

# *Ethics and Human-Animal Transgenesis*

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## 1

### **Is It Morally Acceptable to Transform an Animal Zygote by Introducing Human DNA into Its Genome So That the Developing Embryo Inherits Some Human Biological Characteristics?**

In September 2001, the Pontifical Academy for Life issued a discussion paper titled “Prospects for Xenotransplantation: Scientific Aspects and Ethical Consideration.”<sup>1</sup> The editors hope the document “will represent a concrete contribution to the development of discussion on the important theme of xenotransplantation.”

We are pleased that the Academy has initiated discussion. We take the issuing of this discussion paper as an invitation to reflect on the matter and to contribute to the ongoing analysis of the issues. One small section of the document deals with the issue of human-animal transgenesis.

The Academy studied the prospects for transplanting animal organs to humans. In order to prevent the human body from rejecting animal tissue, it is thought that by introducing some human genes that will produce human proteins, and by “knocking-out” some of the animal genes, transgenic animals may develop from the transgenic

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<sup>1</sup> The paper was published as a supplement to *L'Osservatore Romano*, September 26, 2001, 18.

zygote, with tissue that may be satisfactorily transplanted without rejection. Cloning the transgenic animal might usefully provide a renewable source of transplantable organs.

The discussion has been about using pigs as a source of organs for transplant to humans, with a focus on hyperacute rejection. The idea is to add the human gene responsible for producing a protein that inhibits rejection. It is also thought to be necessary to knock-out the pig gene for alpha-1,3-galactosyltransferase antigen to which human antibodies may be directed.

In the scale of the whole pig genome, in which there may be as many as thirty-five thousand endogenous genes, these genetic changes are not particularly significant in terms of altering the fundamental nature of the pig formed. The pig will not appear to be a different species from its parents, even though it is not strictly an entire pig genomically. Its human characteristics would be at the biological level and would not produce changes that raise questions about whether or not it has gained moral agency. One would not expect it to stand up on its hind legs as an adult and demand the keys of the car.

This line of experimentation at least raises questions about how far such experimentation might go. One might ask, How many genes might be added and how many could be “knocked-out” before there is a significant change such that one would recognize the animal is no longer a pig but another type of organism? If human genes are being added, then one might question at what proportion of genetic change ought one consider the moral status of the developing animal.

*This is a very complex topic, both scientifically and ethically, because it involves the generation of new life with a modified genome, and because it involves crossing the medical and moral boundary between what is human and what is animal.*

The Academy’s document mentions ethical conditions for transgenesis in relation to:

- Pain and suffering in the transgenic animals
- Effects on offspring and environmental repercussions
- Control of animals so that they are not released into the environment
- Limits on the number of animals
- Organ and tissue removal
- Evaluation by ethics committees

The authors do not attempt to discuss the intrinsic moral issue of whether human-animal transgenesis is a form of human-animal hybridization. Attempts to achieve human-animal hybridization by fertilization between human and animal gametes were condemned by the Congregation for the Doctrine of the Faith in *Donum vitae* as being contrary to human dignity.<sup>2</sup>

The authors of the Academy’s document also do not discuss the significance of the human genome in the formation and in the generation of a human life, and the

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<sup>2</sup> Congregation for the Doctrine of the Faith, *Donum vitae* (February 22, 1987), I, 6.

consequent moral significance of using parts of the human genome to generate a being who is, in part, genetically of human origin.

In providing no analysis of these topics, the Academy thus offers no authoritative teaching in this regard. For that reason we think it important to offer a discussion of the moral aspects of attempting to transform an animal zygote by introducing human DNA into its genome, so that the developing embryo inherits some human biological characteristics.

## 2

### **Is Human-Animal Transgenesis to be Condemned as a Form of Human-Animal Hybridization?**

In response to our queries, a scientist advising the Academy argued that transgenic animals cannot be defined as human-animal hybrid embryos or animals since they are not derived from the fusion of a human and an animal gamete.<sup>3</sup>

There is a matter of language at issue. The *Oxford English Dictionary* defines “hybrid” biologically as the offspring of two plants or animals of different species. In biology, “offspring” does not imply fusion of gametes because it can be used for an individual organism resulting from another by asexual reproduction. An organism is a hybrid organism if its inherited characteristics are from organisms of different species. Being a hybrid does not imply an origin in a fertilization event.

