

## **CMDA Ethics Statement**

### **Human Hybrids and Chimeras**

Science has developed the capability to create novel organisms by combining cells or tissues (chimeras) or genetic information (hybrids) from different species.\* The creation of novel organisms that combine human and animal living cells or human and animal genetic material raises moral concerns not only regarding individual patients but also the whole of humanity and the human future.

CMDA believes that a distinct moral boundary separates human from nonhuman animal life. This boundary is not definable by cognitive, physical or genetic criteria alone. God established this boundary when he created humankind in his own image. God granted humankind alone a spiritual nature and gave humankind responsibility and dominion over all other creatures, which, by his design, reproduce according to their own kind. We must respect the created and clear boundary between humankind and animals.

Nonhuman animals are a valuable resource for medicine. From animals medical science has acquired knowledge about cellular and organ function, gained insights into genetics, and developed models of human disease and drug effects. For example, from animals we obtain transplantable heart valves that save human lives. CMDA recognizes valid ethical frameworks for each of these enterprises, which derive benefit for humankind from the anatomical, biochemical, genetic and physiological similarities that humans and nonhuman animals share as earthly creatures.

#### **Ethical Guidelines**

1. As Christians and as medical professionals, we are bound to actively seek the spiritual and physical well being of all humankind.
2. The use of research and technology must be guided and limited by ethical principles. There is no unlimited or unrestricted technological imperative.
3. There are compelling moral reasons to refrain from applying biotechnology to create chimeras or hybrid organisms that are partly human and partly nonhuman. These reasons include:
  - Humankind alone was created in God's Image.
    - We are not to desecrate the image of God by reducing a human being to animal status.
    - We are never to elevate animals to human status.
    - We are not to create intermediate or indeterminate species sharing human and animal genetic material.†

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\* The term "chimera" has also been used in reference to certain natural phenomena occurring within a species. For example, humans commonly harbor some cells from the mother acquired during gestation (a process known as microchimerism). Rarely, the fusion of genetically distinct twin human embryos can result in the birth of one "chimeric" individual whose tissues comprise two populations of cells containing two sets of genetic information. The terms "chimera" and "hybrid" as used in this statement are meant to refer specifically to interspecies organisms combining human and nonhuman cells or genetic material.

† I Cor. 15:38-40

- Humankind alone has the unique capacity to enter into a personal relationship with God through Jesus Christ his Son.<sup>‡</sup> Because human dignity is not wholly reducible to cellular matter or fully determined by genes, some limited combinations of cellular or genetic material across species lines may be ethically permissible (see Appendix). However, there are certain human characteristics that are inviolate and should not be blended with animal characteristics. We must not compromise that which makes us human. Fundamentally this includes the ability to know God and may encompass such characteristics as human reasoning, free will, and sexuality. The formation of human organisms that have nonhuman progenitors or are capable of generating nonhuman offspring is an affront to God, his created order, and his image within us.
- It is not permissible to use human subjects for research purposes without disclosure and informed and voluntary consent.\*<sup>§</sup>
- In matters this consequential, full disclosure and discussion should extend to society as a whole. Societal consent, however, does not determine moral acceptability.
- Preventing harm to human beings is a moral mandate.\*\* The potential consequences of human chimera/hybrid research are so far-reaching and troublesome that the most stringent precaution is required. For example:
  - Chimeras and hybrids will enable diseases to cross species lines, bypassing normal barriers and resistance, imperiling both the individual and the species.
  - Transferring genes encoding disease may cause novel virulence, or create new diseases, gravely threatening the host species and public health.
- We are stewards of the animal kingdom and owe to it our care and concern. Although it is permissible to use animals in experiments designed to improve human care, we must not violate the mandate of stewardship by engaging in cruel or needlessly destructive experiments.
- The creation in the laboratory of creatures or species with novel sentience would place upon society moral obligations for which we are unprepared.
- Moral problems are not resolved by terminating the life of the chimera prior to the emergence of any particular stage of development.
- Moral problems are not nullified by anticipated scientific or medical gains.

### **Conclusion**

CMDA endorses ethical chimeric and hybrid research and technology designed for the benefit of humankind, provided that these are safe and do not degrade the unique status of humankind.

