCERNS RELATED TO SPECIFIC RESEARCH INVOLVING HUMAN-ANIMAL MIXTURES

A. General Comments

As mentioned above, the NCCS does not object to some forms of chimeric research, for example, those involving the transfer of differentiated human stem cells into the kidneys or hearts of pigs, mice or even monkeys. Such experiments would not result in chimeric creatures with the human capacity to think and feel. But the NCCS maintains that research involving the transplant of human neural stem cells, human germinal cells, or undifferentiated human stem cells to prenatal nonhumans must be prohibited. Such experiments may produce human-animal creatures with human features and capacities.

Whether research involving the introduction of human stem cells into nonhuman hosts should be approved or not therefore depends on the following factors:

- a. the sort of human stem cells being studied;
- b. whether these stem cells are specialised or unspecialised;
- c. the number of human stem cells to be implanted into non-human hosts;
- d. the pluripotency of the implanted cells
- e. where in the animal hosts these stem cells are inserted;
- f. how closely related is the animal to the human;
- g. when a prenatal animal is used as host, i.e., at what stage of development is the animal;
- h. measures to regulate or limit the proliferation and development of implanted cells in the recipient animal;
- i. available experimental data from implantation of non-human stem cells on all the outcomes (likely and rare).³³

³² Allen Verhey, ‘Playing God’, *Genetic Ethics: Do the Ends Justify the Genes?* Edited by John F. Kilner, Rebecca D. Pentz and Frank E. Young (Grand Rapids, Michigan: Eerdmans, 1997), 72.

³³ Cohen, *Renewing the Stuff of Life*, 129.

In Section B of this part, we examine the different types of research involving human-animal mixtures.³⁴ While many of these experiments involve the use of stem cells, others do not. Some of the procedures examined here have not been carried out and are currently prohibited in most parts of the world. These procedures are discussed nonetheless because the fact that they are currently prohibited does not preclude them from being carried out in the future. Furthermore, in this paper, the NCCS aims to provide its clear position on as many variations of research involving human-animal combinations as possible.

B. Animal and Human Gestation

The first group of experiments involving animal-human mixtures that we would like to discuss is animal and human gestation. There are four possible ways in which such experiments can be conducted:

- (1) By inserting *ex vivo* human embryos into the bodies of animals
- (2) By inserting an animal embryo in a human
- (3) By placing human sperm into an animal
- (4) By placing animal sperm into a woman

To date, none of the above experiments have been conducted and there is a clear international consensus that they should be prohibited. However, in its 2005 report entitled, 'Human Reproductive Technologies and the Law' the UK House of Commons Science and Technology Committee suggested that research involving the incubation of a human embryo in an animal could help scientists better understand the causes of infertility and miscarriage. If this is indeed the case, the report maintains that this is an appropriate use for the embryo and that it is also consistent to its status.

These experiments, however, pose serious ethical problems. Inserting a human embryo into the body of an animal (1) would violate the dignity of the embryo that must be regarded as a human being worthy of respect and protection. Such a procedure would result in possible moral confusion in that the human embryo in an animal will be accorded the status of an animal. Similar ethical problems would arise when an animal embryo is placed in the womb of a human being (2). In light of these ethical problems the President's Council on Bioethics states in its report entitled *Reproduction and Responsibility: The Regulation of New Biotechnologies* that a bright line must be drawn at the 'insertion of *ex vivo* human embryos into the bodies of animals: an *ex vivo* human embryo entering a uterus belongs *only* in a human uterus'.³⁵ In similar vein, the UK Human Fertilisation and Embryology Acts (1990) states that 'No person shall place in a woman a live embryo other than a human embryo' (Section 3[2]).³⁶

³⁴ Section B of this Part is in many ways indebted to the Scottish Council on Human Bioethics' Report entitled, 'Embryonic, Fetal and Post-natal Anima-Human Mixtures: An Ethical Discussion', published on 1 September 2005.