The Congregation for the Doctrine of the Faith condemns “attempts or plans for fertilization between human and animal gametes” and describes them as “contrary to human dignity”:

Techniques of fertilization *in vitro* can open the way to other forms of biological and genetic manipulation of human embryos, such as attempts or plans for fertilization between human and animal gametes and the gestation of human embryos in the uterus of animals, or the hypothesis or project of constructing artificial uteruses for the human embryo. *These procedures are contrary to the human dignity proper to the embryo, and at the same time they are contrary to the rights of every person to be conceived and to be born within marriage and from marriage.*<sup>4</sup>

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<sup>3</sup>“Some Notes on Transgenesis,” by a scientist assisting the Pontifical Academy for Life in relation to “Prospects for Xenotransplantation.” The notes were given to one of the authors by Archbishop Elio Sgreccia on December 11, 2001, in correspondence about the moral permissibility of human-animal transgenesis.

<sup>4</sup>*Donum vitae*, I, 6: “Rationes technicae fecundationis in vitro aditum patefacere possunt ad alias formas artificiosae tractionis biologicae vel geneticae embryonum humanorum, cuiusmodi sunt, conatus vel proposita fecundationis inter hominum et animaliam gametes, et gestationis embryonum humanorum in uteris animalium; coniecturae vel consilia artificiales uteros fabricandi ad embryones excipiendos. *Huiusmodi procedendi rationes repugnant creaturae humanae dignitati quae ad embryonem spectat, simulque ius laedunt uniuscuiusque personae et concipiatur ut nascatur in matrimonio et ex matrimonio*” (original emphasis).

There would seem to be two aspects of attempting fertilization between human and animal gametes that would draw this condemnation. One is the confusion of the identity and status of any being formed that way. The second is the wrongful use of the human generative capacity of a human gamete to form a being by uniting it with an animal gamete.

It would be a mistake to hold that the Congregation would support human-animal hybridization by processes not involving fertilization. The Congregation condemns techniques “such as” (*cuiusmodi sunt*) attempts or plans to achieve fertilization between human and animal gametes.

The advent of somatic cell nuclear transfer (cloning) technology in animals in 1997<sup>5</sup> indicates that it might be possible to produce a human being other by means other than fertilization. On November 26, 2001, a U.S. biotech company reported the formation of the first cloned human embryo by use of the somatic cell nuclear transfer technique with an ovum.<sup>6</sup> Subsequently, there have been claims in the popular media of human pregnancies produced by somatic cell nuclear transfer, but at the time of this writing, they have not been reported in peer-reviewed journals.

Because human beings may be produced without fertilization (by asexual and agamic reproduction), we have had to reexamine the question as to what defines the origin of a specifically human being. The contemporary references to fertilization and conception are no longer sufficient. The Congregation for the Doctrine of the Faith, for instance, defines the beginning of human life to be the fusion of the gametes,<sup>7</sup> but that is not the only way in which a human life may begin. There are human beings who are not the result of fertilization or conception, but have been produced asexually.

The Pontifical Academy for Life, in its “Reflections on Human Cloning,” writes that human cloning “is immoral because even in the case of a clone, we are in the presence of a ‘man,’ although in the embryonic stage.”<sup>8</sup> There is no doubt that the product of the process known as *human somatic cell nuclear transfer* to a human ovum would be a human zygote, to be respected and treated as a person, even though he or she did not result from fertilization between gametes.

The transmission of a human genome is a significant consequence of both human fertilization and human asexual reproduction by somatic cell nuclear transfer. Scientifically, it is the transmission of a human genome in the formation of the zygote that results in the generation of a new human being. We argue that a zygote with a

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<sup>5</sup>I. Wilmut et al., “Viable Offspring Derived from Fetal and Adult Mammalian Cells,” *Nature* 385.6619 (February 27, 1997): 810–813.

<sup>6</sup>“Special Report: Cloning and Human Stem Cells,” [www.newscientist.com](http://www.newscientist.com) (January 29, 2002); article no longer available. It is open to question whether what was formed was genuinely a human embryo, that is, one capable of gastrulation.

<sup>7</sup>*Donum vitae*, I, 1.

<sup>8</sup>Pontifical Academy for Life, “Reflections on Cloning,” *L’Osservatore Romano* (July 9, 1997): 10.

human genome must be considered a human individual, who is thus made in the image and likeness of God, with all the inheritance of human dignity that that implies.

