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MSL-2 is a male-specific protein in Drosophila that binds to hundreds of sites along the single male X chromosome and increases gene expression to match that of the two X chromosomes in females. When this protein is ectopically expressed in females, as shown in this immunofluorescence micrograph, the two X chromosomes (paired over most of their length) are decorated in a male-like pattern. See page 1607. [Image: R. L. Kelley and M. I. Kuroda]
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Earthquake simulation
Recent earthquakes in California and Mexico show that major urban areas can experience significant damage and shaking from distant, moderately sized seismic events. Olsen et al. (p. 1628) simulated 2 minutes of long-period ground motion after a large earthquake on the San Andreas fault in southern California. Basin shapes and sediment loads in the San Fernando Valley and Los Angeles basins can amplify and prolong shaking compared to other locations at comparable distances from the fault.

Fluctuating flux
The difference between the measured flux of solar neutrinos and that expected from models constitutes the solar neutrino problem. McNutt (p. 1635) reports a correlation between variations in neutrino flux and changes in the solar wind that may indicate a need to revise standard neutrino physics. The correlation is consistent with resonant conversion of electron neutrinos to a nondetected type by interactions with the sun's magnetic field in the corona.

Quantum computers
A computer with logic elements constructed from quantum mechanical systems could in principle factor large numbers into primes, a problem beyond the capacity of conventional computers. However, the algorithm to do this assumes that the quantum computer would be completely isolated. Chuang et al. (p. 1633) show that even in the presence of interactions between the quantum computer and its environment that lead to decoherence, such computers may be still realizable. Quantum error correction would be needed to stabilize the computations.

Aerosol source
The stratosphere contains a fine mist of highly concentrated liquid sulfuric acid particles that participate in reactions that can ultimately lead to ozone depletion. Volcanic eruptions inject matter into the stratosphere that can nucleate these particles, but where do the nuclei come from when volcanoes are inactive? Brock et al. (p. 1650) show that sulfuric acid-water particles are homogeneously nucleated in the upper troposphere over the tropics and are then transported up into the stratosphere.

Finely fabricated
Two reports focus on fabricating micro- and nanoscale devices. Snow and Campbell (p. 1639; see the Perspective by Dagata, p. 1625) can write metal lines and create metal-oxide-metal junctions with an atomic force microscope tip. The conducting tip can reduce TiO$_2$ to form Ti structures with 10-nanometer features. Lehmann and Stuke (p. 1644) have created three-dimensional microstructures of aluminum and aluminum oxide. A computer directs the movement of a pair of laser beams, and deposition from gas-phase reactants occurs where the lasers cross. They made a linear micromotor that is moved by thermal expansion and contraction; lasers are used to supply the heat.

Hold the salt
The ability of plants to grow in saline soils is correlated with several physiological features, including ion transport. Rubio et al. (p. 1660) have identified an aspect of ion transport that is required for normal physiology of the plant but leads to sodium-induced toxicity when the plant is grown in the presence of excessive sodium. The HKT1 ion symporter normally transports K$^+$ along with Na$^+$. At high Na$^+$ concentrations, however, HKT1 mediates additional Na$^+$ transport through a low-affinity site at the expense of K$^+$ transport. Mutations in a transmembrane domain resulted in improved ability to discriminate between Na$^+$ and K$^+$ and may contribute to improved salt tolerance.

Telomere protein
Chromosome ends, or telomeres, are complexes of double-stranded DNA hexamer repeats and proteins that need to be maintained to avoid DNA damage that can lead to cell cycle disruption or malignancy. Chong et al. (p. 1663) report the cloning of the human telomeric repeat binding factor (TRF). Immunofluorescent labeling showed that the cloned protein localized in vivo to chromosome ends.

Editing and epilepsy
Neurons that express AMPA-sensitive glutamate receptors undergo an RNA editing mechanism whose physiological significance has been unclear. The edited subunits have a lower Ca permeability because of an arginine for glutamine substitution in the pore-forming region of the receptor channel. Brusa et al. (p. 1677) produced transgenic mice that could not edit versions of some of their AMPA receptor subunit RNAs. The animals died within 21 days of birth after suffering several seizures. The phenotype of the animals show the importance of RNA editing in the intact mammalian brain and provide a model for early onset epilepsy.
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**Rapid Analysis of Phospho-MAP Kinase...**

<table>
<thead>
<tr>
<th>PC12 CELLS (NGF 100 ng/ml)</th>
<th>0</th>
<th>10</th>
<th>30</th>
<th>60</th>
<th>180 time (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. phospho-MAPK Ab (Tyr)</td>
<td></td>
<td></td>
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<tr>
<td>p44 MAPK</td>
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<td>p42 MAPK</td>
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<tr>
<td>B. control MAPK Ab</td>
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<td>p44 MAPK</td>
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**Western Blotting:** Quick and easy detection of MAP kinase activation (on Tyr) from SDS-lyses of total PC12 cell extracts using A. phospho- and B. control-MAP kinase antibodies.

