Stem-cell therapies

Prometheus unbound

Researchers have yet to realise the old dream of regenerating organs. But they are getting closer

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§1 The dream of regenerating human organs is as old as Prometheus. Chained to his rock, the Titan survived attacks by an eagle that feasted on his liver by growing it anew under cover of darkness. When Mary Shelley wrote *Frankenstein*, her shocker on the creation of life, she gave it the alternative title *The Modern Prometheus.*

§2 But myths have a habit of becoming reality, and life of imitating art. For more than a decade we have been seduced by the idea that it may truly be possible to recreate organs. Our response to this possibility incorporates both the Promethean dream and the Frankenstein nightmare, inspiring hope and fear in almost equal measure.

§3 But something titanic is indeed happening. Stem cells are the wellsprings of life. Unlike the specialised cells of the skin, the muscle, or the brain, which have narrowly defined functions, stem cells are full of infinite possibilities. They can develop, given the right setting, into any of those specialised cells. In theory, they could replace those lost by age or illness just as Prometheus regenerated his liver. They are "pluripotent", in the jargon.

§4 The obvious place to find them is in the embryo, the small bundle of cells produced by the fertilisation of egg by sperm that will develop into a human being. In 1981, two teams independently isolated embryonic stem cells from mice and, in 1998, a technique was developed to isolate and grow human stem cells in tissue culture, which were able to create the huge number of cells needed for clinical interventions. The stage appeared set for stem cell treatments to transform medicine.

§5 More than a decade later, a more sober mood prevails. Embryonic stem cells are finally in clinical trials but it has been a long road, both scientifically and politically. Ethical question marks over the morality of using human embryos halted public backing for the research for many years in the US, science's greatest powerhouse, and diverted attention instead to the idea of transforming adult cells back into a class of cells called induced pluripotent stem cells (iPS cells). By winding the clock back, it is possible for iPS cells to regain the qualities of those present at the beginning of life, and bypass the moral dilemmas.

§6 The way to do that might, paradoxically, be for scientists to do less. Instead of making the whole organ in a laboratory, they might create a less-developed form, as Dr Sasai did with his proto-retina, and then leave the rest of the work to the body.

§7 This is what Dr Takebe, of Yokohama City University, in Japan has done with a mouse's liver buds. After two months the buds not only looked like liver, they acted like it. They produced liver-specific proteins. And if Dr Takebe transplanted them to their host's abdominal cavity, having first caused the animal's real liver to fail, they often kept the mouse alive when an animal without the transplant would have died.

§8 Translating this work into a way of growing new livers for people whose old ones have stopped working will take time. But it is a big step forward. After years of promise, regenerative medicine may be coming close to delivering.