or even declining budgets would threaten Gruss's main goal: to keep MPG in the top ranks of global science. He wasted no time confronting the government over the matter in his inaugural speech at MPG's annual meeting last week. Although he acknowledged that German scientists can't expect a windfall similar to the 5-year budget doubling that the U.S. Congress has promised the National Institutes of Health, Gruss said a budget cut would send exactly the wrong signal to German scientists and to the rest of the world. "We can save anywhere except in shaping our future," he said.

All yours. Peter Gruss (left) takes reins of the Max Planck Society from Hubert Markl.

Gruss, a prominent developmental biologist who has been a director at the Max Planck Institute for Biophysical Chemistry in Göttingen since 1986, has little political experience, but he has not been reluctant to jump into political debates. In remarks to the press last week, he strongly criticized Germany's compromise law on the use of human embryonic stem cells passed by parliament earlier this year (*Science*, 8 February, p. 943). Although the law allows basic research to go forward by permitting researchers to work on existing stem cell lines, he pointed out that the compromise rules out any therapeutic applications because these lines have been exposed to mouse cells and would not be safe for implanting in humans. He has also said that he would welcome final passage of a controversial immigration law in Germany, saying it would remove obstacles to recruitment of top foreign scientists.

Outgoing MPG president Hubert Markl leaves the organization in the hands of one of his former students. At the 14 June handover ceremony, Markl joked that Gruss "showed good judgment at an early age" when he chose a different field after hearing Markl's lectures in zoology.

Markl's 6-year term was dominated by rapid expansion. The society founded more than a dozen new institutes in the former East Germany, bringing the total up to 80. Now, with 18 institutes and one research station in the new *Länder*, the "buildup of the east" is all but completed, Markl said at a press conference. East-West divisions are gone, he said, and "the Max Planck Society is now a unified organization." Markl also earned praise during his term for encouraging the society to examine the darker periods of its history. Last summer, he offered the first explicit apology to victims of abuses during the Nazi era by scientists of the Kaiser Wilhelm Society, the forerunner of MPG (*Science*, 15 June 2001, p. 1979).

Gruss told the MPG meeting that one of his top priorities will be strengthening connections with German universities, especially through the new International Max Planck Research Schools, which are jointly funded and run by Max Planck institutes and cooperating universities. Establishing the interdisciplinary graduate schools "is one of the best things Markl did" as president, says Wieland Huttner of the Max Planck Institute for Molecular Cell Biology and Genetics in Dresden. Gruss said he hopes to strengthen the existing 19 schools and launch seven new ones already in the planning stages.

–PHILIPP WEIS AND GRETCHEN VOGEL

Philipp Weis is a science writer in Berlin.

IMMUNOLOGY

Plant a Few Cells, Sprout a Thymus

Shriveling as it ages, wedged between the heart and the thyroid, the raisin-sized thymus is an unlikely warrior. Still, without one, people wouldn't last long. The thymus attracts a blank slate of stem cells from the bone marrow and transforms them into infection-fighting T cells. Now, two teams have found that a tiny subset of cells from a mouse embryo can be grown into a full-blown thymus and beget a healthy immune system in the recipient mice. The finding suggests that it might be relatively easy, as far as regenerating organs goes, to give a failing thymus a boost.

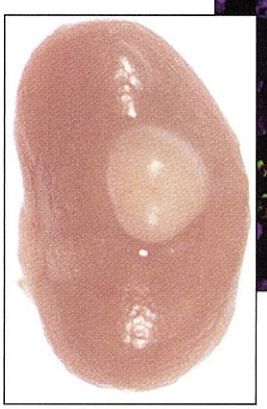
"What's interesting is the ability to generate an organ from a small population of cells," says Nancy Manley, a developmental biologist at the University of Georgia, Athens, who was "totally floored" when she first heard about the work.

