

Xenotransplantation and moral theology

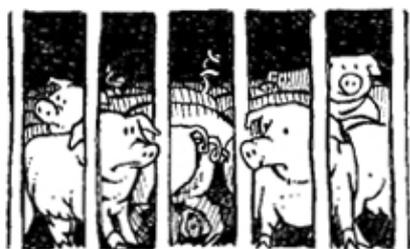
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Introduction

Xenografting (xg), or xenotransplantation (xt), may be defined as the transplantation of cells, tissues or organs from one organism into another of a different species. In practice, however, discussions on the topic tend to be more specific than this and focus on the transplantation of animal (usually pig) cells, tissues or organs into humans. Although xenograft technology is still under development and far from being perfect – particularly in the case of organ transplantation –, expectations of its success run high, with the technology being seen as a possible solution to the shortage of human organs for allotransplantation (i.e. within species transplantation).



For this reason, xt has not only become an important area of research but has also attracted much attention in society. It attracts special attention because the

animals involved (i.e. pigs) must be genetically modified before they are used, and their use is new and unfamiliar to us – it is not for food or as pets, but for transplantation. This combination of genetic modification and the introduction of a new way to use animals has not only given rise to many scientific and technological problems but has also raised numerous ethical, philosophical and religious questions and caused much public concern. Consequently, xt has become a social and political problem. It is perhaps not surprising, therefore, that the Council of Europe has set up a working group on xt, under the joint responsibility of the Steering Committee on Bioethics (CDBI) and the European Health Committee (CDSF). Xt is also on the social and political agenda of many EU member states, and churches and special interest groups, such as the animal protection movement, have also fervently joined the discussions.

In this essay, I will discuss the moral dilemmas associated with xt and related

questions in moral theology. I do not pretend to be able to solve these questions,

Moral aspects

As indicated above, xt gives rise both to expectations and to concerns in society. From a moral point of view it is easy to recognise positive aspects of the new technology, if indeed it eventually becomes successful. The most important of these would be the removal of organ shortages, which would lead to an increase in the life expectancy and quality of life of extremely sick people. This may be seen as the dominant ethical motive behind xt¹, since life and health are fundamental human values. But there are other potential benefits that should also be mentioned. Xt would make us less dependent on human organs, which in most cases are donated in very sad and emotional circumstances, it would offer a much less hectic preparation procedure than is presently experienced by patients receiving allografts, who have to undergo surgery within hours of an organ becoming available, and it would help curtail the illegal trade in human organs.

¹ Cf. *The Ethics of Xenografting*, a document issued by the Society, Religion and Technology Project (SRT Project) of the Church of Scotland (Edinburgh, 1995). In *Xenotransplantation: Eine Hilfe zur ethischen Urteilsbildung*, edited by the Kirchenamt der Evangelischen Kirche in Germany and the Sekretariat der Deutschen Bischofskonferenz (Bonn, 1998). One can find a helpful overview of the pros and cons of xt, which is partly based on a xt technology assessment project carried out by the Swiss Science Council.

but rather my intention is to put them in an annotated form on the theological agenda.

Furthermore, the achievement of xt would result in a tremendous increase in our knowledge of immunology and would give an economic impulse to the bio and pharmaceutical industries.

In spite of the positive considerations, there is still much (public) concern over xt, even intuitive repulsion. These reactions should not be dismissed as ‘mere emotions’. Emotions are important for ethics and may be taken, at least *prima facie*, as ‘markers’ of (moral) values.

When people reveal emotions such as concern, anger, gladness and sadness, it is because they believe there are important values at stake. The task of ethics is, then, to articulate and analyse these values, by lifting them to a level and into a context where they can be properly discussed. We should be asking ourselves why xt is considered morally problematic in society. After analysing public concerns, the answer to this question may include the following points:

Feasibility and Effectiveness

There are serious doubts as to whether xt, in particular of organs, will ever be a feasible procedure since there are huge problems still to be overcome before it can

be seriously considered for routine use. Immunological rejection of xenografts is the greatest of these problems. Xt of animal organs into human patients elicits a hyper acute response (HAR) that results in rejection of the graft within a very short time. To overcome this problem researchers are focusing their efforts on the development of genetically modified donor animals, *in casu* pigs. To be successful, not one but several genes must be modified, which increases the complexity of the challenge and the difficulty of realising a solution. However, even if this problem were to be overcome there is yet another to be faced, namely the physiological compatibility between pig and human organs. If a transplanted pig organ were not to function physiologically then xt would not be effective. There is also the question of whether transferred pig organs can match the lifespan of man.