**NIH 3T3 CELLS/PHOSPHO-MAPK Ab**

**Immunohistochemistry:** Phospho-antibody allows in situ-detection and subcellular resolution of Epidermal Growth Factor (EGF)-induced MAP kinase activation and nuclear translocation.

**And cdc2 Kinase**

<table>
<thead>
<tr>
<th>Control</th>
<th>G1/S</th>
<th>G2/M</th>
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<tbody>
<tr>
<td>A. phospho-cdc2 Ab (Tyr15)</td>
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<td>p34cdc2</td>
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<tr>
<td>B. control-cdc2 Ab</td>
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<tr>
<td>p34cdc2</td>
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</tbody>
</table>

**Western Blotting** of cell extracts from Soac cells treated with Hydroxyurea (G1/S) or Nocodizate (G2/M) with A. phospho-cdc2 (Tyr15) B. control cdc2 antibody.

For more information on Phospho-Specific Antibodies, call 1-800-NEB-LABS or via the internet: <info@neb.com>

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**Rapid and easy detection of MAP kinase activation (on Tyr) from SDS-lyses of total PC12 cell extracts using A. phospho- and B. control-MAP kinase antibodies.**

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Need for Finer, More Detailed Images Puts the Focus on Fluorescence

Until fairly recently, brightfield and phase contrast were the most popular techniques used for microscopic studies. These techniques work well for studies of individual cells, but they are not adequate for imaging smaller entities such as some cellular organelles, proteins, antibodies, microtubules, RNA and DNA. Because fluorescence permits selective imaging and analysis of these substances with resolution down to several nanometers, it is becoming increasingly popular. Recent advances in optics design promise to make it an even more powerful technique.

Smaller objects, finer details
Using fluorescence, scientists can resolve images that cannot be observed with ordinary light. The diameter of a single DNA molecule, for example, is about 2 nm, while the finest detail that can be resolved by optical lenses is about 200 nm. However, if a fluorescent dye is conjugated with the DNA molecule and the specimen is viewed with a fluorescence microscope, the molecule can be easily detected and measured.

Although it is a very powerful and relatively easy to use tool, fluorescence places extreme demands on the microscope's optics. The near-ultraviolet wavelengths that are used to excite the specimen are very high in energy. At the same time, the light emitted from the specimen is of much lower intensity than the light used to excite it, so the imaging optics must be designed to transmit as much light as possible. Care must also be taken to prevent autofluorescence emissions, which can mask and rob contrast from the image.

Special objectives required
Because today's ultrasensitive techniques place extreme demands on optics, the emitted fluorescence requires specially designed objectives with higher numerical apertures, enhanced brightness and higher UV light transmission than those used with other techniques. The new Nikon CF PLAN FLUOR Universal Objectives have these characteristics.

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Nikon is the only microscope manufacturer to formulate and manufacture its own glass, and has taken advantage of this capability to create these truly special objectives. They also feature new optical cements and high transmission coatings to permit brighter images and broader wavelength ranges (UV - Deep Red) that are color aberration free with extremely high contrast and low background autofluorescence.

The new CF PLAN FLUOR Objectives also offer higher numerical apertures to capture more of the available light emitted by the specimen. The N.A. of the 40X PLAN FLUOR, for example, is 0.75 compared with 0.7 for the 40X Plan Achromat. The N.A. of the 100X oil PLAN FLUOR is 1.3 compared with 1.25 for the 100X Plan Achromat oil.

For more information on Nikon's new CF PLAN FLUOR Universal Objectives, call Nikon at (516) 547-8567, fax us at (516) 547-0306 or contact us on the Internet at nikonbio@aol.com.

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Biomedical Instrument Department
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As biomedical researchers continue to explore smaller and smaller entities, fluorescence microscopy is proving to be an exceptionally powerful tool. Because fluorescent dyes, or fluorochromes, are absorbed selectively by different substances within a specimen, each substance can be targeted and observed separately. This has made possible techniques such as Fluorescence in situ Hybridization (FISH), for example, which has played a key role in identifying chromosomes and determining the number, size and location of specific DNA sequences in mammalian cells.
**Letters**

**Career issues**

The mail was heavy in reaction to the 6 October issue, "Careers '95: The Future of the Ph.D." Several letters expressed the belief that scientists should be in their professions for the sheer love of research, not for a job. Others suggested that those who pursue scientific careers should expect no guarantees about employment. Some proposed alternative ways that science Ph.D.'s could be employed—in business, government, law, or journalism, for example.