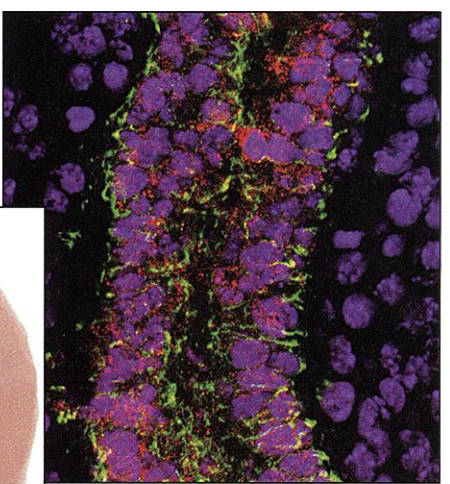
Both groups, one at Monash University Medical School in Melbourne, Australia, and the other at the Centre for Genome Research at the University of Edinburgh, U.K., are quick to say that they haven't found the putative "thymic stem cell": a single cell that, by itself, can produce a fully functioning thymus. Both used hundreds of cells to jump-start the thymus-growing process. However, the teams say the work strongly suggests that such a stem cell, whose existence is a source of passionate debate in the thymus world, is buried somewhere amid the cells they isolated.

The Monash group, led by immunologists Richard Boyd and Jason Gill, and the Edinburgh group, led by developmental immunologist Clare Blackburn, started with cells that met two criteria. They had to belong to the set of functional cells in the thymus, called thymic epithelial cells. And they had to flourish early in development but fade from the picture later on—a pattern a stem cell would follow. Both groups used monoclonal antibodies, which bind to specific molecules on a cell surface, to home in on epithelial cells that fit the profile. These cells were marked by two proteins, MTS20 and MTS24.

In mouse embryos, so-called MTS20/24 cells make up about a third of the cells in the developing thymus. The researchers grafted clusters of these cells onto the kidneys of adult mice and watched what happened. Whether 40,000 or 1000 MTS24 epithelial cells were implanted made little difference, says Gill: "We put them underneath a kidney from a mouse, then pat it on the head and let it run around for 4 or 8 or 6 weeks, then we open up the mouse and lo and behold, there's a plump, juicy, functioning thymus." Gill and his colleagues, who grew the organs in mice that had their own thymuses, found a host of T cell types within the new tissue.

Blackburn and her colleagues implanted even fewer cells, less than 500, into four "nude" mice that lack a thymus altogether. This allowed them to test the new-grown thymus's powers by examining distant lymph





Organ transplant. A class of young thymus cells in a mouse embryo (stained red) grow into a working thymus when grafted onto another animal's kidney (*inset*).

CREDITS: (TOP TO BOTTOM) WOLFGANG SCHOLTYSECH; C. BLACKBURN, N. BLAIR, L. SHARP; J. GILL *ET AL.*, *NAT. IMMUNOL.* EARLY ONLINE PUBLICATION (2002)

nodes for T cells. Three months after implantation, the researchers determined that the mice had relatively healthy immune systems, although they produced half as many T cells as normal mice. But when the researchers dug around the kidney to find the thymus, they saw nothing. They suggest that the cells differentiated and produced a range of T cells but then died off. Blackburn believes that 500 cells might be below the critical mass needed to sustain a thymus; the group reports finding full thymuses in mice that had received larger implants. Blackburn's work will be published in the June issue of *Immunity*; the Monash team's results appear in the 17 June online edition of *Nature Immunology*.

Still to be proven, however, is that the thymic stem cell exists. If MTS20/24 cells are largely homogeneous, that would bolster the case that the long-sought thymic stem cell exists and is among them. But the thymic cells huddled in the original implanted cluster might have been more diverse than they appeared. If so, more than a single cell type might be needed to grow a new thymus. Howard Petrie, an immunologist at Memorial Sloan-Kettering Cancer Center in New York City, also questions whether all the cells in the Monash thymus arose from the original cluster; they might have recruited others from the recipient's body. Still, Petrie and others embrace the therapeutic potential of stimulating the thymus in those with weak immune systems—an enormous population that includes the elderly, patients undergoing chemotherapy, and people with immune diseases, including AIDS.

–JENNIFER COUZIN

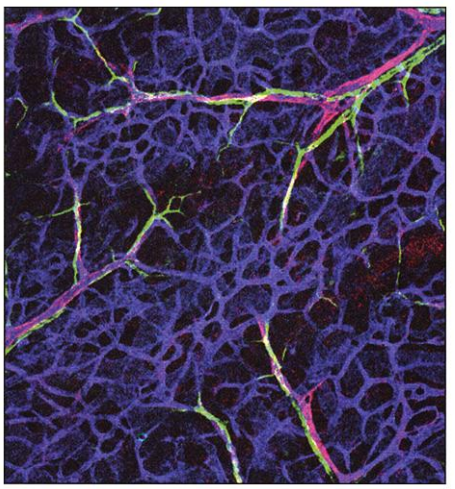
DEVELOPMENTAL BIOLOGY

Nerves Tell Arteries to Make Like a Tree

By the time an embryo's heart beats for the first time, an extensive tree of arteries is already in place. Its delicate branches—which will ultimately stretch tens of thousands of kilometers in a full-grown human—ensure that no bit of tissue goes wanting for oxygen and nutrients.