These biological issues present huge technical problems but also have a moral relevance. If xt proves to be neither feasible nor effective then hundreds of thousands of laboratory animals would have been sacrificed in vain and the huge amount of money invested in this work could have been better spent on a much more fruitful project. For these reasons some interest groups (and scientists) are against xt and are demanding alternative

ways to solve the organ shortage problem. It is, however, possible that xt will eventually become successful, but this can only be shown *a posteriori*; unfortunately, the development of techniques by trial and error is an intrinsic feature of science. Perhaps xt will turn out to be partly feasible by offering a temporary or interim solution before another more acceptable and more permanent one is found. Whatever, a long and difficult path lies ahead.

Risk factors

The second reason for concern about xt is the element of risk that it carries. In the section above, risk was mentioned in terms of immunological rejection of transplanted organs, but there is also a risk of disease transfer from donor to patient. Worse still, the risk may be exacerbated by the need to treat patients with immunosuppressive drugs to reduce the risk of rejection. The most serious threat of disease comes from so-called retroviruses (see Rui Mang's review on retroviruses and xenotransplantation in this issue), which are hidden in the genome of donor animals and are, therefore, difficult to detect. The chance of retroviral infection may be small, but remains a risk nevertheless, since assessments of risk and safety conditions cannot reduce it to zero. Consequently, we must face the potential

danger of transferring unknown diseases that have no cure, as was (and still is) the case with AIDS. Clearly, this would have serious ramifications for the affected patient, the patient's family and friends and for society as a whole. It may eventually become an international, even global, problem. Thus, application of a technology that is supposed to rescue an individual from imminent death may become a danger to society. Is it morally acceptable to run such a risk?

Yet another risk factor can be associated with xt and is best termed psychological risk. What does it mean for a human being to live with the knowledge that he/she has a pig organ in his/her body. Does it affect his/her personal identity? Are some organs, like the heart, more 'special' than others, such as the kidneys? And what about brain cells? These sorts of concerns may contribute to the so-called 'yuck factor', the emotional rejection of xt. There is still no science-based evidence for these risks and so we can only rely on the psychological assessment of patients who have undergone allotransplantation. These patients are known to experience feelings of ambivalence and fear for a considerable length of time after surgery, probably due in part to the circumstances in which they obtained the organs but also because of the high-risk situation in which they still find

themselves. It is important to remember that the transplantation of organs is usually a matter of life or death, or at best a poor quality of life, for the patient concerned. Knowing that the organ has been donated seems to be the most significant factor in a patient's psychological acceptance of a transplanted organ, which obviously would not be the case for patients receiving a xenograft.

Finally, a third risk factor should be mentioned, that of social risk. What will be the effect of xt on people's willingness to donate organs for allotransplantation? In other words, what does xt mean for human solidarity? If xt turns out to be successful, it is likely to lower the criteria for eligibility of undergoing transplantation, so that an increasing number of cells, tissues and organs will be required.

Clearly, these risks present moral dilemmas because of their consequences on safety (physical and public health), psychological health and social solidarity ('health'), yet it is far from clear how these risk factors should be dealt with.

Use of Animals

As mentioned previously, the development of xt requires experiments on a huge number of laboratory animals and the breeding of donor animals (pigs) in

specific pathogen free (SPF) environments. Apparently it is possible to imitate a natural habitat in SPF surroundings and thus the animals should not suffer.

Nevertheless, experiments on animals are widely seen as morally questionable and a necessary evil. Against this background there is a set of accepted rules in animal experimentation, the so-called 'three Rs': If possible, *Reduce* the number of animals, *Replace* animal experiments by alternatives and *Refine* the experiments.

If the issue of animal experimentation is put aside, xt faces us with a new use of animals for human interests: Not for food or for the development of science and technology, but for the production of organs, tissues and cells. This could be seen as a step towards instrumentalisation of animals, i.e. they are bred simply to be a 'kit of spare parts' for man, which might then be interpreted as further evidence of man's reduction in the value of animals to their practical usefulness?