³⁵ The President's Council on Bioethics, *Reproduction and Responsibility: The Regulations of New Biotechnologies*, Washington D.C., March 2004, <http://bioethics.gov/reports/reproductionandresponsibility/chapter10.html>.

³⁶ House of Commons science and Technology Committee, *Human Reproductive Technologies and the Law*, Fifth Report of Session 2004-5, Vol. 1, 30-32. <http://www.publications.parliament.uk/pa/cm200405/cmselect/cmsctech/7/702.htm>.

Experiments (3) and (4) also pose serious ethical problems. Judeo-Christian ethics is unequivocal on the question of bestiality. Prohibition against the act is clearly expressed in Leviticus 18:23: ‘Do not have sexual relations with an animal and defile yourself with it. A woman must not present herself to an animal to have sexual relations with it; that is a perversion’.³⁷ Many countries prohibit human-animal sexual activity. In the UK, the Sexual Offences Act 2003 states in Section 69, paragraph (1) that a man commits an offence if he has sexual intercourse with an animal. The same revulsion must be expressed for experiments that involve the biological insertion of animal sperm into a woman or human sperm into a female animal that may result in human-animal mixtures.

The NCCS maintains that because of the grave ethical problems they pose the above experiments should be prohibited.

C. Animal-Human Hybrid Embryos

The next group of experiments aim to produce animal-human hybrid embryos for research. Unlike the experiments discussed in the last sub-section, the experiments below have been conducted and the ethical responses to them are varied.

The insertion of human nuclei into non-human eggs

Dr Orly Lacham-Kaplan and her colleagues at the Monash Institute of Reproduction and Development in Australia have developed a way of ‘fertilising’ non-nucleated mouse oocytes by injecting somatic cell nuclei taken from adult male mice. Embryos with two sets of chromosomes were then formed after the chemical activation of the ‘fertilised’ oocytes and the extrusion of two secondary polar bodies.³⁸ In 2003, a team of scientists from Cambridge University fused frog eggs with nuclei from adult human cells. The purpose of this procedure was to produce rejuvenated master cells that could be developed into replacement tissues for treating certain diseases.³⁹

Serious and complex ethical problems would arise if such experiments result in human-animal entities (i.e., human-frog embryos). If the purpose of such experiments and research is to better understand the mechanism of nuclear reprogramming, the nuclei of other mammalian species should be used instead of the nuclei from a human donor. There is the possibility of cross infection or even of creating new diseases through such animal-human mixtures. The benefits versus risks of such research are ambiguous and therefore caution must be exercised.

The NCCS maintains that experiments involving the insertion of human nuclei into non-human eggs should be prohibited.

³⁷ See also Exodus 22:19: ‘Anyone who has sexual relations with an animal must be put to death’.

³⁸ Lacham-Kaplan, O. Daniels, R. & Trounson A. *Reprod. Biomed. Online* 3, 205-211(2001).
http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?holding=npg&cmd=Retrieve&db=PubMed&list_uids=12513856&dopt=Abstract.

³⁹ Byrne, J.A. Simonsson, S., Western, P.S. & Gurdon, J.B. entitled *Nuclei of adult mammalian somatic cells are directly reprogrammed to oct-4 stem cells gene expression by amphibian oocytes*. *Current Biology*, 13, 1206-1213 (2003).

The insertion of human nuclei into non-human eggs stripped of their chromosomes

Hui Zhen Sheng of Shanghai Second Medical University, China, announced in August 2003 that they had succeeded in creating rabbit-human embryos by fusing adult human stem cells with rabbit eggs stripped of chromosomes (nuclei). The rabbit-human hybrid embryos, which were created by using donor cells from the foreskins of a five-year old boy, two men and facial tissue from a woman, developed to the approximately 100 cell-stage that forms about four days of development.⁴⁰ Gametal cow-human hybrid embryos have also been created using this method.^{41,42} By generating human embryonic stem cell lines through the creation of cytoplasmic hybrid embryos scientists hope to address the problem of the limited supply of human eggs. Scientists also hope that interspecies hybrid embryos would provide valuable tools to study the reprogramming of somatic nuclei that could provide long-term solutions to the problem of tissue rejections.