Significantly for this discussion of human-animal transgenesis, a Melbourne company, Stem Cell Sciences Pty. Ltd., was reported to have formed an organism that combines a human cell nucleus with an enucleated pig ovum.<sup>9</sup> The organism developed in similar fashion to a human embryo until the stage at which it died, at around thirty-two cells. A team in Massachusetts led by Dr. Thomas Murray reported a similar experiment using a human cell nucleus and an enucleated cow ovum. They reported that the human nucleus took control and displaced cow proteins with human proteins, and they claimed to have obtained human embryonic stem cells from the embryo thus formed.<sup>10</sup>

It seems to us that in such cases, provided that the new being formed has a human genome, the new being should be given the benefit of any doubt as to its human status; that is to say that, as a matter of science, the genome is determinative of the nature and capacity of the zygote.

It would seem to follow that, if part of the wrong of a human-animal hybrid formed by a process other than fertilization is confusion of the identity and status of the being (formed by fertilization between human and animal gametes to produce a zygote with a mixed human animal genome), then the same conclusion should be drawn in relation to a zygote with a human-animal hybrid genome formed by transgenesis and not by fertilization. The outcome, a being with confusion of identity and status because it has a genome that has both human and animal genes, is the same in both instances.

*For this reason, we submit that it is intrinsically immoral to undertake human-animal transgenesis in the formation of an embryo because of the confusion of the identity and status of any being formed that way.*

### 3

#### **Is There an Acceptable Level or Proportion of Human-Animal Hybridization?**

A question may arise as to whether there is an acceptable proportion of the human genome, perhaps something less than 50 percent, that may be added to an animal ovum or zygote. Our view is that the confusion of identity arises as soon as any human genes become formative of the new being. The functions of the genes, especially the multi-chromosomal genes, are very complex and may never be fully understood.

It has been argued that the genetic similarity between humans and other species is very high, so as to be nearly identical for many genes, thereby diminishing the

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<sup>9</sup>Dr. Alan Trounson, letter to the president of the Australian Senate, tabled by Senator Tambling during the debate on the Gene Technology Bill 2000, Senate *Hansard*, December 4, 2000.

<sup>10</sup>Nicholas Wade, "Human-Cow Hybrid Cells Are Topic of Ethics Panel," *New York Times*, November 18, 1998.

uniqueness of the human genome. It could be argued that if so many human genes are virtually the same as those found in other species, then there should be nothing unusual about moving genes from one to the other. Of course, there would also be little point in transferring a human gene at all if it is very similar to one that already exists in a target species.

But what does genetic similarity really mean? The genetic similarity between humans and our “nearest neighbor,” the chimpanzee, has been placed variously between 96 and 98 percent. Does this mean that 96 to 98 percent of our genes are the same, or that each gene is 96 to 98 percent the same?

In fact, the homology between humans and chimpanzees is across the whole genome, so that each and every gene is different between humans and chimpanzees to a varying extent. The degree of homology may be very high, so that a given human gene might be only slightly different from a chimpanzee equivalent; or, alternatively, the homology may be considerably lower, so that a gene might be quite dissimilar between the two species or entirely novel in humans.<sup>11</sup> Nevertheless, even tiny differences in the nucleotide sequence of a gene can have a dramatic effect on the protein produced, and therefore on the function served by that protein.<sup>12</sup> Therefore, a tiny difference at the level of nucleotide bases might give rise to dramatic differences in function, and hence to development and form.

Furthermore, certain control genes in humans may direct development by influencing large numbers of other genes. This hierarchy of gene action means that the addition or modification of just one or a few genes high in the chain of command can lead to startling differences in form.<sup>13</sup> The absence of certain master genes in chimpanzees may be behind at least some of the significant differences in development and therefore functional capacity between humans and chimpanzees.<sup>14</sup>

The environment in which a gene is located can have a strong influence not only on the extent of its expression but also on the protein that is produced. Post-transcriptional events modify proteins in particular ways, so that a human gene trans-

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<sup>11</sup> This raises the interesting question concerning how different a gene needs to be, compared to a similar one in another species, to be considered novel.

<sup>12</sup> Various single-gene disorders result from changes to one or a few nucleotide bases out of hundreds of thousands and yet produce life-threatening conditions. For example, in the most common mutation causing cystic fibrosis, just three wrong nucleotide bases out of two hundred and fifty thousand (i.e., a 0.0012 percent change) leads to a defective protein and all the serious health consequences of this genetic disorder. See Friedrich Vogel and Arno G. Motulsky, *Human Genetics: Problems and Approaches*, 4th ed. (Heidelberg: Springer-Verlag, 1996).

<sup>13</sup> One rather bizarre expression of this principle in action can be found in the genetic manipulation of the fruit fly *Drosophila melangaster*. The manipulation of control genes gave rise to the development of eyes on the ends of wings and limbs.