It might be argued that if xt were to be successful, the use of animals for the purpose of improving human health and well-being would be morally justifiable, especially when we are considering very ill people. It is even possible to say that using animals for xt is much more vital, and hence better, than using them for food

production. Whatever, this new use of animals is a good reason to look carefully at the relationship between man and animals, particularly in relation to the question of where the limit in the use of animals for human interests should be drawn. The instrumentalisation of animals, with its associated problems of feasibility and risk, is why a considerable number of people in society, like the animal rights movements, reject xt as a morally viable direction to pursue.

Unnaturalness

Another reason to consider xt as morally questionable is its unnaturalness. The phenomenon of hyper acute rejection (HAR) may be seen as symptomatic of this, and because of its occurrence xt will not be feasible without genetic modification of the donor animals. Clearly, xt is a 'high tech' procedure, and thus highly artificial. The question is: Does this matter? Does nature teach us how to behave? Does (belief in) creation imply a moral order in nature? Does the introduction of xt mean that we are violating the fundamentals of this 'given' order of nature?

These questions are not so easy to answer. Genetic modification, resulting in the 'creation' of transgenic animals, makes use of processes well known in nature. What is

the difference in principle between genetic modification and selective breeding of animals and crops? In the latter case we make use of processes that are well known in nature. There may be a difference in scale, helped by our ability to cross species barriers, and a difference in effectiveness, but does this mean there is a difference in principle? Thus, is it unnatural after all, and even if it is, so what? If xt is considered unnatural then so is allotransplantation, but both have been developed because sometimes nature fails! Where does the presupposition that nature is good come from, at least that it is better than an artificial solution? Why does the expression of 'playing God' emerge again and again in the field of biomedical technology?

Biblical law

That xt is morally problematic might be based on some biblical texts, like *Leviticus* 19: 19 and *Deuteronomy* 22: 9f, where the intermingling of animal kinds, seeds or yarns is forbidden. In particular, the former text, which has its origin in the so-called Priest tradition of the Old Testament, could be interpreted as the application of a theology of creation, found in *Genesis* 1. God created animals and plants 'after their kinds', in other words He created the kinds and then man and man is not allowed to go in the opposite direction.

However, the problem is not only that already in Old Testament times mules, which arise from the cross-breeding of horses and donkeys (male = horse, female = donkey), were found everywhere, but also that many Biblical laws, in particular ceremonial and sanitary laws, were not adopted by Christian tradition. It is not clear whether, for instance, *Leviticus* 19,19 belongs to this category or whether it reflects a moral teaching that is still relevant today. Moreover, one could argue that xt is not the same as inter-breeding different species of animals or plants and that exchange of genetic material appears to be a normal phenomenon in nature. Lastly, the kinds that are mentioned in the Bible and the species barriers between mammals do not seem to be very relevant in the light of evolutionary thinking. These texts may, therefore, have lost their relevance, for they reflect a worldview, or at least a biology, that is not ours anymore. Further exegesis and hermeneutics are required to underpin this hypothesis and to find an answer to the question of how to use these old texts of Biblical law in Christian ethics.

Alternatives

Finally, xt presents a moral dilemma because alternatives do exist. The three Rs rule, mentioned above, states that an

alternative to experiments on animals should be sought whenever possible. Instead of xt, therefore, human organ donation could be promoted, as well as a more efficient use of human organs and better organisation of allotransplantation. Much more money could be invested in the development of artificial organs, in human stem cell research and in tissue engineering. The latter, in particular, offers a very promising solution, although it is still in an early stage of development. Stem cells are cells that can divide to produce cells either like themselves (self-renewal) or of (a) specific type(s). They can be obtained from (1) very early stage embryos, (2) aborted fetuses, (3) certain adult tissues, or (4) by the application of cloning technology. Using tissue engineering techniques, it is hoped that stem cells could be used to produce specific tissues for therapeutic purposes, so that cardiac muscle cells might be used to alleviate heart diseases, liver cells could be used against hepatitis and neural cells against degenerative brain diseases.

It hardly needs saying that the use of human embryos to derive stem cells raises moral dilemmas in itself. It is becoming clear that in general the alternatives for xt have their own ethical problems. The use of adult stem cells is probably the least problematic, but they are more difficult to

obtain than embryonic stem cells and they do not have the same potential.

One could question whether these alternatives really are alternatives. It is, for instance, far from proven that whole organs can be grown using tissue engineering technology. In view of what might be achieved in the future, these alternatives probably only partly overlap in their function, except allo- and xenotransplantation, and even then allotransplantation cannot solve the problem of organ shortage. So why not give both xt and its alternatives a fair chance?

