AUSTRALIA

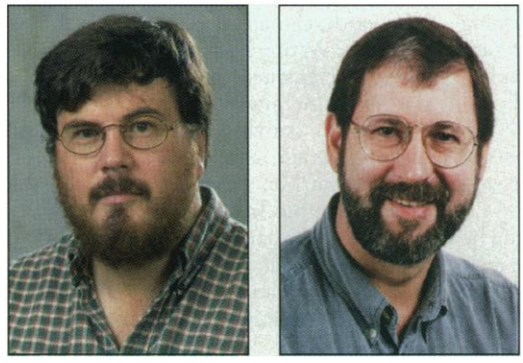
New Funds Plant Seeds for Genome Research Effort

MELBOURNE—As biologists down under prepared last month to head off for a Christmas of sun and surf, they had an extra reason for holiday cheer: two government decisions that will add meat to the country's innovative but meagerly funded foray into the world of genome research. The plan's core is a unique central facility that will carry out genome analysis on a contract basis for scientists from all fields—from medical researchers to those studying everything from cattle and prawns to plants and microbes. "Ours will be a completely generic facility, unlike most countries, whose genome programs are aimed at specific tasks," says molecular biologist John Mattick of the University of Queensland in Brisbane, who is directing the effort. "We want to make the power of genomics accessible and affordable even for small labs."

Although the total funding is still small, the Australian Genome Research Facility (AGRF) is being welcomed by the country's biologists, especially those in medical research. "The potential for human genetic science in Australia is fantastic," says Bob Williamson, director of the Murdoch Institute at the Royal Melbourne Hospital, thanks to its particular medical system and population structure. But until now researchers have lacked easy access to key technologies. Australia remains "one of the few major industrialized countries without a focused or organized genome research program," laments Grant Sutherland of the Women's and Children's Hospital in Adelaide, president of the London-based Human Genome Organization (HUGO). "We have a lot of genetics research but very little of what I'd call genomics." Adds Williamson: "The lack of facilities for sequencing and genotyping has been very frustrating."

Last month's decisions continue a process begun early last year when the federal government approved $7.9 million (U.S.) to set up the AGRF in two centers that will carry out large-scale sequencing, gene mapping, and mutation detection for clients. But that money covered only core equipment, not rooms to house it in, running costs, or research projects. Now, the government is providing some funds for those missing elements. One installment is a $10.3 million grant over 7 years for disease gene studies by four academic groups (including the two AGRF centers) and the Melbourne-based biotech company AMRAD Corp.; the second is a near-final commitment of $12 million by the Queensland government—matching an equal sum from the University of Queensland—for a new building to house part of the AGRF alongside basic and applied scientists in genomics, structural biology, and drug design. "Now we have a research and physical context that will allow us to grow and prosper," a jubilant Mattick told *Science* just after the decision was announced.

Sequencing to go. If all goes well, both halves of the AGRF will open for business in mid-1997. Large-scale sequencing will be based temporarily in Mattick's current lab, home to Australia's biggest sequencing facility, and will move into the new building once it is complete. The second site, at the Walter and Eliza Hall Institute for Medical Research in Melbourne, will be set up after modest renovations to an adjacent wing of the Royal Melbourne Hospital. The Melbourne branch's mandate, says head scientist Simon Foote, is to help researchers pinpoint genes involved in disease using a technology called genotyping, which involves testing thousands of DNA samples for certain short sequences spread throughout the genome. It will also develop an automated setup for detecting mutations—still a huge technical hurdle in genetics research.



Dual center. Simon Foote *(left)*, chief scientist at Melbourne site, and Queensland director John Mattick.

While a few countries have some form of genome service center, mostly for genotyping in humans, Australia's facility—open to all comers from any field—is the broadest and most ambitious. And many researchers think it is an idea whose time has come. "I don't see that you can follow the strategy being pursued by most countries of funding only individual projects," says Peter Little of London's Imperial College of Science, Technology, and Medicine. "Sequencing and genotyping will become more common ... [and] people need somewhere to go to have that done," he says. "The [Australian] idea is spectacular," agrees Eric Lander of the Whitehead Institute for Biomedical Research in Cambridge, Massachusetts. "These technologies must be available for many projects and labs."