CMDA opposes chimeric and hybrid research and technology that fundamentally alters human nature as designed by God.

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<sup>‡</sup> Hebrews 1:3, Colossians 1:15-20, II Cor. 4:5-6

<sup>§</sup> see pending CMDA statement on Research Ethics in Human Beings.

\*\* “Primum non nocere.” Hippocrates, *Epidemics*. Additionally, find reference to another document. [We discussed using a Scripture reference, but there are numerous ones; uncertain whether there is one key verse.]

## **APPENDIX**

### **Evaluative Guidelines for Chimeric and Hybrid Research**

Realizing this is a continually developing area of technology and it is not possible to identify and address all the potential variations, we suggest the following guidelines:

#### **I. CMDA approves the following as morally acceptable:**

- The use of recombinant DNA for research, environmental improvement, drug development, and medical treatment purposes.
- The following projects, provided they can be done safely and without defacing the Image of God:
  - Transgenic research and treatment of disease
    - Transfer of a limited amount of human genetic material or human-derived gene products into an animal or animal cell line
    - Transfer of a limited amount of animal genetic material or animal-derived gene products into a human or human cell line
  - Xenotransplantation research and treatment of disease
    - Transplantation of nonliving animal tissue into a human host to treat disease
    - Transplantation of living animal tissues or organs into a human host to treat disease
    - Transfer of human organs or tissue into a nonhuman host for temporary safekeeping
    - Transfer of human cancer (including brain cancer) cells into a nonhuman host for research

#### **II. CMDA considers the following projects to be morally uncertain or questionable and in need of further reflection, broad dialogue, and study:**

- Creation and cultivation of nonhuman animals possessing a distinctively human organ system other than a brain
- Transfer across species lines, from human to animal or from animal to human, of functioning central nervous system tissue, even if it does not appear to alter higher cerebral function
- Transfer across species lines, from human to animal or from animal to human, of cells or genetic material that might have the potential to alter higher cerebral function

#### **III. CMDA, based on the current scientific understanding, considers the following projects to be morally unacceptable:**

- Transplantation which confers the reproductive capacity of one species to another
  - Engineering a nonhuman life form such that human gametes develop within its body
  - Engineering a human being having nonhuman gametes
- Mixing of human and nonhuman gametes
  - Fertilizing a human egg with animal sperm

- Fertilizing an animal egg with human sperm
- Combining human and nonhuman gamete equivalents
  - Introducing a human nucleus into a nonhuman egg
  - Introducing a nonhuman nucleus into a human egg
  - Creating an embryo combining haploid sets of chromosomes from both human and nonhuman progenitors
- Mixing of human and nonhuman blastomeres
- Cross-species pregnancy involving humans
  - Placing a live human embryo or fetus into an animal
  - Placing a live animal embryo or fetus into a human
- Exchange of distinctive form
  - Redesigning an animal to bear distinctively human physical features
  - Redesigning humans to bear distinctively animal physical features
- Exchange of distinctive function
  - Engineering a nonhuman life form containing a human brain or a brain derived wholly or predominantly from human neural tissue
  - Redesigning humans to take on distinctively animal functional capacities, for example, to enhance performance

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[Despite a long and valuable history, human-animal chimera research has often been questioned. Among the moral issues raised by chimeras is the concept that integration of human cells into anatomical locations such as the brain might endow animals with "human-like" capacities including self-awareness. We present a justification for one type of human-animal chimera experiment: the evaluation of hES cell developmental potency via teratoma formation in immunodeficient mice. We argue that this experiment raises no significant moral concerns and should be the jurisdiction of animal care and use committees and exempt from formal review by the stem cell research oversight process.]

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**In regard to the question regarding the transfer of diseases across species lines:**

Holmes EC. On the origin and evolution of the human immunodeficiency virus (HIV). *Biol Rev Camb Philos Soc* 2001; 76(2): 239-254.

