



Producing human organs in animal chimeras raises objective medical and ethical problems

The major medical and social problems in organ transplantation owing to the increasing shortage of donor organs is well known. Solutions must therefore be sought in the fairly near future that can resolve these issues. One of these is the production of animal chimeras in which quasi-human organs can be developed. This has been attempted using human embryonic stem cells injected into mice (Nature 521; 316-321, 2015), but the practice raises *significant problems, from both a medical and ethical perspective*. The main difficulty from a medical point of view is that, since this is an allogeneic material, it can give rise to as yet unresolved problems with immune rejection.

The **use of embryonic stem cell also entails what I would call insurmountable ethical difficulties**, since obtaining these types of cells requires the destruction of human embryos. Furthermore, **the transplanted human cells can colonise the organs of the recipient animal**, so animals may be generated with practically human organs, which means great new ethical challenges.

Aside from the use of human embryonic stem cells, though, new possibilities have now been opened for these types of experiments with the development of adult somatic cell reprogramming from which so-called [iPS cells](#) can be derived. Since these can be obtained from somatic cells of the individual requiring the transplant, they minimise immune rejection. This is an attractive therapeutic possibility that looks likely to be implemented in the fairly near future.

An interesting article on this topic was published in the *Journal of Medical Ethics* last year (41; 970-974, 2015).

The article begins by making extensive reference to the problems that can arise in patients who are awaiting transplants, which, in addition to diminishing their quality of life, can sometimes lead to death.

It also refers to the attempts made by various countries to resolve this issue, particularly with policies that encourage donation and other medical interventions, such as xenotransplantation, the creation of bioartificial organs and construction of bionic organs. Given that all three possibilities present as yet unresolved technical problems, the possibility of producing organs in animals using [human iPS cells](#) offers significant advantages.

The article continues by referring to the medical potential of pluripotent cells, since these cells — the aforementioned iPS cells ([click HERE](#)) — have been able to be produced in the laboratory since 2006, by reprogramming adult somatic cells.

Recent Japanese studies have shown that organs (thymus and pancreas) can be produced in animal chimeras using iPS cells obtained from rat somatic cells and injected into the blastocysts of mutated mice. The authors confirmed that these cells integrated with the murine embryos, and were able to develop the desired tissues and organs.

Magnitude of the potential problem

However, these types of experiments present major problems that must be resolved (see “Human-animal chimeras for use in regenerative medicine”), one of which could be the risk of zoonosis, i.e. the chance that a mutated animal virus could be transmitted to human beings, with the possibility of creating a pandemic. While the risk of this happening is minimal — lower than in the case of xenotransplantation, as the organs produced would be quasi-human — it must nevertheless be taken into account due to the magnitude of the potential problem.

In conclusion, although producing quasi-human organs in animals offers enormous possibilities for resolving the scarcity of organs for transplantation, all the medical and ethical problems that these techniques entail must be resolved before they can be used in human medicine

Justo Aznar

Director

[Bioethics Observatory](#)

Catholic University of Valencia