

# What are IPS cells?

## Stem Cell & Regenerative Medicine Center University of Wisconsin-Madison



An induced pluripotent stem cell, or IPS cell, is a stem cell that has been created from an adult cell such as a skin cell through the introduction of genes that reprogram the skin cell and transform it into a cell that has all the characteristics of an embryonic stem cell. The term pluripotent connotes the ability of a cell to give rise to multiple cell types, including all three embryonic lineages forming the body's organs, nervous system, skin, muscle and skeleton.

### What are the advantages of induced pluripotent stem cells?

*Bioethics:* Induced stem cells have the obvious edge of not having to be derived from human embryos, a major ethical consideration. The ability to reprogram an adult cell to behave like an embryonic stem cell may also enable scientists to sidestep other controversial methods, notably somatic cell nuclear transfer, also known as cloning, a technique that has additional ethical considerations and that is extremely difficult to do routinely, as unfertilized human eggs are required.

*Genetically matched cell lines:* Another critical advantage of induced pluripotent stem cell technology is that, in theory, it allows for the creation of cell lines that are genetically customized to a patient. The issue of immune rejection, in which the body's immune system recognizes implanted cells or tissues as foreign and attacks them, is a barrier to the therapeutic application of cell-based therapies. If cells for therapy can be created using a patient's own cells, the issue can be potentially overcome.

*Easier to create:* Finally, the other key benefit of induced stem cells is that the technique can be performed in any moderately equipped molecular biology lab and does not require materials — human eggs or embryos — that are difficult to obtain or that limit scientists' ability to do such work with federal funding.

### How do we know induced pluripotent stem cells can match embryonic stem cells?

So far, induced pluripotent stem cells appear to exhibit the same key features of embryonic stem cells: the ability to differentiate from a blank-slate state to any of the 220 types of cells in the human body, and the ability to reproduce indefinitely in culture. Because induced stem cells are relatively new, however, scientists must compare the cells to those obtained from embryos to assess their characteristics in detail and ensure that there are no significant differences.

### Do induced pluripotent stem cells mean we no longer need embryonic stem cells?

No. It remains to be seen whether reprogrammed skin cells differ in significant ways from embryonic stem cells. Comparative studies of embryonic and induced pluripotent stem cells will be necessary to ensure they are the same. It is essential for science to explore the full spectrum of research options to bring stem cell research to clinical fruition as soon as possible.

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