<sup>14</sup> For a discussion of some genetic differences between chimpanzees and human beings, see D. Elder, “Humans vs. Chimps: Small Steps for DNA, Giant Leaps for Us,” *Bioethics Research Notes* 14.2 (June 2002): 13–14.

ferred to an animal may not behave in exactly the same way it does in the human.<sup>15</sup> Human genes working in the context of human cellular machinery create an environment that functions in a highly integrative and complementary fashion. It is likely that moving certain human genes out of their normal context may mean they will operate quite differently.

There is also the matter of so-called “junk,” or non-coding, DNA. A typical figure for the percentage of the human genome that goes by this unfortunate label is approximately 95 percent, although it may be higher; that is, 5 percent or less of the human genome is composed of genes that code for proteins. The rest have typically been considered uninteresting—packing at best, refuse at worst. However, researchers are rapidly discovering roles for this overlooked “junk” DNA. And while there is much to learn, according to recent findings, non-coding DNA is active in cellular function.<sup>16</sup> Indeed, it has been suggested that as much as 50 percent of active transcription inside cells may be from non-coding DNA.<sup>17</sup> Furthermore, and possibly more important, the amount of “junk” DNA varies greatly from species to species and, depending on its possible roles in a given species, may contribute to the complexity of function demanded by higher organisms. Or it may not. Not enough is yet known.<sup>18</sup>

There is an additional and related reason that might be used to argue for the legitimacy of transgenesis. If genes are transferred in the natural course of events from humans to other species and vice versa, then the human genome is undergoing a form of “natural transgenesis,” making artificial transgenesis hardly out of the ordinary.<sup>19</sup>

The natural transfer of genes between species, independent of reproduction, is typically referred to as horizontal gene transfer. Do genes move in this way from one genome to another, and to what extent?

Humans, as well as other species, continually consume foods that contain large amounts of the genomes of other species. The DNA and RNA are digested, and our stable genomes do not incorporate any of that genetic material, remaining unchanged.

An exception occurs when viruses enter the body by various routes and become incorporated into our genomes, often with dramatic results. Some of those viruses can remain dormant for a long time before any effect is exerted. But the

<sup>15</sup> Simon Bawden, a geneticist with the South Australian Research and Development Institute, conversation with Dr. Gregory Pike, November 2005.

<sup>16</sup> For a recent review of the possible roles played by non-coding “junk” DNA, see J. S. Mattick, “Challenging the Dogma: The Hidden Layer of Non-Protein-Coding RNAs in Complex Organisms,” *BioEssays* 25.10 (October 25, 2003): 930–939.

<sup>17</sup> Simon Bawden, conversation with Dr. Pike, November 2005.

<sup>18</sup> It is puzzling that the onion genome, for example, is twelve times the size of the human genome, presumably because of its large amount of “junk” DNA.

<sup>19</sup> This argument, however, if used to justify human-animal transgenesis, is an example of the naturalistic fallacy.

incorporation of viral material into the human genome does not change the integrity of the human genome, and not in a way that influences identity. If anything, viruses are considered foreign invaders that disrupt normal processes and leave the essential nature of the host unchanged.

However, horizontal gene transfer has been shown to occur between bacteria, and while this may present a special concern for the safety of genetically modified foods,<sup>20</sup> the transfer of genes to higher species has not been convincingly shown.<sup>21</sup>

It was recently reported that approximately one hundred genes from bacteria are found to be very similar to sections of the human genome, and that they got there in the first place via horizontal gene transfer;<sup>22</sup> that is, it was proposed that genes are directly transferred from the bacterial genome to the human genome by virtue of the presence of the bacteria within the human body. Subsequent studies have shown that this is not the case, and if horizontal gene transfer does occur between humans and other species, then it is exceedingly rare.<sup>23</sup>

The issue of transgenesis is clearly complicated. In the type of project currently discussed, the changes being made to the pig's genes are said to be minor. Nevertheless, the experiment does raise the question of whether humanness is a matter of degree. At what point would the substitution of human genes into a pig result in a being who is less a pig but rather deserving of greater moral status.

There would seem to be an apparently unanswerable question: How much, or for which genes, or for which functions, would the transfer of human genes to an animal ovum or embryo warrant to consider that animal embryo to have a greater moral status?

It is tempting to answer this question in terms of function. A being is "human" in status when he or she has those genes which cause him or her to have those capacities that we particularly value in human beings, for instance, the ability to doubt, reason, wonder, love, and be self-constructive of one's own character. In fact, we might be prepared to give such a protected status to a being who still looked like a pig but exhibited human rationality.