There are, however, a number of serious and complex ethical problems associated with such research. Because the hybrid embryos created by this method are 99% human, the ethical objection surrounding the use of human embryos for research must be answered. These interspecies embryos that are 99% human must be accorded the dignity and protection they deserve. They should not be used for research or for obtaining cell-lines and then destroyed.

It is important to note that oocytes are not totally devoid of genetic material, and the mammalian oocyte cytoplasm is rich in mitochondrial DNA. According to M.H. Pineda, 'the cytoplasmic inheritance of mitochondrial DNA is an important component of the eukaryotic inheritance'.⁴³ There is evidence that there can be interaction between mitochondrial DNA and nuclear DNA. This means that in experiments where the human nuclei is inserted into an animal egg, there may be interaction between the human and animal DNA even though the egg in question has been enucleated.

Due to the presence of different degrees of interspecies incompatibility between mitochondrial and nuclear function, there are therefore considerable medical risks in implanting cells that contain a mixture of animal mitochondrial DNA and human nuclear DNA. In addition, some of the diseases for which therapeutic cloning are supposed to provide treatment are neurodegenerative diseases. Since mitochondrial dysfunction is the key to many neurodegenerative diseases, their treatment using enucleated animal eggs for somatic nuclear transfer (SCNT) is liable to result in serious medical risks. There is also the possibility of the transmission of animal diseases to humans and / or the creation of new diseases. Furthermore, the risks involved are unknown and the benefits of such research are largely speculative.

⁴⁰ Hui Zheng Sheng et al., 'Embryonic stem cells generated by nuclear transfer of human somatic nuclei into rabbit oocytes', *Cell Research* (2003) 13 (4): 251-264, <http://www.cell-research.com/20034/2003-116/2003-4-05-ShengHZ.htm>.

⁴¹ BBC News -18 June 1999, 'Company 'cloned human cells'', <http://news.bbc.co.uk/1/hi/sci/tech/213663.stm>.

⁴² Coghian, A., NewScientist.com – 15 September 2003, 'First human clone embryo ready for implantation', <http://uk.news.yahoo.com/030916/12/e8k6h.html>.

⁴³ M.H. Pineda, 'The Biology of Sex' in *McDonald's Veterinary Endocrinology and Reproduction* (5th Edition), Edited, M.H. Pineda (Ames, IA: Iowa State Press, 2003), 229.

Finally, there are so many serious and profound genetic and epigenetic flaws in cloned embryos even when the eggs of the same species are used. The use of interspecies hybrid embryos created through SCNT involving enucleated animal eggs for research into diseases could be so problematic that such research would become a study of artefacts: the results of such studies would be very difficult to interpret.

The NCCS maintains that experiments involving the insertion of human nuclei into animal eggs stripped of their chromosomes should be prohibited.

Mixing human and animal gametes to form human-animal entities

In the UK, the ‘Hamster Egg Penetration Test’ (HEPT) in which human sperm is mixed with the egg of a hamster stripped of its outer membrane (zona pellucida) was used to test the viability of some patient’s sperm. The resulting human-hamster chimera was sometimes allowed to develop to the two-cell stage for observation before it was destroyed. With the introduction of Intra Cytoplasmic Sperm Injection (ICSI) and other treatments HEPT was effectively rendered obsolete.

A number of countries like Denmark, Germany, and France⁴⁴ have prohibited such procedures, which are deemed to have no scientific benefits. The creation of human-hamster chimera as a result of such procedures poses serious and complex ethical problems that have to do with the moral status of such entities and the question of human dignity.

The NCCS maintains that the mixing of human and animal gametes to form human-animal entities should be prohibited.