One correspondent would like to see the position of 'postdoc' eliminated altogether, to be replaced by permanent positions that would give a greater sense of security to new Ph.D.'s. The consensus was that a graduate degree in science should qualify one to contribute to society in a variety of useful ways.

**Ph.D. Employment**

Given the employment situation in science, I believe it would be in the best interests of our field, and of young and mature scientists, if the position of postdoc was eliminated. This could be done by universities, national laboratories, funding agencies, and accreditation agencies working cooperatively or independently. In a field with the economic prospects of ours, to suggest that a new Ph.D. needs additional education before he is really qualified to work is laughable. Naturally, a scientist's education never ends, and there are many ways a scientist could profitably spend time in different universities or national labs. However, such visits are best arranged as exchanges between employed persons.

Many universities have research staff positions, and many national labs contract work out. Universities may be able to use independent contractors also. This way the recent Ph.D. would be hired into what at least may be a permanent position. If he does not work out, he can be terminated, just like any other employee. On the other hand, as grant support shifts, the company or research staff might or might not want to retain the person.

It is probably true that with the available support more postdocs can be employed than permanent employees. However, this could be considered even more of a reason to eliminate the postdoc position. If the field cannot support a scientist, it is better that he should know it after he completes his Ph.D. than if he has bounced around the country for 10 years, completing five postdocs.

_Wallace M. Manheimer_
Senior Scientist for Fundamental Plasma Processes, Naval Research Laboratory, Code 6707, Department of the Navy, Washington, DC 20375-5000, USA

I would like to propose a somewhat heretical solution to the career trauma facing young scientists: paying postdocs to embark on nonresearch careers. Individuals adventurous enough to leave research science should be assisted and encouraged. Call it a "G.I. Bill for Postdocs."

An appropriate mechanism would be a federally mandated requirement that all bodies funding research allocate 5% (or more) of their salary budget to fund postdocs seeking to leave research through higher degrees such as the M.B.A. (Small concessions such as this would greatly alleviate the sense of guilt that many principal investigators now feel when they train young scientists.)

Under such a system, a young scientist wanting to go into business, computing, government, teaching, or journalism would have the chance to obtain the formal qualifications and the contacts that are usually essential in such a venture. This would afford them the best possible chance in a new profession and would leave them with a rare combination of training that would enhance the range of contacts between science and other professions. This depth of contact would invigorate science and greatly enhance the "science constituency" within influential sectors of the economy, at the same time securing a brighter future for research and easier access to jobs for tomorrow's graduate students.

_Michael Burnet_
Laboratoire de Biologie de la Rizosphère, Institut National de la Recherche Agronomique, 78026, Versailles, Cedex, France
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Circle No. 90 on Readers’ Service Card
It is reasonable for faculty to express concern that we are training too many Ph.D.'s. Individuals who aspire to obtain a Ph.D. are commonly enthusiastic about research and eager to channel their creative skills into productive work. It is counterproductive to dampen this enthusiasm with clouds of uncertainty about the future of academic research. The discoveries of tomorrow may improve job availability. Moreover, the intelligent, creative, and enthusiastic Ph.D.'s of tomorrow are quite likely to be the people to open new opportunities for research in academia, business, politics, or areas yet to be defined. It would be a significant loss to the progress of society to channel these individuals into less creative career paths.

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Many students embark on the study of a discipline because they love the discipline, and not because they regard it as a sure way to make a living. It is an avocation rather than a vocation. In many sciences, graduate students are needed by professors to accomplish their own research. This raises the spectre of exploitation: Is it just to encourage students to undertake graduate work because we need them in our laboratories, even though there is no prospect of all of them being our successors?

It is certainly unjust to mislead a student as to his prospects for employment. But it is not unjust to offer a student employment as a research assistant as a way of helping the student to follow his avocation.

It has been argued that too much education is a bad thing and that overeducated citizens are a source of unrest and dissatisfaction. It can also be argued that there is no such thing as an overeducated citizen: there are only those who have acquired false expectations in the pursuit of learning rather than true education. For that, I think, we may justly blame ourselves, and resolve to do our jobs better.

Henry E. Kyburg Jr.  
Departments of Philosophy and Computer Science,  
University of Rochester,  
Rochester, NY 14627, USA

In answer to Don S. Doering's question (Editorial, 18 Aug., p. 903), "How do we fix a system that... has produced many more Ph.D.'s than the market can bear?", William Lockeretz (Letters, 13 Oct., p. 219) proposes a scheme of rationing to be executed by scientific research professors whose students become the Ph.D. scientists. Although he offers an essentially quantitative goal for the scheme, Lockeretz makes no suggestion as to how the selection from among potential Ph.D.'s is to be effected. About half a century ago there had for at least a decade been in place, as described below, a self-regulating system for producing Ph.D.'s in science that required no selection process and no rationing; and in light of external circumstances, that is, the job market, it was successful. I am convinced that a like system would be successful in our time and beyond.