[The human AIDS viruses--HIV-1 and HIV-2--impose major burdens on the health and economic status of many developing countries. Surveys of other animal species have revealed that related viruses--the SIVs are widespread in a large number of African simian primates where they do not appear to cause disease. Phylogenetic analyses indicate that these SIVs are the reservoirs for the human viruses, with SIVsm from the sooty mangabey monkey the most likely source of HIV-2, and SIVcpz from the common chimpanzee the progenitor population for HIV-1. Although it is clear that AIDS has a zoonotic origin, it is less certain when HIV-1 and HIV-2 first entered human populations and whether cross-species viral transmission is common among primates. Within infected individuals the process of HIV evolution takes the form of an arms race, with the virus continually fixing mutations by natural selection which allow it to escape from host immune responses. The arms race is less intense in SIV-infected monkeys, where a weaker immune response generates less selective pressure on the virus. Such a difference in virus-host interaction, along with a broadening of co-receptor usage such that HIV strains are able to infect cells with both CCR5 and CXCR4 chemokine receptors, may explain the increased virulence of HIV in humans compared to SIV in other primates.]

Bastone P, Truyen U, Lochelt M. Potential of zoonotic transmission of non-primate foamy viruses to humans. *J Vet Med B Infect Dis Vet Public Health* 2003; 59(9): 417-423.

[The zoonotic introduction of an animal pathogen into the human population and the subsequent extension or alteration of its host range leading to the successful maintenance of the corresponding pathogen by human-to-human transmission pose a serious risk for world-wide health care. Such a scenario occurred for instance by the introduction of simian immunodeficiency viruses into the human population resulting in the human immunodeficiency viruses (HIV) and the subsequent AIDS pandemic or the proposed recent host range switch of the SARS coronavirus from a presently unknown animal species to humans. The occurrence of zoonotic transmissions of animal viruses to humans is a permanent threat to human health and is even increased by changes in the human lifestyle. In this review, the potential of the zoonotic transmission of bovine, feline and equine foamy retroviruses will be discussed in the light of well-documented cases of zoonotic transmissions of different simian foamy viruses to humans.]

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## Glossary – Human Hybrids and Chimeras

Blastomere	A stage in the early development of the embryo occurring approximately days 2 to 7 after fertilization. In its later stages (days 5 to 7) the blastomere assumes the shape of a hollow ball called a blastocyst.
Central Nervous System	The brain and spinal cord – as opposed to the peripheral nervous system consisting of the nerves extending from the central nervous system to the tissues and organs of the body.
Chimera	A single individual having cells, tissues, or organs from two or more different species. (See Hybrid)
Chromosome	Organized structure of DNA within the nucleus of the cell containing the genes and most of the DNA of the organism.
Cognitive	Of or relating to conscious intellectual activity. The process whereby we think or are aware.
DNA	The letters used to designate deoxyribonucleic acid, the <a href="#">nucleic acid</a> that contains the <a href="#">genetic</a> instructions used in the <a href="#">development</a> and functioning of all known <a href="#">living organisms</a> .
Encoding	The process of transforming information from one format to another. In genetics this refers to information from DNA of the nucleus being transformed into workable instructions to the cell.
Gamete	The sex cell. In the human a gamete would be a sperm or an oocyte (egg).
Gamete equivalent	A quantity of DNA sufficient to function as the equivalent or near-equivalent of a sperm or egg.
Gene	A segment of genomic (DNA) information that must be taken as a whole to define traits. The gene is the basic unit of heredity. The human cell contains about 25-30,000 genes.
Haploid	Half. A haploid cell would contain only one member or set of the two paired chromosomes of a living organism. This occurs normally in the gamete (or sex cell) so that the combination of the egg and sperm (haploid cells) results in complete DNA information at fertilization.
Hybrid	A single individual having DNA from two or more different species. (See Chimera)
Recombinant DNA	A DNA sequence formed by the joining (transplanting, splicing) of the DNA from two unrelated organisms.
Sentience	Awareness – especially self-awareness. Consciousness.
Species	A species is one of the basic units of <a href="#">biological classification</a> and a <a href="#">taxonomic rank</a> – often defined as a group of organisms capable of interbreeding and producing fertile offspring.
Transgenic	Having a foreign gene from another species.
Xenotransplantation	<a href="#">Xeno</a> from Greek, <i>foreign</i> . The <a href="#">transplantation</a> of living <a href="#">cells</a> , <a href="#">tissues</a> or <a href="#">organs</a> from one <a href="#">species</a> to another. Such an act would form a chimera.