D. Animal-Human Chimeras

While the hybrid is ‘an organism whose cells contain genetic material from organisms of different species’, a chimera is an organism ‘whose body contains cells from another different organism of the same or different species’.⁴⁵ In this section, we examine research that requires the creation of embryonic, foetal and post-natal animal-human chimeras.

Transplanting (1) human pluripotent stem cells into a non-human blastocyst or early embryo (2) non-human pluripotent stem cells into a human blastocyst or early embryo

It was reported that scientists at the South Korean firm Maria Biotech injected human embryonic stem cells labelled with fluorescent protein into 11 mouse blastocysts in an experiment conducted in 2003.⁴⁶ Foster mice were used to carry the embryos. Five offspring with fluorescence in tissues including heart, bone, kidney and liver were

⁴⁴ Calum MacKellar, ‘Reproductive Medicine and Embryological Research – A European Handbook of Bioethical Legislation’, *European Bioethical Research*, 1997.

⁴⁵ BAC, ‘Human-Animal Combinations for Biomedical Research: A Consultation Paper’, 8 January 2008, 11-12.

⁴⁶ Neil Boyce, ‘Mixing species – and crossing a line?’, 27 October 2003, usnews.com, <http://www.usnews.com/usnews/issue/031027/misc/27chimeras.htm?track=rss>.

eventually born. But ‘severe protests’ from the public forced these scientists to terminate the project.

Such research would create serious and complex ethical difficulties because the developing inner cell mass of the non-human blastocyst or early embryo – the progenitor of the foetus – into which human pluripotent stem cells are incorporated, would then consist of a mixture of human and animal cells. It is not clear how great the human contribution to the resulting chimera would be. Most scientists would agree that the closer the animal whose embryo is the recipient of these stem cells is biologically to the human, the greater the potential for human contributions. The moral status of such creatures would at best be ambiguous.

In its guidelines on research involving the insertion of undifferentiated human embryonic stem cells into nonhuman host, the National Academies of Sciences (NAS) highlights the following considerations:

The number of hES cells to be transferred, what areas of the animal body would be involved, and whether the cells might migrate through the animal’s body. The hES cells might affect some animal organs rather than others, raising questions about the number of organs affected, how the animal’s functioning would be affected, and whether some valued human characteristics might be exhibited in the animal, including physical appearance.⁴⁷

In its discussion on the insertion of human embryonic stem cells into the blastocyst of the mouse, the NAS document again expressed profound concerns. Its recommendation is that such research is not justified at this time.

[when hES cells are incorporated into a mouse blastocyst] the human cells [could] contribute extensively to any mouse that arises from the implantation of such a chimeric blastocyst ... Potentially the inner cell mass, the progenitor of the foetus, would consist of a mixture of human and mouse cells. It is not now possible to predict the extent of human contributions to such chimeras. If the recipient blastocyst were from an animal that is evolutionarily close to a human the potential for human contributions would appear to be greater. For these reasons, research that involves the production of such chimeras should be performed first using nonhuman primate ES cells in mouse blastocysts before proceeding to the use of hES cells. The need for the use of blastocysts from larger mammals would need to be very clearly justified and nonhuman primate blastocysts should not be used at this time.⁴⁸

The NCCS maintains that the transplantation of (1) human pluripotent stem cells into a non-human blastocyst or early embryo and (2) non-human pluripotent stem cells into a human blastocyst or early embryo should be prohibited.

⁴⁷ National Research Council and the Institute of Medicine of the National Academies, *Stem Cells and the Future of Regenerative Medicine* (Washington, D.C.: National Academies, 2002), 50.

⁴⁸ *Ibid.* 40-41.