A problem with this reasoning is that, in terms of our Christian tradition and the human rights movement, particularly the part of the human rights movement that deals with disability, membership in the human family is significant, and not capacity. While we might concede that a pig-like being with human intelligence deserves human status, are we prepared to say that only human beings who approach normal

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<sup>20</sup> See "Horizontal Transfer—An Introduction: Gene Transfer between Organisms without Reproduction," a short paper published by Physicians and Scientists for Responsible Application of Science and Technology at <http://www.psrast.org/hrtrintr.htm>.

<sup>21</sup> Some agrobacteria are able to transfer genes to plant chromosomes.

<sup>22</sup> For a discussion of the relevant papers and a review of horizontal gene transfer, see C. G. Kurland, B. Canback, and O. G. Berg, "Horizontal Gene Transfer: A Critical Review," *Proceedings of the National Academy of Sciences* 100.17 (August 19, 2003): 9658–9662.

<sup>23</sup> *Ibid.*



standards of human intelligence deserve moral status? In the Christian tradition, we make no such moral distinction between human beings.

Already there are scholars, evaluating the inherent dignity of an animal purely in terms of sentience and function, who have claimed that chimpanzees are more worthy of respect as “persons” than new born babies, and that a normal adult pig is of greater moral significance than a defective newborn baby. These claims might well be enhanced when the chimpanzee or pig in question has a genome that is, in part, human.

*We hold that an endorsement of procedures to transform an animal zygote by introducing human DNA into its genome, so that the developing embryo inherits some human biological characteristics, undermines respect for the human zygote, because, in the created order, it is possession of a human genome, even if damaged or incomplete, that sets a human zygote apart from animals. Human-animal transgenesis undermines that very notion of human dignity and sacredness which determines the moral status of every human being, however nascent or damaged he or she may be.*

#### 4

### **Is Human-Animal Transgenesis Involving an Animal Zygote Morally Different from Established Procedures Involving Bacteria?**

Scientific advisers to the Academy argue that it is not an offence against human dignity to insert a small part of the human genome (one or few genes) into the genome of another organism, because the practice of inserting human genes into bacteria, such as the human insulin gene in *Escherichia coli* for use in the treatment of diabetes, is well established and indeed accepted.<sup>24</sup>

A bacterium is a unicellular micro-organism which lacks an organized nucleus.<sup>25</sup> It has no capacity to form a blastocyst, to gastrulate, to undertake cell differentiation, or to form a complex organism. The significance of altering the DNA of a bacterium would seem to be on a par with altering the genome of somatic cells in culture.

By contrast, altering the genome of a zygote means altering every cell in the complex being that the zygote may become and, by altering the genome, changing, at least to some extent, the nature of the animal who may develop. A crucial difference is the zygote’s capacity for embryogenesis. A bacterium remains a single-cell organism lacking an organized nucleus. Because of its capacity to form a blastocyst and to gastrulate, a zygote is the first cell of a very complex being, and its genome determines how it will develop and what kind of organized development can occur. Essentially, the genome of the zygote determines who or what that being is, not just as a cell, but also as a complex being composed of many differentiated cells. Furthermore, the change in the animal is inheritable by its offspring.

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<sup>24</sup> “Some Notes on Transgenesis.”

<sup>25</sup> *Concise Oxford English Dictionary*, 10th ed., s.v. “Bacterium”; see also *Dorland’s Illustrated Medical Dictionary*, 27th ed., s.v. “Bacterium.”

The scientific advice to the Pontifical Academy for Life appears to have drawn an equivalence between a bacterium and a zygote or embryo. In fact, a zygote—with its enormous capacity to form a blastocyst, to gastrulate, and to differentiate so that eventually a complex being forms, capable of integrated autonomous activity—is vastly different from a bacterium.

In the case of human-animal transgenesis, the capacities to form a blastocyst and to gastrulate (the first stages of differentiation) are present in the animal zygote to which the human genes are added.

In the process under discussion, no human gamete is used. However, the generative capacity of the animal zygote is used as a vehicle for developing a being that expresses and may reproduce parts of the human genome.

We strongly oppose the practice for the philosophical reason that adding human DNA to an animal zygote transforms the zygote so that it has some human biological characteristics. Given that as human beings we are a psychosomatic unity, we cannot make satisfactory distinctions between which genes are thus acceptably added and which are not. There is no acceptable extent to which a human-animal transgenic being may be created or generated.