A single addition to the present mode of producing Ph.D.'s in science should be sufficient to reestablish the old system's essential equivalent: Every student embarking on a scientific education must be made unequivocally aware that there is no guarantee of employment in a field of one's choice as consequence of one's studies—not even with a Ph.D. Let each become imbued with the spirit of the following injunction: "Study this field because you love it. If eventually you are sustained by a career in it, so much the better; if not, the career's failure to materialize must rather neither snare nor bruise you. Bear no resentment, but cherish the experience and insight your education will have brought you."

In the late 1930s, physics majors knew of no guarantees of eventual employment in physics. Nor was a particular group of graduate students surprised in 1941 on being informed by its department chair that "this is a physics department, not an employment agency."

Research professors must be—compelled to be, if necessary—persistently frank with their students with regard to career prospects. What has evidently long been a practice of sustaining unjustifiably sanguine future-career illusions in graduate science departments must be halted. Establishment of a rigorous "no-career-guaranteed" understanding within each graduate science department would likely entail (i) a reduced, if not eliminated, production of many more Ph.D.'s than the market can bear; (ii) a greater proportion of Ph.D. candidates who are in the pursuit for the love of it; and (iii) a lowering of the number of bruised, resentful science Ph.D.'s among those who are obliged to seek employment outside their fields of preference.

Robert Weinstock  
Emeritus Professor, Department of Physics,  
Oberlin College,  
Oberlin, OH 44074, USA

I share with Doering and many other investigators the panic over future employment opportunities within academia. Not only do...
I worry about the future of my own graduate students and postdocs, I have even more worries about the implications for the country as a whole.

Doering seems to suggest that we train Ph.D.'s for three reasons. The first is to obtain cheap labor to get our science done. The implications here are beyond comment. I would hope that kind of attitude does not exist, and if it does, we should wipe it out. The second justification given for training Ph.D.'s is that we need cheap labor to instruct undergraduates. Again, the implications about the morality of the academic community are disturbing. If this is happening, we should be working to change the structure of undergraduate education. Why do we need so many graduate students to teach so many undergraduates if the market is dictating a need for fewer people trained in science? The third reason, and in my opinion, the most disturbing one of all, is that we train people so that they can take jobs. I am not convinced that this should be a major goal. People can pursue learning for many reasons, only one of which is to secure employment.

Stephen M. Schwartz
Department of Pathology,
School of Medicine,
University of Washington,
Seattle, WA 98195, USA

Academic Expressways

I was taken aback by the headline “Scientists enjoy life in the not-so-fast lanes” (Karen Celia Fox, Careers ’95, 6 Oct., p. 141). It is true that my colleagues do very much enjoy their lives. It is also true that they are very much in the fast lanes, but on an expressway that is different from those where faculty at research universities are found. Faculty at many undergraduate colleges must run very hard to achieve excellence in both instruction and research. Their product, their students, are the graduate students, business leaders, and educated citizens upon which our nation depends. My institution is often the leading producer of B.A./B.S. chemistry majors in the nation. In the past 10 years 11 graduates have earned one of the 50 National Science Foundation (NSF) graduate fellowships granted annually to graduates of 4-year colleges. All of my colleagues hold or have recently held peer-reviewed research grants, and most have substantial publication records. They are also excellent teachers and some are national leaders in curriculum reform. Nearly all have been awarded grants by NSF for instructional equipment or curricular development. Three members of our chemistry faculty have been awarded the Catalyst Award of the Chemical Manufacturer’s Association. As the article indicates, faculty at undergraduate institutions have different goals, and they have chosen a different route; there is substantial evidence that their work in the fast lanes contributes in an important way to the nation.

James E. Swartz
Department of Chemistry,
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What Is Excellence?

The Careers ’95 issue raises the spectre of the “versatile Ph.D.” Definitely, broad experience enables a committed and restless curious graduate student to attack a lifelong research question from many angles. But I suspect that what is meant is conferring on those graduate students who do not have a burning curiosity the ability to provide skilled hands for any of a variety of employers. If our programs are versatile, we will still need a focused program for students who have always known they wanted to uncover mysteries. We already

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NCI AIDS Budget Under Microscope

Once again, the intramural AIDS research program at the National Cancer Institute (NCI) is on the griddle. This time, the chef is the Gay Men's Health Crisis, a New York–based AIDS advocacy group, and the main dish is a spicy 35-page report that details—for the first time—how NCI divvied up the $172 million it allocated to intramural AIDS research in 1994. "It's a very scholarly report," says Alan Rabson, NCI's deputy director. The analysis includes a breakdown of how much AIDS money each NCI principal investigator (PI) received last year and how many citations each one has on the AIDSLine papers database. More than $5.5 million was spent on researchers who have no citations whatsoever on AIDSLine.