Moral theology

Clearly, behind the moral problems of xt lie more fundamental theological and philosophical issues. Most are not specific to xt, but it is appropriate to consider them nonetheless.

‘Playing God’

Advances in biomedical technology mean that we not only understand the blueprint of life but also are increasingly able to apply this knowledge to ‘manipulate’ life. In this context the term ‘playing God’ is often used as a vague expression of uneasiness and concern. It is interesting that it often arises in a secular context. On closer inspection, at least four fundamental

questions may be associated with the term. First is the concern that biomedical technology crosses the boundaries of human finitude. One could call it the Promethean aspect, the 'original' sin of human pride and arrogance. In manipulating life, human beings misappropriate something that belongs to God (or Nature, or Evolution). Or do they? Second, the term 'playing God' shows an awareness of the suggestion that science and technology pretend to be the 'saviour' of the world. One could refer to this as the aspect of the 'Tower of Babel', an old Biblical image (in *Genesis* 11) for technology pretending to pave a way to heaven (without God's help), or in more secular words, to a society where the good life will become reality. Does it have any relevance to what Christian tradition understands by 'salvation'? Or, put another way: Does 'salvation' have any relevance to (the results of) biotechnology? Third, there is a fear of the possible runaway consequences of biomedical technology on society, the aspect of the sorcerer's apprentice, which is equivalent to the problem of 'risk society' (Ulrich Beck) and man's responsibility within it. The question is: What does theology have to say about this 'risk society'. Finally, 'playing God' expresses unease in not being able to cope with a world where traditional borderlines and certainties are

constantly being eroded, i.e. the aspect of alienation. What does biomedical technology (and information technology) mean for human self-understanding? This is not only a question of theological anthropology but also of pastoral theology.

To make this 'agenda item' more interesting for (moral) theology, there may be another interpretation of the term 'playing God' in the light of Christian faith. The belief is that man is created 'in the image of God', which means that they are supposed to resemble God in their life and work, they are called to 'dress and to keep the Garden of Eden' (i.e. Earth) and to follow Jesus Christ in his creative, redemptive and loving relation with the world. What does this mean in terms of 'crossing the boundaries' with science and technology? What sorts of boundaries are meant? Is it not part of man's vocation 'to get out thy country, and from thy kindred, and from thy father's house', as Abram did (*Genesis* 12,1)? And does God not reveal Himself as being present on our way into the future? Both interpretations should be taken seriously. We could use Pascal's terminology in saying that both interpretations show that the *grandeur* and *misère* of humankind are two sides of the same coin, and that the first interpretation is always a menace to the second.

Human identity (1)

Once again xt confronts us with an old problem in Western tradition: human identity and the role of the body in relation to this. Xt technology implies a reductionist understanding of the human body. Can the body be seen as functional or instrumental with regard to human identity? Is the heart merely a pump to push blood around the body? Is the body merely a collection of organs that can be replaced wilfully? For centuries in Western (also Christian) tradition, the body has not been seen as essential for human identity. Although the resurrection of the body was part of the Christian confession, which meant that the body was important enough to participate in salvation, in practice the soul was taken to be the essence of the human being. In the twentieth century this dualistic image of the human individual has been severely criticised in philosophy and theology, and it has been replaced by a more monistic or holistic image of the human being. Body and mind are both essential for human identity. Does xt mean that we have, at least in practice, returned to dualism again? Does it indeed convey a reductionist image of man? And does that matter in questions of life and death?

Human identity (2)

There is another reason why attention should be paid to the question of human identity. Clearly, all organisms share the blueprint of life, and hence: What is so special about human beings compared to animals and plants? There is a tendency to challenge the idea that man is the 'crown of creation'. Interest groups, like the Animal Rights Movement and Deep Ecology, defend a form of biocentrism instead of anthropocentrism. But even if one is not inclined to follow these groups, the instrumentalisation of animals in bio industry, in biomedical research and in xt especially, are reasons to put the relationship between man and animals, as well as the position of man in nature, on the agenda of theology and philosophy. So the question of human identity is not only the question 'Who am I?', but also 'Who are we among our fellow creatures?' We are challenged to think about the fundamentals of human self-understanding and of hierarchy in creation in the light of Christian faith. Here is the first remark in this process of reflection: In the light of Christian faith the uniqueness of man might not primarily be dependent on special qualities (e.g. rationality) or organs (e.g. brain or heart). Animals are created 'after their kinds', human beings, however, 'in the image of God'. This means that man's vocation is to be faithful 'housekeepers' or stewards in creation and

places him in a position of responsibility towards his fellow creatures and the environment.