## 5

### **Is It Permissible to Introduce Human DNA into an Animal Such That the Change Is Inheritable and Affects Organs That Are Crucial to Identity, Such as the Brain?**

There is an issue of identity that is being ignored in attempts to achieve human-animal transgenesis. By changing the DNA in a zygote, we make an inheritable change that affects every cell in the body of the being who eventuates, including brain cells and reproductive cells.

It should be noted here that the Pontifical Council for Pastoral Assistance to Health Care Workers addresses the issue of brain and gonad transplantation and concludes that such transplants are unethical.<sup>26</sup> The reason it gives is that the brain and the gonads “ensure the personal and procreative identity. These are organs which embody the characteristic uniqueness of the person, which medicine is bound to protect.”

A human-animal transgenic being has had, in effect, human DNA transplanted to its brain cells and to its gonads, as well as to every other tissue in the body. The human DNA will be inherited by its offspring, and the brain, when it develops, will have those changes. What is being altered thus has profound significance for identity.

If we deliberately create beings that have DNA from both human and animal sources, then we violate the sacredness of all human beings. The distinction between human and animal identity, so vital for the protection of basic human rights, would be blurred.

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<sup>26</sup> *The Charter for Health Care Workers* (1995), n. 88.

## 6

### **Is the Generation of an Embryo That is Part Human and Part Animal a Misuse of the Human Generative Capacity Contained Within the Human Genome?**

#### *Science and the Human Genome*

In 1996, the UNESCO International Bioethics Committee (IBC), the drafters of the *Universal Declaration on the Human Genome and Human Rights* (1997), after protracted debate, decided not to define “the human genome.” Instead, the *travaux préparatoires* record eight alternative meanings of the term:

- The genetic substrata of human beings
- The total genetic material of humanity
- All the genes of every individual
- The genome in its tangible aspect (DNA and RNA molecules)
- The genome in its immaterial aspect (genetic information)
- The genetic program which is the source of the vital functions of every individual
- The genes that can be detached from the body of every human individual
- The values attached to human identity<sup>27</sup>

The Web site for the human genome project defines a genome as all the DNA in an organism, including its genes.

It seems to us that it is not enough to say that the human genome is all the DNA in an organism, including its genes. The human genome is also the genetic information that may be transferred by copying the DNA sequences in a cell. Thus, *the genome is all the material that constitutes the DNA sequences or genes in an organism, and it is the information that those DNA sequences express or represent. The genes are the DNA sequences that determine the inherited characteristics of a cell or an individual.*

The scientific significance of the human genome is that it is determinative of the inherited characteristics of the individual.

#### *Is the Genome Related to Human Dignity?*

In the cloning process the basic relationships of the human person—filiality, consanguinity, kinship, and parenthood<sup>28</sup>—are perverted precisely because the genome that is formed is not a unique new genome that originates equally in the genomes of both parents.

The new genomic technologies and development of the scientific understanding of what it is to be human, and the function of the human genome in that respect, necessitates an answer to the question, What gives all members of the human family

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<sup>27</sup> UNESCO, *Universal Declaration on the Human Genome and Human Rights*, preliminary draft of December 1996, n. 20.

<sup>28</sup> Pontifical Academy for Life, “Reflections on Cloning,” 10.

inherent dignity and equal and inalienable rights? Historically, Western culture has been based on the Christian tradition. The tradition holds (with some notable historical aberrations) that the protected status or inviolability of human beings does not depend on individuals, nor is it a concession made by society and the state. Inviolability or sacredness belongs to human nature and is inherent in the person by virtue of the creative act from which the person took his origin.<sup>29</sup>

No doubt, this claim gives cause for theological reflection on the nature of creation and God's law for humanity, especially the fifth commandment of the Decalogue and Christ's "new" commandment that we love one another.

Aristotle supplanted the platonic idea of man as incarcerated soul with the notion of man as rational animal. St. Thomas Aquinas, through adopting Aristotle's *naturalism*, placed confidence in our ability to reason, and this includes our ability to reason about morality and to discover and know moral truth. In this, Aquinas envisaged that the Christian thinker would not divide allegiances between Christian and non-Christian thinkers, but engage in a common project with others to discover the meaning of reason and the conditions of true thinking. This is a point that is most relevant in contemporary society. Is there an appeal to reason that would be a common basis for upholding the notion that all members of the human family, that is, all human beings, have inherent human dignity and equal and inalienable rights?

It is true that rationality is normally a feature, even a characteristic feature, of a mature human being. Rationality, as we experience it, is the capacity not just to set ends and to determine means to achieve those ends, it is also the capacity to wonder, doubt, speculate, imagine, abstract, hypothesize, deduce, and love.

