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All pumped up
Porous silicon is an efficient emitter of photoluminescence, compared with the relatively low emission from bulk or smooth surfaces. The mechanism that allows this enhanced emission might involve contributions from quantum confinement in nanocrystallites or excitation and emission from surface chemical species. Chin et al. (p. 776) measured photoluminescence from anodically etched silicon induced by multiphoton excitation with infrared light. The excitation was only effective when the infrared photon frequency matched the vibrational frequency of SiH$_x$$_y$$_z$$_w$$_v$$_u$$_t$$_s$$_r$$_q$$_p$$_o$$_n$ species. The authors conclude that luminescence is the result of pumping the electronic excitation via a vibrational ladder, indicating that surface states play a key role.

Carbon sink
Estimates of the carbon budget seem to imply that forests represent an important sink for anthropogenically produced carbon, but it has been difficult to determine the magnitude of the sink, or which forests are the most important sinks. Grace et al. (p. 778) measured the carbon flux in an undisturbed tropical forest in Brazil over the wet and dry season. The results indicate that this forest ecosystem acted as a net sink for CO$_2$ in both seasons.

Tilted crystals
Ferroelectric liquid crystals respond to electric field changes rapidly, making them of interest for technological application in computer displays and electrotroplical devices. These materials are of special interest because they exhibit spontaneous electric polarization, but the origins of the polarization are unclear. Photinos and Samulski (p. 783) report the results from a model that suggests the polarization is the result of constraints on the packing of the molecules. By understanding the origins and implications of such ordering, it may be possible to study the effects of different compositions and thereby design even better ferroelectric liquid crystal devices.

Control of circadian rhythms
The timeless (tim) and period (per) genes are necessary for circadian rhythms in Drosophila. Three reports and a news story by Baringa (p. 732) focus on advances in the study of the tim gene. Myers et al. (p. 805) have cloned and sequenced tim. Sehgal et al. (p. 808) have found that tim RNA is expressed in a circadian manner in a pattern identical to that of per RNA. This expression is dependent on the presence of PER and TIM proteins. Gekakis et al. (p. 811) show that PER interacts with TIM by way of a PAS dimerization domain in PER and that this interaction is disrupted in mutations that cause an alteration in the circadian period. These studies suggest that the PER-TIM interaction controls the duration of part of the circadian cycle.

In the wrong place
BRCA1, the protein responsible for hereditary breast and ovarian cancer, has limited sequence similarity with known proteins, so its cellular function has remained elusive. Chen et al. (p. 789) show that in normal breast epithelial cells, BRCA1 is localized in the nucleus, whereas in the majority of breast cancer cell lines and in malignant pleural effusions from breast cancer patients, it is localized mainly in the cytoplasm. These results suggest that BRCA1 can be indirectly inactivated by mislocation in the cytoplasm, and that this mechanism of inactivation may be more common in sporadic breast cancers, which have a much lower frequency of intractable mutations than occur in hereditary breast cancers.

Last place you look
The time required to locate a target object on the basis of a single visual feature, such as its color or rate of movement within a collection of distractor objects is approximately independent of the number of distractors. However, trying to find an object that has both features takes more time with more distractors. Is this due to the additional time taken to search the visual field serially, or does a parallel search function serve less well with increasing complexity? Corbetta et al. (p. 802) present a functional imaging study in which they localize the cortical areas activated in humans performing the two-feature search process. These areas correspond to those known to participate in spatial shifts of attention, suggesting that the subjects used serial searching.

Jak3 and lymphoid cells
Cytokine receptors are thought to produce their cellular effects in part by activating members of the Janus family of kinases (Jaks). The Jaks phosphorylate and activate transcription factors known as Stats. Three reports clarify the crucial biological roles of Jak3, which is activated by several members of the interleukin receptor family. Nosaka et al. (p. 800) and Thomis et al. (p. 794) describe mice that lack Jak3. Such mice have reduced numbers of B and T cells and associated defects in T and B cell function. Russell et al. (p. 797) describe a human patient who lacks Jak3 and suffers from X-linked severe combined immunodeficiency. The results indicate that Jak3 is essential for proper development of lymphoid cells.
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New On-Line Tools for Scholars: 1

These days, seasoned researchers as well as students of science must constantly battle an information overload that gets in the way of their pursuit of knowledge. Scientists are always playing catch-up in an attempt to stay abreast of the literature, whether their interests are narrowly or broadly focused.