Supporters of the AGRF point to another reason for their enthusiasm: Australia's superb conditions for human genetics research. For a start, there are "first-rate population and medical records, an excellent health system available to all, and a strong tradition of cooperation among patients, researchers, and clinicians," says molecular geneticist Williamson. Add in some large rural populations with little migration in or out, and the result is golden opportunities to study many members of single families—the formidable, rate-limiting factor for genetics research in most countries (*Science*, 8 March 1996, p. 1352).

The hunts begin. Foote and others have samples in the freezer and are ready to start tracking down genes as soon as the new facility opens for business. One of the first projects, a collaboration between Foote and John Hopper and John Wark of the University of Melbourne, will search for genes affecting bone density, a risk factor for osteoporosis. Another will analyze DNA, mostly from large families on the island of Tasmania, for genes involved in glaucoma. At the Queensland Institute of Medical Research in Brisbane, geneticist Nick Martin is collecting material to study genetic contributions to anxiety and depression, and for gynecological conditions such as endometriosis and preeclampsia.

Agricultural scientists are also eagerly anticipating AGRF's services. The Queensland Department of Primary Industries' Agricultural Biotechnology Center is studying the genomes of some 60 different species—from livestock to tropical fruits—and their pathogens. "Up until now we've taken a frugal approach to hunting genes," says the center's director, Ken Reed. "But with access to cheaper genomic technologies, the way you go about solving problems is totally revolutionized."

Beyond mapping and sequencing, the AGRF will offer a service unavailable anywhere else: automated detection of mutations. Although finding mutations is crucial to studying genetic variation, the lack of good, cheap techniques causes researchers lots of grief, says Dick Cotton of Melbourne's St. Vincent's Hospital, a leading expert in the field. Initially, AGRF's Melbourne site will rely on a precise detection method devised by Cotton, but which is not widely used because it requires highly noxious chemicals; newer technologies will be added as they become available. "Many people interested in the [AGRF] want mutation detection," says

Foote, who planned the automation.

With so many good ideas floating around, the AGRF's future should be rosy, but many researchers who spoke with *Science* are concerned that the government's overall support for genome research remains skimpy. "Great. Glad they're doing something, but look what's happening elsewhere," says one. Compared to the tens and hundreds of millions spent on genome programs in other countries, "it's a drop in the bucket," he says.

And a big boost is not likely soon. While the National Health and Medical Research Council will support genome research (and AGRF costs) within present granting programs, it will only consider allocating specific funds if new money becomes available, says nephrologist Judith Whitworth of St. George's Hospital in Sydney, who chairs the council's medical research committee. And that prospect, says John Bell, a top administrator at the Department of Industry, Science, and Technology, is "hard to predict, but personally I don't think it's very good."

Researchers are hoping to tap other sources of funding to make up some of the shortfall. Foreign money, both public and private, supports some genetics research in Australia, and Mattick has high hopes of attracting foreign projects to the AGRF from the growing scientific powers in the Asia-Pacific region as well as countries with well-established genome programs but little service capacity. "The new program is a great idea," says HUGO's Sutherland. "But without more project funding, the benefit of all this won't be realized." Last month's announcement will, however, at least give Australia the basis for a strong start.

–Patricia Kahn

MARINE GEOSCIENCE

Navigating Shrinking Financial Seas

ASHLAND, OREGON—Deep-sea oceanography, like some other areas of high-tech science, is getting a cold splash of fiscal reality these days. The field was once supported by several different agencies, but many funding sources have largely dried up, thanks to new defense priorities and congressional budget cuts. As a result, the National Science Foundation (NSF) now finds itself funding the lion's share of research in everything from the geochemistry of deep-sea vents to the development of new undersea robotic craft.

Given the shrunken pie, what should be the field's intellectual course over the next 20 years? Representatives of NSF's Marine Geology and Geophysics (MG&G) program and Ocean Drilling Program (ODP) posed that question to a select group of about 40 marine researchers invited to a gloves-off workshop here in December.* They got an emotional response. Researchers offered ideas ranging from more interdisciplinary research to better public relations, but if there was one single theme, it was this: hard choices lie ahead.