Part of the problem, as a critic of NCI known as the Bishop-Calabresi report pointed out last spring (Science, 26 May, p. 1121), is that many investigators' work has AIDS applications but is not primarily focused on the disease. One glaring example is John Schiller, a respected papillomavirus researcher (see table). Rabson says NCI is now cutting back Schiller's AIDS dollars.

Biomedicine Loses a Friend in Congress

Next year is shaping up to be a watershed in Congress, as 12 senators and 15 representatives have said they will not run again. Included in this departing flock is a strong supporter of basic biomedical research, Senator Mark Hatfield (R–OR), now chair of the Senate Appropriations Committee. Hatfield, 73, announced on 1 December that he will retire and move to Oregon's coast.

Often at odds with his own party's agenda, Hatfield never in his five Senate terms voted for a defense authorization bill. Meanwhile, he's given a "lifetime of support to biomedical research," says a longtime congressional staffer. The aide believes that "support for the National Institutes of Health is broad but thin" in Congress, and it isn't clear who, if anyone, will become NIH's next "white knight" in the Senate. Another aide notes that Hatfield played a critical role this year in pushing the Senate budget process to allocate $1.5 billion more than the House wanted in the bill that includes funding for NIH.

Fossil Bill Has Scientists Fuming

Legislation that would allow amateur and commercial fossil collectors to dig on federal lands is stirring up dust among paleontologists, who argue that unskilled collectors will destroy sites and plunder them of fossils that belong in museums. Only academic paleontologists and their trainees can obtain permits to collect fossils on federal property. But the Fossil Preservation Act, soon to be introduced by Representatives Tim Johnson (D–SD) and Joe Skeen (R–NM), would permit anyone to take fossils from the surface using hand tools in areas not containing "scientifically unique" fossils. It would also allow amateur and commercial collectors to excavate on federal land if they signed an agreement with an overseeing research institution and promised to turn over to the area's manager any "scientifically unique" find. Marion Zenker of the American Lands Access Association (ALAA) says the bill will curb "the horrendous loss of fossils . . . due to weathering."

Paleontologists, however, have been blasting the bill on the Internet, saying that while there's a need for a new fossil law, the proposal lacks tough penalties and provisions for strong oversight. Jerry Harris, a graduate student at Southern Methodist University, warns that amateurs without proper training could damage specimens or sites. And David Krause, president of the Society of Vertebrate Paleontology, says he has "very grave concerns" that the bill will allow fossils that should be in museums to go instead to private collections. The term "scientifically unique" is murky, he says, and "significant fossils are not necessarily unique." A staffer for Johnson says he is "cautiously optimistic" that the bill will pass this Congress. The ALAA also hopes for a companion bill in the Senate.

Defense Bill Backs EPSCoR, Hits Labs

Tucked into the $243 billion defense spending bill that President Clinton reluctantly signed last week are two provisions that inadvertently line up with recent advice from the National Academy of Sciences (NAS) to make peer-reviewed, academic research the government's highest priority (Science, 1 December, p. 1430). One preserves a $20 million program that gives university scientists in have-not states seed money to vie for federal grants, and the other slashes $90 million from the military's $1.1 billion pot for its contract labs.

The state aid plan, called the Experimental Program to Stimulate Competitive Research (EPSCoR), is part of an $80 million multiagency effort that began in 1978. Congress overrode the Defense Department's attempt to kill the program, keeping its current level of funding. "We did pretty well considering the rest of the budget," says Stu van Scoyoc, a lobbyist for EPSCoR states. But the holiday season is a lot bleaker for scientists at the Pentagon's R&D labs: Congress cut $90 million from that account for the third straight year. One of the largest, the $275 million Lincoln Laboratory in Lexington, Massachusetts, is bracing for a cut of $20 million to $25 million, says a spokesperson. That's on top of a 21% decline in staff, to 2200, since the early 1990s. While the defense bill helps parts of academia, it ignores an NAS plea to hold the line on science and technology funds, cutting basic research by 4%, to $1.17 billion. And by giving defense $7 billion more than the Administration requested, the measure puts the squeeze on pending bills that fund civilian research.

Prehistoric loot? Law would affect protection of fossils such as this, from a hoofed mammal in Oregon.
Undersea Observatory

A unique sea-floor observatory will soon be keeping a continuous watch on two underwater volcanoes off the coasts of Washington and Oregon, according to a plan announced last week.