Transplanting human pluripotent stem cells into post-blastocyst stages of animal embryo

In December 2003, scientists injected human stem cells into the foetuses of sheep, which produced a high proportion of human cells in some of the organs of these animals. In some cases 40% of the cells in these sheep were human. Although the animals looked normal scientists are unsure whether these sheep foetuses had human brain cells.⁴⁹

This sort of research would raise the same ethical problems as above. The degree of human participation in the resulting chimera is largely unknown. The moral status of the resulting creature would be ambiguous. More research should be done using other mammalian pluripotent stem cells before employing human stem cells.

The NCCS maintains that transplanting (1) human pluripotent stem cells into post-blastocyst stages of animal embryo and (2) non-human pluripotent cells into post-blastocyst of human embryos should be prohibited

Transferring human neural stem cells into prenatal nonhuman animals

The experiment conducted by Ourednik and colleagues in which human neural progenitor cells are transferred into the forebrain of foetal monkeys has indicated that the human neural cells became an integral part of the monkey brain. In other words, the human neural cells developed along the same pathways as the surrounding monkey cells, and no adult human-monkey chimera resulted from these experiments.⁵⁰ In the same way, the study conducted by Weissman showed that when human foetal neural stem cells are inserted into the brains of newborn mice, the human cells migrated to various regions of the brains of the mice and became integrated with the mouse neural cells.⁵¹ However, in a famous experiment conducted more than a decade ago in which small sections of the brains from developing quails were transplanted into the developing brains of chickens, the recipient chickens exhibited vocal trills and head bobs unique to quails.⁵²

This led scientists to conclude that only when whole masses of associated neural stem cells are introduced into nonhuman embryos would there be a risk of the nonhuman host developing a human-like brain.

This conclusion does not satisfy some ethicists simply because not enough is known about the behaviour of human neural stem cells in prenatal nonhuman hosts. The suggestion, forwarded by some scientists that the number of human stem cells introduced to the nonhuman host should be reduced to the smallest number fails to satisfy ethicists and scientists alike. For reasons already cited, the suggestion that such

⁴⁹ ““Humanised” organs can be grown in animals”, 17 December 2003, *New Scientist*, <http://www.newscientist.com/news/news.jsp?id=n99994558>.

⁵⁰ V. Ourednik, J. Ourednik, J.D. Flax, W.M. Zawada, C. Hutt, C. Yang, K.I. Park, S.U. Kim, R.I. Sidman, E.Y. Snyder, ‘Segregation of Human Neural Stem Cells in the Developing Primate Forebrain’, *Science* 293 (2001): 998-999.

⁵¹ N. Uchida, D.W. Buck, D. He, M.J. Reitsma, M. Masek, T.V. Phan, A.S. Tsukamoto, F.H. Gage, I.L. Weissman, ‘Direct Isolation of Human Central Nervous System Stem Cells’, *Proceedings of the National Academy of Sciences USA* 97 (2000): 14720-14725.

⁵² E. Balaban, M.A. Teillet, N. Le Douarin, ‘Application of the Quail-Chick Chimera System to the Study of Brain Development and Behaviour’, *Science* 241 (1988): 1339-1342.

experiments should be conducted only by transferring dissociated neural stem cells and not whole masses of organised tissue into the host does not fully address the ethical concerns. The limitations introduced to these procedures are purposed to prevent the emergence of chimeric creatures with the capacities and characteristics that are associated with human dignity. But such limitations are theoretical because scientists are unsure about how much human stem cells in the brains of nonhuman hosts would bring about these characteristics. Not enough research is done using animal neural stems cells to justify the use of human neural stems cells.

The NCCS maintains that transferring human neural stem cells into nonhuman animals should be prohibited until scientists are sure that such procedures will not result in 'higher order' brain functions in the nonhuman hosts.

Human and animal chimeras through xenotransplantation

Xenotransplantation technology is not new, as inert heart valves of pigs are already used in heart valve replacement operations. Xenotransplantation promises to surmount some of the issues that we have examined above attending allotransplantation from the availability of organs to the problems associated with living donors. Xenotransplantation chimeras are widely used in research and medicine. Some examples include the transplantation of human skin onto mice, human tumours onto mice, and human bone marrow into mice. These experiments are used to provide models for biomedical examinations.

