

## Regenerative medicine has opened new frontier for science

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*Mark Henderson, Science Editor*

Over the past decade increasing understanding of both adult and embryonic stem cells has opened a new frontier for science through regenerative medicine.

As research has revealed how the body's master cells can be coaxed to form new tissue, it has raised the prospect of producing new organs to replace those that have been damaged.

Growing new cells with specialised functions, however, is only the first hurdle that has to be cleared before regenerative medicine can help patients. A clump of cells is rarely, by itself, much use to anybody. They also need to be properly plumbed into blood vessels, to be protected from the body's immune system and to be structured in a shape that allows them to perform.

This means that regenerative medicine is not reliant only on the cell biologists who can coax stem cells to make the right sort of tissue. It also needs engineers and immunologists. It is by its nature an interdisciplinary field.

Where scientists are starting to make strides in regenerative medicine, it is often because other challenges are being addressed. The development of biocompatible scaffolds, which guide the growth of new cells, has underpinned most advances such as the breast reconstruction technique.

Last year, a team led by Professor Anthony Hollander successfully replaced that part of a woman's trachea called a bronchus with a version grown in the lab. This achievement was also made possible by the use of a bronchus from a dead donor that was stripped of its living tissue. The patient's stem cells were seeded around this inert cartilage tube to create the new organ.

Artificial scaffolds can also be used, as when Anthony Atala's team at Wake Forest University grew artificial bladders. The same group reported another advance this week, placing rabbit cells on to a matrix to generate functional erectile tissue. The technique could eventually be used to reconstruct the penises of men with genital injuries or cancer.

As fast as this technology is advancing, however, there is still a long way to go before scientists can re-create more complex organs. Professor Hollander said: "The early successes have involved organs without moving parts or complicated biology."

The creation of new breasts, windpipes and bladders is an amazing step forward for medicine, but it remains a different challenge to grow new hearts or livers.