The plan, which could cost $30 million, involves setting up instruments on the sea floor to monitor seismic activity, currents, temperature change, and marine biota at two volcanic sites for years at a time. "Nothing of this magnitude and duration has been done in the deep sea before," says Chuck Fisher, a marine biologist at Pennsylvania State University. Fisher is part of the team, led by scientists at the University of Washington and Scripps Institution of Oceanography, that developed the plan. Currently, says University of Washington oceanographer John Delaney, scientists are only able to study such underwater sites from the surface or in submersible flybys.

Part of the National Science Foundation's RIDGE (Ridge Inter-Disciplinary Global Experiments) program, the observatory will be able to study the environment and processes that occur at the sites, including the interaction of the sea floor with magma from the volcanic activity. The observatories, which will take 4 years to set up, will cost between $2 million and $3 million a year for at least 10 years, says Delaney. Some instruments are already deployed at the sites, which lie between 600 and 400 kilometers offshore along the Juan de Fuca ridge, where two of Earth's plates are moving apart. Volcanic eruptions and earthquakes are common in such areas, as magma from the mantle rises to fill the openings. The ridge is also lined with hydrothermal vents, where unusual microbial life forms thrive in superheated, mineral-charged seawater. "The many types of instruments in the observatories will be our time-space 'telescopes' into how volcanoes—in the presence of water—can sustain life without sunlight," says Delaney. Remote-controlled vehicles may eventually be docked at the sites to collect samples and data.

Richard Thomson, a physical oceanographer at the Institute of Ocean Sciences in Sidney, British Columbia, says the plan is "quite exciting, because it focuses people on one area for a significant period of time. We'll get an integrated look at the whole system for the first time."

Ironmaking the old-fashioned way. Hayas recreate ancient forge.

How Hayas Fired Iron

Recent research into ancient and modern ironmaking in Africa provides new evidence of innovation among early iron workers as they coped with some unusual properties of indigenous materials.

In the November-December issue of American Scientist, anthropologist Peter Schmidt of the University of Florida and National Park Service archaeologist S. Terry Childs combine ethnographic and archaeological observations with laboratory analyses to study ancient technology among the Haya of Western Tanzania. Ironmaking is said to have originated in the Mediterranean region between 1600 and 1200 B.C., spreading to Africa around 600 B.C. Although the Haya stopped iron smelting at least 70 years ago, the researchers found elders who were able to recreate the technology with iron ore from an old mine. The researchers compared slag and iron from the experimental furnaces to materials excavated from Early Iron Age (600 B.C. to A.D. 600) sites in Tanzania. They were surprised to find both the ancient and modern materials had an unusually high phosphorus content—apparently from the trees and grasses used as fuel. The phosphorus helped in the smelting process, but the impurity made the iron brittle and easily cracked when cold-worked into objects.

The Haya smiths were able to identify the different kinds of iron produced in smelting and found ways to deal with them. They reduced the brittleness by reheating the partially purified "bloom" of iron, steel, and slag. This released carbon, making the iron stronger and more workable. The smiths used iron that was too phosphorus-rich for toolmaking to make simple ritual items.

"The genius of the Haya iron workers in dealing with the difficult materials is much greater than we initially realized," says Schmidt. Chapurkha Kusimba, an archaeologist who studies African iron technology at the Field Museum in Chicago, agrees, saying the research reveals that "inventions were going on as a result of experimentation."

AIDS Tumor Bank

AIDS researchers now have a new resource available to them: a bank of AIDS-related tumors with previously hard-to-obtain tissue and fluid samples from AIDS sufferers along with detailed clinical information.

The AIDS Malignancy Bank (AMB), which opened in October, has been a year in the making. Funded by the National Cancer Institute (NCI), it comprises repositories in five sites around the United States.

Cancer biologist Michael McGrath of the University of California, San Francisco, says that almost half of all AIDS patients get some type of malignancy. About 20% will get Kaposi's sarcoma, and 10% to 15% develop some form of non-Hodgkins lymphoma. Yet tumor samples from AIDS patients—especially samples with full clinical and demographic information—are often hard for researchers to get, says Ellen Feigl of NCI's cancer therapy evaluation program, who has been coordinating the creation of AMB. "There are very few people who can do important work on AIDS-associated lymphomas because there are only a handful of sites around the country that see those patients and get biopsy material," says McGrath.

Now the bank will be able to supply "all types of fluid, tissues, cells, and blood products" associated with AIDS tumors and see that every sample is accompanied by "a high-quality clinical pedigree" so researchers will know about patients' treatment and how they responded to it, says McGrath, who heads one of the repositories. He says the bank will also enhance the work of the newly established AIDS Malignancy Clinical Consortium, funded by NCI, which comprises 13 institutions doing innovative clinical trials.