Nature

Another important issue, mentioned earlier in this contribution, is whether nature can teach us how to behave, in other words whether nature displays a moral order. This is a strong feature in Christian tradition, but it is not clear. On the one hand, if we believe that God created the world, the implication is that this world is somehow an expression of His will. On the other hand because we are confronted with much evil in creation, there is always a large element of human construction and interpretation in the way we 'perceive' moral order in nature. In other words, 'natural law' is mainly man's interpretation in the light of (increasing) knowledge and faith. It is, to a large degree, 'cultural' law.

Here is not the place to open the very sophisticated discussion on natural law, although biomedical technology may give reason to do so. There is another reason, however, to do so, which is a contextual one. Perhaps it is an exaggeration, but my impression is that an ideology is emerging, a form of holism which perhaps implicitly evaluates nature as intrinsically good, at least better than human intervention.

Nature is seen as having a sort of taboo

status, something that is nearly divine. And human intervention becomes almost by definition an infringement of the 'holiness' of nature. If this is the case, then we are confronted with a form of neo-paganism. That nature is divine is already strongly rejected in the Old Testament. The world is God's creation, not God. Moreover, this world is affected by sin and evil. And if we take another idea of creation (present in the Bible), namely that creation is not *creatio ex nihilo*, but is God creating cosmos out of chaos, it means that chaos is a constant threat to and presence in cosmos. In that case, the idea of moral order in creation is even more difficult to maintain. In short, we are in need of a theology of nature.

Science and revelation

The last question is about moral theology itself and its relation to developments in science and technology. Are (revolutionary) scientific disclosures and technological developments morally relevant? Of course, one is inclined to say, because they change the conditions of human behaviour and, thus, the playing ground for ethics. An increase of knowledge means an increase of power, which means an increase of responsibility. Science and technology are a challenge to ethics and moral theology, as we have seen above.

But there is another dimension to this issue. Could scientific disclosures and technological developments result in making some moral theological positions (partly) obsolete? Take, for instance, human embryology. We do not have the same embryology as the church fathers, or as St. Thomas Aquinas. What does this mean for our position concerning the *moral* status of the human embryo? As a result of *in vitro* fertilisation there are human (pre-)embryos that will never be transferred into the womb. So it is possible to distinguish between (pre-) embryos that are, or will, be transferred and those that will definitely not. Does that make a moral difference? To generalise the point once again: What is the theological evaluation of science and technology? Could they be seen, from a theological point of view, as a form of revelation, and if so, what does that mean for moral theology?

Provisional conclusion

Putting issues on the agenda means that associated decisions have not yet been made. There is much (scientific and theological) uncertainty surrounding biotechnology in general, and in *xt* in particular. There is no place, therefore, for premature answers in this essay, least of all for a simple 'Yes' or 'No'. In the case of uncertainty, a step-by-step policy might offer a good practical translation of the

ancient virtue of prudence. This means that not only do deontological considerations play a role (like freedom of research) but that the consequences of science and technology should be taken into account as well.

Against this background two things might be said. Firstly, prudence does mean something for an ethos of researchers². It is a plea for an attitude that considers the social context of science and technology and the willingness, or rather the commitment, to work in accordance with rules that reflect the basic values of our culture. In other words, ethics is not something detached from science but is an integral part of science and technology themselves.

Secondly, this ethos should be extended to universities. Universities may be seen as knowledge producers, and nowadays knowledge does not only mean power, but has increasingly become of economic value. If they want to remain faithful to their traditions, universities have a duty to think about the moral aspects of knowledge acquisition and application. They should be places where a scientific ethos can flourish and should not be reduced to science parks alone. The days

² This is very well worked out in the German text mentioned in note 1.

when theology was *regina scientiarum* (the queen of the sciences) and philosophy was *ancilla theologiae* (the servant of theology) have gone, thank goodness! But thinking about the fundamental questions behind science and technology belongs to the core business of a university. Since the Renaissance, the sciences have become more and more independent of the so-called humanities. This move towards independence has been, and still is, very important for Western culture.

Nevertheless, a price was paid, in the form of a language gap between the two disciplines. It is an important task of the universities to bridge this gap, by creating the right conditions for communication, understanding and cross-fertilisation between the sciences and humanities.