

Health

14 Medical Pioneers Who Aren't Holding Back

Building hearts, mapping memories, and restoring vision, these researchers aim high and don't give up

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In 25 or 50 or 75 years, maybe today's scourges—cancer, heart disease, diabetes—will have receded into medical lore as 21st-century versions of [childbirth](#) fever (it once killed a quarter of the women who delivered at some hospitals) or tuberculosis (the cause of 1 in 4 deaths in Europe in the first half of the 20th century).

If so, thanks will be owed to [medical](#) pioneers like the 14 you can read about here—smart, imaginative, and impatient with conventional boundaries. Such cutting-edge scientists are also increasingly well funded, thanks to the new emphasis by the White House and Congress on research. The National Institutes of [Health](#) is pumping \$10 billion in stimulus funds into the nation's labs, along with some \$24 billion already budgeted. Much of the money will go to programs that face steep odds but that, like all long shots, will pay off big if they succeed.

These 14 pioneers have long been deep into such projects, from searching for a way to erase traumatic memories to building new body parts from scratch—long enough that some, like the use of an electromagnet to treat [severe depression](#), deserve a term that researchers hate to use: breakthrough.

[Anthony Atala: Grinding Out New Organs One at a Time](#)

[Jean Bennett and Albert Maguire: Gene Therapy to Reverse Near-Blindness](#)

[Elizabeth Blackburn: Ordering Cancer Cells to "Curl Up and Die"](#)

Mark George: Treating Depression With an Electromagnet
Denise Faustman: To Stop Diabetes, She's Attacking the Immune System
David Holtzman: Attacking Alzheimer's With a New Test for Amyloid Beta
C. Ronald Kahn: Is Brown Fat a Good Fat That Can Erase Bad Fat?
Boris Kovatchev: Artificial Pancreas Could Help Diabetics
Wayne Marasco: A Shot at a Universal Flu Vaccine
Elaine Mardis and Richard Wilson: Taking Cancer's Genetic Measure
Chad Mirkin: Standing Tall in a Nanoparticle Universe
Todd Sacktor: Making Memories—and Selectively Forgetting Them



Anthony Atala: Grinding Out New Organs One at a Time

Give this pediatric urologist 6 weeks or so, and he'll grow a working bladder. Or artery. Or...

By Megan Johnson

Posted June 30, 2009

Anthony Atala was the first to build a functioning organ from scratch—a bladder made cell by cell—and put it into a patient, a child whose own bladder was congenitally deformed. Since that breakthrough a decade ago, the 50-year-old pediatric urologist, director of Wake Forest University's Institute for Regenerative Medicine, has moved on to cobbling up bones, heart valves, muscles, and some 20 other body parts.



Anthony Atala, Pediatric Urologist, Wake Forest University

Atala's quest was born out of frustration with conventional bladder repair, which uses a section of [intestine](#). The procedure, at least a century old (and still employed today), poses a risk of cancer in children. "Nothing is more devastating to a surgeon," says Atala, "than knowing you're not necessarily doing what's best for the patient, but that is your only choice." Now he runs one of the world's premier engineered-organ centers.

Growing a bladder or a body part such as a [blood vessel](#) takes about six weeks. To create an artery, say, Atala plucks some of the immature cells that make up arterial lining and muscle from a sample of the patient's blood and incubates them by the billions in liquid nutrient. The cell-rich soup is then painted on a tube-shaped scaffold made from flexible collagen, like the tissue that forms the nose. (The collagen will gradually disintegrate once the vessel is in place.) The cells mature, multiply further, and form an artery. A small machine exercises the vessel, conditioning it to function normally after it is implanted.

Building organs such as bladders and blood vessels, which have only a few different types of cells, has become almost routine for Atala's lab. A heart or [pancreas](#) is far more complex and challenging. Atala's team is assembling a catalog of alternatives to building a solid organ.

In the case of injured skin, one approach being developed is to print out new skin, one layer at a time, using ordinary inkjet printer technology. To treat battlefield burns, Atala is working on a scanner/printer equipped with an inkjet cartridge that is loaded with immature human skin cells. Modeled on technology developed by researchers at Clemson University, the portable machine will be suspended over the patient to scan the size and topography of the damaged tissue and then lay down one thin sheet at a time of new skin cells on the burned area. It could print out layers of different cell types (fat cells covered by skin cells, for example) to specific thicknesses and pigmentations. Hair potentially could be added later.

Two skin-growing [clinical trials](#) will start later this year. One will employ a computer-controlled stretching device to expand healthy pieces of skin as much as threefold before grafting them to burned tissue. That could take the place of current procedures, which are painful and drawn out. In the other trial, Atala's team will paint skin cells directly onto a wound.

Most engineered organs and cell treatments await human tests. Those and the many steps that follow each will require federal approval, a process that could take years. But Atala's busy lab suggests that transplant waiting times could one

day melt to weeks instead of months or years, and organ rejection could be a thing of the past.