

What is a chimera?

Named after the creature from Greek mythology which was part lion, part goat, and part serpent, in medical terminology a chimera is an organism or tissue that contains at least two genetically distinct types of DNA. A plant chimera can be formed when one plant is grafted onto another plant and a shoot forms which contains two different types of genetic material. An animal or human chimera is formed from the fusion of two or more zygotes, or when two individuals exchange cells during embryonic development, and the resulting individual carries at least two different types of DNA. A chimera can also be formed experimentally by combining the cells of two different species, especially during embryonic development. This is different from a hybrid, which is a genetic cross between two species, using an egg from one species and a sperm from another, e.g. a mule, which is a cross between a male donkey and a female horse.

What are the different types of chimeras?

Dispermic chimeras are formed when two eggs that have been fertilized by two sperm fuse together, producing a tetragametic individual — an individual originating from four gametes, or sex cells. Dispermic chimerism can also occur when a zygote fuses with a fertilized polar body (a small degenerative cell produced by egg cell division). A tetragametic chimera will have some tissues which came from one zygote, some tissues from the other zygote, and may have some tissues that are cellular composites of both zygotes.

Blood chimeras occur when blood connections form between the placentas of fraternal twins, enabling the transfer of stem cells between embryos. One or both of the twins have cells which originated in the other twin. About 8% of non-identical twins are blood chimeras.

Microchimeras are formed when a few fetal stem cells or maternal cells cross the placenta. It is a common occurrence that after a baby is born, the mother still has some fetal cells in her body, and these cells can remain for decades. Read more about maternal-fetal microchimerism at: <http://www.scientificamerican.com/article/scientists-discover-childrens-cells-living-in-mothers-brain/> A baby can be born with a few maternal cells that crossed the placenta during pregnancy. Microchimerism can also be the result of blood transfusion or organ transplantation.

Parthenogenic chimeras are formed when a fertilized egg generated through parthogenesis (a form of asexual reproduction) fuses with a normal zygote. This does not occur naturally in mammals, but mammalian parthogenetic chimeras have been developed experimentally and are commonly used for the study of developmental genetics.

Androgenetic chimeras are made up of cells that contain the normal combination of maternal and paternal chromosomes, and cells that contain two sets of paternal chromosomes. When this occurs, either naturally or generated by an experiment, the resulting embryo is afflicted by severe developmental disorders and rarely survives to birth.

Why do some researchers want to purposely create chimeras?

Some scientists believe they can “practice” and perfect cloning and genetic engineering of humans by first creating partly-human creatures. Chimeras have been proposed as ways to study human development by combining human and animal cells at the embryo stage. Creation of chimeras has been proposed as a way to grow many human organs for transplant, without arousing ethical concerns when these “organ incubators” are killed. Some people have even proposed the development of human-animal chimeras to do “drudge work” or dangerous work that human beings do not want to do.

Why oppose chimera research?

Research involving the creating of chimeras is controversial for several reasons:

- 1) The research on these procedures would destroy many human embryos. No matter what we might learn from watching cells grow in the conditions created by a chimera, the fact remains that researchers would be killing human embryos to get their cells.
- 2) If the purposeful creation of human-animal chimeras is allowed for research purposes, it opens the door to abuse of the technique for reproduction, as well as creation of part-human organisms as bizarre designer humans or animals.
- 3) It could produce an animal that produces human sperm or eggs.
- 4) It could produce an animal with a human brain.