One of the most serious issues surrounding this procedure is the threat of Porcine Endogenous Retro Viruses (PERVs), the spread of animal diseases to humans. The dangers include the spread of Bovine Spongiform Encephalopathy (BSE or 'Mad Cow Disease'), HIV and AIDS from animals to humans. Another major issue has to do with the emotional response related to xenotransplantation. Some have expressed repugnance over the idea of humans receiving animal organ transplants. The final issue has to do with concerns about the abuse of animals.⁵³

For the NCCS, however, xenotransplantation does not pose serious theological or ethical problems so long as the procedure itself does not cause any physical and psychological harm to the recipient. The question of whether the introduction of an organ from an animal into a human body will significantly change or affect the genetic or psychological identity of the person has been raised. As we have already seen, from the standpoint of theological anthropology, the identity of a person is established firstly in God's knowledge of the person, and secondarily on the being of his person, his embodied individuality. We have seen that it is our duty to protect the integrity and dignity of the whole person. Xenotransplantation is permissible only if it does not affect the psychological and genetic identity of the person who receives it.

⁵³ The question concerning the use of animals for the good of human beings must be briefly addressed. The Christian tradition maintains that animals as God creatures have their own specific values which human beings must recognise and respect. However, human beings enjoy a unique and higher dignity since they are created in the image of God. Animals are given for the service of human beings in order that they may achieve their fullest potential. Human beings have always used animals for their good, either to provide food, clothing or transport. With the advances in technology, the 'service' that animals can render to human beings takes a different form. In the biomedical field, animals perform a special service to human beings through xenotransplantation. We therefore agree with the Pontifical Academy for Life in its statement that the sacrifice of animals can be justified if it is required 'to achieve an important benefit for man, as is the case with xenotransplantation of organs or tissues to man, even when this involves experiments on animals and/or genetically modifying them'.

We concur with the conclusion of the Pontifical Academy for Life in a paper entitled *Prospects for Xenotransplantation: Scientific Aspects and Ethical Considerations* that ‘the implantation of a foreign organ into a human body finds an ethical limit in the degree of change that it may entail in the identity of the person who receives it’.⁵⁴

The NCCS maintains that research involving xenotransplantation chimera is permissible as long as the proper guidelines and international laws governing such research are strictly observed.

SUMMARY

Here is the summary of the positions of the NCCS on the various forms of research involving human-animal chimeras or hybrids:

- The insertion ex vivo human embryos into the bodies of animals should be prohibited.
- The insertion of an animal embryo into a human should be prohibited.
- The insertion of human sperm into an animal should be prohibited.
- The insertion of an animal sperm into a woman should be prohibited.
- The insertions of human nuclei into non-human eggs should be prohibited.
- The insertion of human nuclei into animal eggs stripped of their chromosomes should be prohibited.
- The mixing of human and animal gametes to form human-animal entities should be prohibited.
- The transplantation of (1) human pluripotent stem cells into a non-human blastocyst or early embryo (2) non-human pluripotent stem cells into a human blastocyst or early embryo should be prohibited.
- The transplantation of (1) human pluripotent cells into post-blastocyst stages of animal embryo and (2) non-human pluripotent cells into post-blastocyst of human embryos should be prohibited.
- The transference of human neural stem cells into nonhuman animals should be prohibited until scientists are sure that such procedures will not result in ‘higher order’ brain functions in the nonhuman hosts.
- The creation of human and animal chimeras through xenotransplantation should proceed with caution and should abide by established international laws.

Dr Roland Chia is Chew Hock Hin Professor of Christian Doctrine at Trinity Theological College and Theological and Research Advisor of ETHOS.

⁵⁴ https://www.vatican.va/roman_curia/pont...ife_doc_20010926_xenotrapianti_en.html.