How arteries shape themselves into such fine patterns has been an open question. Now a study shows that arteries follow the lead of another of the body's branching specialists: nerves. In the 14 June issue of *Cell*, developmental neurobiologists Yoh-suke Mukouyama and David Anderson of the California Institute of Technology (Caltech) in Pasadena and colleagues report that embryonic nerves form a template that directs the growth of arteries. The team also identifies a molecule released by the nerves that apparently signals the arteries to fall in step.

"This is the most elegant paper I've read in years," says angiogenesis researcher Judah Folkman of Harvard University Medical School and Children's Hospital in Boston. "They answer one question after another."



CREDIT: Y.-S. MUKOUYAMA

Developmental tango. Branching arteries (red) follow the lead of neurons (green) in embryonic mouse skin.

Blood vessels and peripheral nerves tend to snuggle closely together. This arrangement has advantages: Arteries supply neurons with oxygenated blood; nerves tell blood vessels when to dilate or contract and help direct immune responses. However, few studies have examined how this relationship develops.

The Caltech researchers labeled nerves and blood vessels in the skin of embryonic mice. They found that arteries, but not veins, align closely with nerves. Snapshots of the skin at several time points revealed that the nerves appear first. Soon after, primitive vessels—which have yet to don the molecular trappings of arteries—align with the nerves. This hinted that the nerves might be calling the shots.

The team then turned to mutant mice lacking a gene important for guiding axons, the long tendrils extending from neuron bodies. Peripheral nerve axons in these mice tend to clump together and have fewer fine branches, and Mukouyama and Anderson's team found that the mice's arteries had the same pattern. Apparently, arteries follow axons even when the axons go astray.

It makes sense that the development of nerves and arteries is linked, says George Yancopoulos, a molecular geneticist at Regeneron Pharmaceuticals in Tarrytown, New York. "It's easy to speculate that if you're going to have two branching systems that integrate into the various tissues of the body, when one system comes up with a solution, it's very economical to have the second system just follow along."

Nerves also appear to secrete a molecule that tells embryonic blood vessels to become arteries in the first place. The team found that

ScienceScope

More for Livermore The Bush Administration this week delivered draft legislation creating the Department of Homeland Security to Congress, which is scrambling to decide how it will oversee the proposed $37 billion addition to the federal bureaucracy. But one element seems clear: The department's scientific and technological activities will be managed at Lawrence Livermore National Laboratory in California —although lab officials emphasize that the lab itself will not be swallowed up by the new department.

"There'll be a separate building on the Livermore campus, with a sign on the door designating it as an office of the new department," explains John Marburger, the president's science adviser. Asked why Livermore was chosen, Marburger says that the Department of Energy weapons lab "has a long history" of being involved in the issue, from the biological, chemical, and nuclear weapons in a potential terrorist's arsenal to the measures needed to thwart their deployment.

Although much of the department's work might be carried out by health and medical agencies, Marburger says he expects the Livermore-based office to manage their budgets. It will also represent science to the rest of the department.

U.K. Cloning Clash The on-and-off battle over the United Kingdom's stem cell and cloning research rules is on again. The country's highest court last week said it will allow an antiabortion group to appeal an earlier defeat that opened the door to human therapeutic cloning research.

Last November, the High Court ruled that the Human Fertilization and Embryology Act, passed in 1990 before human cloning seemed possible, applied only to embryos created by fusion of egg and sperm—and not those made by cloning techniques. The decision prompted one doctor to announce that he would attempt human reproductive cloning in the U.K. But after an appeals court overturned that ruling, the House of Lords empowered a government panel to issue licenses for therapeutic cloning research. Now, the Judicial Office of the House of Lords has ruled that the anti-embryo research group ProLife Alliance can challenge the current regulatory system.

A ProLife win would be a setback for researchers, says Anne McLaren, a developmental biologist at the Wellcome/CRC Institute in Cambridge. The case is expected to be heard later this year.

Contributors: Michael Balter, David Malakoff, Jeffrey Mervis, Adam Bostanci