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EPA Crafts a Strategy For Science

Outside scientists have long urged the Environmental Protection Agency (EPA) to shore up the science behind its regulatory decisions. The agency has been responding—by adding more peer review and boosting extramural grants, for example—and now Robert Huggett, director of EPA’s Office of Research and Development (ORD), has drafted a strategic plan that sets research priorities for the agency.

The plan, released 2 weeks ago, calls for EPA to focus its research on “the greatest risks to people and the environment.” It identifies six near-term research foci: disinfection of drinking water, chemicals that interfere with endocrine systems, ecosystem protection, models for human health and exposure hazards, particulates harmful to health, and pollution prevention. At the same time, the plan calls for the agency to place less emphasis on routine data collection and low-risk hazards like municipal solid waste, says Joseph Alexander, ORD’s deputy science director. EPA will also do more to integrate ecological and human health research.

“I think it’s a big step forward. They’ve matured to … understanding that there’s a necessity to do some basic research,” says ecologist Richard Fisher of Texas A & M University. Howard University toxicologist Baillu Walker, who serves on a National Research Council (NRC) panel that reviews EPA’s research, agrees, adding that the plan “represents a good synthesis of the advice that has been coming to that agency from all directions” (Science, 31 March, p. 1903). EPA is seeking comments from its Science Advisory Board and the NRC panel on the draft, to be finalized next year. Meanwhile, Alexander says the draft plan will be a “pivotal tool” in coping with EPA’s 1996 science and technology budget, which Congress wants to cut 10% compared to 1995 levels.

Eating Like a Greek

For years, physicians have been extolling the “Mediterranean diet”—heavy on fruits, vegetables, cereals, and legumes and light on animal fats—as a way to avoid cardiovascular disease. Now there’s evidence from a study of elderly people in rural Greece, who’ve been on Mediterranean diets all their lives, that these eating habits can also prolong life.

The elderly provide a “living history of past nutrition,” says Dimitrios Trichopoulos, an epidemiologist at Harvard School of Public Health and senior author of the study, which appeared in last week’s British Medical Journal. Elderly Greek villagers “stick to the old customs, as elderly people usually do. … That allowed us to evaluate, for the first time, the effect of a total diet” on survival rates. Previous studies on diet and longevity have focused on specific nutrients, Trichopoulos explains.

The study tracked 182 Greek villagers over age 70 for 6 years. According to questionnaires examining current eating habits, 57% of them followed traditional, healthy patterns in five or more of the eight food categories measured. Nontraditional eaters—who followed healthy patterns in two or fewer categories, made up 19% of the group. During the study period 53 people died. But those who followed tradition in six or more categories—for example, by eating large amounts of beans or bread, or by using olive oil instead of saturated fats—were only half as likely to die as those who adhered in three or fewer categories. No specific food group showed any relation to survival, but, says Trichopoulos, “taken together, they work.” He says the villagers’ regimen—including whole-grain bread, beans, yogurt, feta cheese, vegetables cooked in olive oil, and moderate amounts of wine—helps explain the “Mediterranean paradox”: the relatively long life-spans of people in this region despite their high total fat intake and high rates of smoking.

The study has “a very important message: A pattern of eating that includes all of these factors seems to be the healthiest,” says R. Curtis Ellison, an epidemiologist at Boston University. But Dean Ornish, director of the Preventive Medicine Research Institute in Sausalito, California, and an outspoken advocate of a low-fat diet, notes the study doesn’t necessarily mean the rest of us should imitate all aspects of traditional Greek dining. “People survived longer despite the olive oil and red wine,” he says—“not because of them.”
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All About Mice

LEE M. SILVER. Oxford University Press, New York, 1995, xiv, 362 pp., illus. $49.95 or £40.

Mapping the human genome and identifying genes that contribute to susceptibility and resistance to disease are currently major preoccupations in biomedical science. The foundations for much of this sophisticated field of research were established in the mouse. Almost a hundred years ago, when it was recognized that laboratory mice developed tumors, attempts were made to use transplantable tumors as a means of inducing immunity to cancer. This led ultimately to a requirement for genetic uniformity in this species and the subsequent construction of inbred strains beginning in 1921. It soon became apparent that individual strains differed in their susceptibilities to cancer. Strains with a high incidence of mammary tumors (C3H) or leukemia (C58, AKR) stood in contrast to low-spontaneous-cancer strains (BALB/c, C57BL). The biological problems evolving from the transplantation of tumors in inbred strains opened a brilliant chapter in mammalian genetics with the discovery of the major histocompatibility locus. But quickly the progress in the mouse led to comparable work in humans and the mouse was relegated to a more parochial role in mammalian genetics.