If it is accepted that we recognize the dignity of those who are demonstrably rational, then the question is whether there is a basis for recognizing the dignity of those who belong to the human family but are not demonstrably rational. The authors propose that members of the human family are interconnected, and that this sense of familial connection is a basis for recognizing the dignity of each, even if an individual member at a given moment may not be capable of expressing or realizing the qualities on which respect for dignity is founded.

This notion of familial connection obviously makes sense in relation to immediate family. We argue that interconnectedness makes sense not just within immediate family but, in fact, in regard to all those individuals who share the human genome. The human genome provides, in essence, a capacity for rationality, which we consider so significant in determining that a being is a moral agent and capable of being fully autonomous. When an organism comes into existence formed, as it were, by the human genome, we know empirically that unless it is damaged in some way or it is denied a favorable environment, rationality will come to be without any further information or organization added. Intrinsically, all that the being is capable of is present in embryo. Later, when we see the adult being, we can look back to its origin when the first cell was formed with his or her completed individual genome.

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<sup>29</sup> See the *Catechism of the Catholic Church*, n. 2273.

*The Human Genome and the Moral Status of the Human Zygote*

The line of thought concerning the significance of possessing the human genome has implications for the status of nascent human individuals and furnishes material for what may be a novel argument in the debate over the status of human embryos. This has become a particular issue now that there is, for example, the possibility of creating human embryos by somatic cell nuclear transfer (cloning) specifically for the purpose of harvesting stem cells from them for medical purposes.

Briefly, the argument seeks to explain the major premise of the human rights movement, that:

1. *All members of the human family (including those who may not be rational, especially the developmentally disabled and the mentally ill, children, and the elderly) have inherent dignity and equal and inalienable rights.*

On exploration of the above, the authors offer that this principle need not be arbitrary, nor divorced from most of the philosophical accounts of human worth. We accept that possession of dignity and rights is related to rationality, but that rationality and autonomy are not instantiated at all times by those who are considered rationally autonomous. Inherent dignity and equal and inalienable rights are possessed by all and are not in relation to the extent to which we are rational. We do not pass in and out of a state of dignity and possession of rights depending on whether at a certain moment we are rational. The authors suggest that significance is attached to human beings because we have the ability to be rational even though we are not always rational. The capacity for rationality, which confers moral status and rights, is essential to human beings. Thus, the authors offer the alternative proposition:

2. *The capacity for rationality is a basis for an individual to be recognized as having inherent dignity and hence as bearing equal and inalienable rights.*

This links theories of dignity and rights based on rationality to the proposition that all members of the human family, even though we may not be rational at a given moment of our existence, have dignity and are the bearers of rights, and it removes the arbitrariness of simply saying “all members of the human family.” “All who are of the kind of being who have rational autonomy” is not arbitrary or speciesist if dignity and rights-bearing are understood in terms of rationality. Members of the human family are interconnected, we argue, through sharing a capacity for rationality, because rationality forms the basis of the kind of relationships and those ways of being and flourishing that we particularly value.

We offer that:

3. *The human genome contains information which determines rational capacity and thus identity as a kind of being who has rationality.*

On that basis, we argue that:

4. *Those living individuals who possess and are formed according to the human genome have inherent dignity and are the bearers of rights.*

This leads us to the claim that:

5. *Embryonic human beings are living individuals who possess and are formed according to the human genome.* Therefore:
6. *Embryonic human beings have inherent dignity and equal and inalienable rights.*

### *The Human Genome and the Human Soul*

New developments allow us to expand the teaching of the Congregation for the Doctrine of the Faith:

Certainly no empirical datum can be, in itself sufficient to bring us to recognition of a spiritual soul; nevertheless, the conclusions of science regarding the human embryo provide a valuable indication for discerning by the use of reason a personal presence at the moment of the first appearance of a human life. (*Donum vitae*, I, 1)

We reject the tendency in some circles to reduce the human soul to the human genome. The genome in relation to the body is more like the brain: essential and integrative, but material and not spiritual. The genome is the part of the body that is formed by the soul. We are led by scientific evidence to assert:

- a. Biologically, the human genome directs the formation of the zygote so that it is the kind of being who inherently<sup>30</sup> has the capacity for rationality. That is to say, given a favorable environment and nourishment, and barring misadventure, the zygote will progress to human adulthood and possess the rationality that is normally an attribute of mature human beings.
- b. The human genome is therefore evidence of a *radical contingent capacity for rationality*. By “radical,” we mean that the presence of a human genome is indicative of the presence of a formative cause of rationality. By “contingent” we mean that the human genome on its own or even in a cell that lacks totipotency is not formative of rationality. It needs the context of a totipotent cell to form a being that has the capacity to develop rationality. Totipotency is the inherent capacity to differentiate and form the dynamic organization, involving many different types of cell, which constitutes the body. Biologically, the formation of the blastocyst, which precedes gastrulation, is the first step toward differentiation into all the parts of the body. The inherent capacity to form a blastocyst is indicative of totipotency. (Somatic cells are incapable of forming a blastocyst.)
- c. No empirical datum can be, in itself, sufficient to bring us to recognition of a spiritual soul. Nevertheless, the conclusions of science regarding the human genome and its determining role in the developing human being are a valuable indication for discerning a personal human presence from the moment that a cell is formed that contains a human genome and is inherently capable of forming a blastocyst.

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<sup>30</sup> “Inherent” means to exist as a permanent feature or characteristic that is not acquired. A human being does not acquire the capacity for rationality: he or she has that capacity inherently from the moment the first cell is formed.

On that basis, we argue that *those living individuals who possess and are formed according to the human genome have inherent dignity and are the bearers of rights.*

In this respect the human genome has a particular moral significance; it is the biological means by which human inheritance is transferred in the formation of a new individual, including the continuity of a protected status for that individual from the earliest moment that that new genome occurs in the formation of the first cell of the zygote. It is that which determines biologically that this is a being with the inherent capacity for rationality.

The formation of a being that is a combination of human and animal genomes is morally repugnant to many people. There is a strong moral intuition that rejects the practice. That moral intuition is well founded, because transgenesis is an *act of generation* that uses part of the human genome in the process.

*The human genome has a singular significance in the transmission of human life and the transpecies use of it, or of parts of it, to generate a new human-animal hybrid being, is an offense against the sacredness of the generative faculty that subsists in the human genome. The moral wrong is in the same category of immorality involving misuse of the sexual faculties in which there is an offense against the sacredness of the human procreative capacity. We hold that human-animal transgenesis undermines the sacredness of human generation, that by which we cooperate with God in the creation of a new human being.*

## 7

### **Are Attempts to Transform an Animal Zygote by Introducing Human DNA into Its Genome So That the Developing Embryo Inherits Some Human Biological Characteristics Intrinsically Evil?**

In 1987, the Congregation for the Doctrine of the Faith wrote:

From the moment of conception, the life of every human being is to be respected in an absolute way because man is the only creature on earth that God has “wished for himself” and the spiritual soul of each man is “immediately created” by God; his whole being bears the image of the Creator. Human life is sacred because from its beginning it involves “the creative action of God” and it remains forever in relationship with the Creator, who is its sole end. God alone is Lord of life from its beginning until its end: no one can, in any circumstances, claim for himself the right to destroy directly an innocent human being.<sup>31</sup>

Scientifically, we are able to distinguish a human being from other beings at the moment the first cell is formed. We can so distinguish because a human zygote has a human genome. In the natural order, it is the genome that determines it is a human being and not an animal. It is through the genome that God creates a new human being. In the union of a man and a woman, we have the perfect way in which that act of divine creation is continued in their “responsible collaboration with the fruitful

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<sup>31</sup> *Donum vitae*, I, 5.

love of God.”<sup>32</sup> But the biological effect of the union of a man and a woman, in creating a new life, is the formation of a new human genome to which each have contributed equally, and it appears, as a matter of evidence, that it is through that human genome that the offspring is created as a human being, who is made in the image and likeness of God.

The human genome directs the process of cell reproduction in such a way that growth does not happen in an amorphous or undirected way, but a complex structure forms which, given a favorable environment and nourishment, will exhibit those characteristics that we acknowledge to be particularly human and capable of love, wonder, and reason, and able to form a relationship to God.

*It seems to us that when a scientist fragments the human genome and adds parts of it to an animal genome in the formation of a hybrid zygote, he or she has begun to confuse the identity of what is or is not human and what or who is or is not made in the image and likeness of God, and does or does not count as my neighbor.*

It is on that ground that the authors hold that such a project represents a failure to respect the sacredness of the human genome and the sacredness of human generation.

Reflecting on the mystery of the Incarnation, we note that it is the human genome that the Second Person of the Blessed Trinity has taken to himself. This decisive event fundamentally alters the way in which we should respect the sacredness of the generative capacity of the human genome when it is used to form a zygote.

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<sup>32</sup> Vatican Council II, *Gaudium et spes* (December 7, 1965), n. 5.