The meeting was a first for these programs, which include such diverse fields as solid earth, climate, fluids, and sedimentary processes. Acting MG&G program director David Epp insisted that the gathering was not about funding priorities. But his audience wasn't convinced. In the workshop's first open forum, marine geoscientist Peter B. Kelemen of Massachusetts's Woods Hole Oceanographic Institution pointedly told Epp and his associates, "You can try to pull the wool over our eyes any old way you want, guys, but you can't hide the fact that this meeting is secretly designed to address resource shortages by fiddling with [research] priorities." And certainly, other scientists behaved as if funding was at stake. After a talk on midocean ridges, one scientist stood up and demanded to know why ridges needed more study, asking, "Haven't you already answered the key questions?"

Such scrabbling for a piece of the funding pie is new to deep-sea oceanographers. Ocean sciences have been getting a shrinking share of federal research dollars (see chart), but until the mid-1990s, deep-ocean researchers could tap several sources, including the Defense Department's Office of Naval Research (ONR) and the National Oceanic and Atmospheric Administration, as well as the Department of Energy and the U.S. Geological Survey, for grants. But Congress cut the budgets of the latter three agencies. And although ONR remains a major player, spending about $150 million on science and technology in 1995, its research mission has changed, due to the end of the Cold War. The agency previously focused "on open-ocean and antisubmarine warfare" because of the Soviet threat, says Thomas Kinder, a program manager in coastal dynamics at ONR. "But now, because of things like Somalia and Desert Storm, the emphasis is on littoral [coastal] warfare," and on getting landing craft safely onto hostile shores.

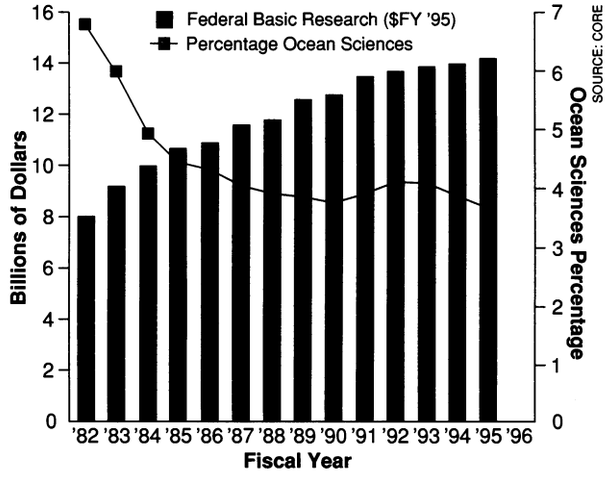
Thus, in 1990, 80% of ONR's research budget was set aside for the open ocean; today, the share has shrunk to 30%, with 40% earmarked for littoral studies, ONR officials say. As a result, researchers fear they'll lose the edge on deep-sea technologies, such as deep-sea observatories that can sample and record data from the ocean's floor. "This science is so driven by the need to get to the sea floor and retrieve data that the loss of ONR grants has really hit it hard," explained Marcia K. McNutt, a marine geoscientist at the Massachusetts Institute of Technology.

NSF hasn't focused on such hardware in the past, but it is now left to play the role of sugar daddy, with a 1996 kitty of about $21 million for its MG&G program and about $40 million for ODP. Those budgets have been flat in recent years, making it hard to fund additional applicants. "It means we have to change," perhaps by funding more tools for research, NSF's Epp said after the meeting, "but the community must as well."

By the workshop's end, most scientists seemed to agree that the solution lay, not in pitting fields against each other, but in working together on interdisciplinary projects that stretch limited dollars. For example, the sedimentologists, puzzling over such basic questions as how sandbars form, are ripe to work with geophysicists to "quantitatively model such processes," says Epp. The group also suggested more publicity for ocean research and cultivating private funding sources, such as oil exploration companies. And despite the frustrations that emerged at the meeting, many scientists said they welcomed the opportunity to work with NSF to envision the field's future—and to chart the hazardous fiscal waters ahead.

–Virginia Morell

* Future of Marine Geosciences Workshop, 5-7 December.



Flowing downhill. Ocean sciences' share of research funding has been declining.