Several important developments rekindled interest in the genetics of the mouse and made genetic findings more relevant to our understanding of human biology. Molecular geneticists discovered that many genes are highly conserved throughout evolution and that the order of genes in segments of chromosomes is conserved as well. Despite exceptions, “over 80% of the autosomes have now been matched up at the subchromosomal level.” This linkage homology has made possible the transposition from one genome to another. Yet another series of observations opened additional ways in which to study human genes in mice. Construction of transgenic mice and gene targeting by homologous recombination to “knock out” the function of genes has created new strains of mice for studying mechanisms of gene action. The combination of these two methods can potentially produce mice that function with human genes.

Lee Silver in a pleasing and easy style presents a unique synthesis of modern mo...
molecular genetics and the biology of the laboratory mouse. As the house mouse and its genome are sometimes employed or regarded (regrettably) as a genetic “test-tube,” there is growing need for the student as well as those who manage colonies of mice to become familiar with the biology of this fascinating creature. Though mundane, “all you ever wanted to know about the sex-life and reproducibility of the house mouse but were afraid to ask” is covered in this book. However, one should not be misled into thinking that the primary mission of the book is to give equal and independent time to husbandry issues along with molecular genetic technology. Mouse Genetics is truly a composite in which all elements contribute to a global understanding. It provides exciting reading for the student and continuing education for the more applied worker and above all unifies its topic. There are practical discussions for the student or researcher including such sections as “starting from scratch with a new mapping project.” In his effort to assist the reader in the “fundamental goal of molecular genetics,” Silver describes and evaluates strategies for mutagenesis (chemical, transgene, knock-out) and linkage analysis (using backcross, congenic, and recombinant inbred strains) to dissect how “genotypes are translated into phenotypes.” Silver’s insightful interest in the evolution of genomes surfaces over and over again in the text, making this book an exciting introduction to the comprehensive biology that is involved in the intriguing mysteries of the evolutionary process.

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Interleukins Etc.


Most books on cytokines are of evanescent value, being rendered obsolete very quickly by the emergence of new ligands, new receptors, new transducers, and new facts. With this thought in mind I looked askance at Guidebook to Cytokines and Their Receptors. Surely, I thought, the task of evaluating it would be akin to appraising a computer with a 386 chip. Refreshingly, it was not. True, there are specific areas in which discoveries have eclipsed the material presented. But for the most part the facts and principles set forth are not likely to change. This attests, in part, to the diligence of Nicola and the panel of experts he has enlisted to lay out the information. It also says something about the field as a whole, which seems at last to have reached a point of maturity.

The book begins with an overview of the cytokines, written by Nicola himself, and an overview of their receptors, written by Douglas J. Hilton. The reductionist approach that these authors entertain is most helpful, since only four families of receptors are known to accommodate the dozens of cytokines that exist. It is a bit disappointing to find that the book then presents the cytokines in an order dictated by their numbers, rather than clustering them in groups related to receptor function or structure. What, after all, do the appellations “IL-1, IL-2, . . . IL-n” really mean?

The enduring quality of this Guidebook owes much to the stylistic consistency and thoroughness of the individual entries. Many, though not all, of the cytokines have...
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Vignettes: Confidings of Herpetology

By the late 1980s . . . scientists who work with frogs slowly and cautiously began sharing their tales of frog-finding difficulty with their colleagues. Among herpetologists, particularly those who work in the field more than in laboratories, being able to find amphians traditionally has been a matter of pride. If a graduate student returned from a summer field trip complaining about not being able to find animals, colleagues and teachers assumed the student was not very competent. So when the professionals began sharing their experiences of not finding frogs, it was almost cathartic, like releasing some horrible family secret.

—Kathryn Phillips, in Tracking the Vanishing Frogs: An Ecological Mystery (St. Martin's Press; Penguin paperback)

Once, I was a member of a prestigious panel of herpetologists meeting to decide the future of herpetology. There were about eight of us sitting around a conference table. Glancing around, I noticed that about two-thirds of us had a missing digit. Herpetologists cannot resist picking up venomous snakes. Sooner or later, most manage to get bitten, and they often lose part of a digit in the process. I felt right at home in that group, even though I didn't lose mine to a snake (how were they to know?).

—Eric R. Pianka, in The Lizard Man Speaks (University of Texas Press)

now been crystallized, and a good number of three-dimensional structural models are presented. Schematic representations of the receptors are included as well, creating an immediate impression of the type of signal transduction that is likely to occur (a notable deficiency here concerns the TNF receptor family, for which a number of transducing molecules have emerged since publication). Detailed descriptions of several knockout phenotypes are also presented. This book meets an obvious need. Many cytokine workers immediately find themselves out of their depth when the conversation (or the impulse of research) turns to a factor with which they have no hands-on experience. For them the Guidebook sets forth facts of a solid character that are not likely to change in the near term. This makes the book extremely attractive and well worth buying.

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