Science cannot escape some responsibility as a contributor to this information glut. As a broadly based weekly journal of original research findings, we aim to communicate to our readers the latest important research events, whether first reported in our own pages or in other journals. We also strive to provide international scientific coverage of discoveries, as viewed by both scientists and science journalists. But how do our readers stay afloat in this constant flood of new information? We suspect that after readers flip through the latest issue looking for news stories and new results pertinent to their fields of interest, the issue goes onto a pile, awaiting that elusive moment of free time when the interesting papers can be recovered and studied in depth. Frequently, the desire to learn is overwhelmed by the distraction caused by having too little time and too much to do.

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In addition to full text of the Table of Contents, the Editorial, and This Week in Science, “Science On-Line” will offer full abstracts of all original Research Articles and Reports; summaries of the Perspectives, Policy Forums, Research News, and News and Comment features; a Table of Contents organized by subject area; and links between related features. Furthermore, through the use of a simple but potent search engine developed by HighWire to fit our needs, “Science On-Line” readers can now recover from their piles that long-lost item that looked so interesting when it arrived. Beginning with the 6 October issue, readers can search by authors, key words, or dates. The search results will indicate if the item is an Article, Report, News story, Perspective, and so on. As our digital archives accumulate, threads connecting general topics will emerge so that one can begin to put into perspective the ways in which new data and ideas relate to previous items on related topics.

In keeping with our goal of providing our readers with more tools to aid their scholarly pursuits, our new electronic armamentarium also includes access to the databases of the Community of Science, to allow users to identify others working in a given area of science and to communicate directly with them. In addition, through special arrangements with the Community of Science, browsers at our Web site can access the Federally Funded Research databases of projects already under way. “Science On-Line” also features new links to “Science’s Electronic Marketplace,” where the latest information on tools, reagents, and other devices, as well as research-related services, can be acquired. Links to the Global Career Network will provide the latest information on job opportunities, searchable by key words. More new interactive features have been added to “Science’s Next Wave,” now taking on a life of its own in providing new facts and people connections for those beginning their scientific careers.

We invite experienced browsers of the first edition of Science’s Web page, as well as those who are curious but Web-wary, to take a look. All of these tools are freely available for now. We ask only that you tell us about yourself via the guestbook button the first time you browse, and give us your impressions via the feedback button when you have used the system. The next additions to our tool kit for science scholars are already well along in their development. We look forward to your suggestions.

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Letters

New stars, old lives, and fast delivery

How to detect and identify laser emissions in space (right), human longevity, and delivering reports quickly to the government are among the topics discussed in this week's letters. Other subjects include expression of major histocompatibility complex class I genes and light-emitting electrochemical cells.

Space Laser

In the News article "First light from a space laser" (8 Sept., p. 1336), James Glanz describes the discovery of possible laser emission at 169 micrometers (μm) from the disk surrounding a young star in Cygnus (MWC349). The reader might be left with the mis impression that this is the first laser discovered in space. Laser emission in the familiar 10-μm bands of CO2 had earlier been identified in the mesospheres and thermospheres of Mars (1) and Venus (2) and are reviewed in (3).

The same lasing bands are used in commercial CO2 lasers for applications ranging from medicine to metallurgy.

The CO2 nonthermal emission on Mars and Venus was first observed (4) by students of Charles Townes and was identified as a "natural laser" after the discovery of significant gain in the transitions (1, 2). The population inversion is pumped by sunlight and is thus found only in the daylit hemisphere. The lines are about 100 million times brighter than if the state populations were in thermodynamic equilibrium, but only a small portion of the excess emission represents stimulated emission. The amplification is about 10% along the tangent path passing through altitudes of maximum gain (1, 2), and this has been confirmed by several independent groups (5).

The amplification is comparable to single-pass gains in some CO2 lasers on Earth, and the laser could be made to oscillate if mirrors were placed in appropriate orbits about the planet. The resulting light would be highly directional and could be detected with high bandwidth over interstellar distances with the use of currently available detection techniques (6). The technology of realizing planetary scale lasers is beyond our current capabilities, but future prospects were explored by Brent Shepherd (7).

Meanwhile, the emission lines have proved useful for probing temperatures and winds on Mars (3) and Venus (8).

The laser detected in the star MWC349 by Vladimir Slenitski and his team—in the H15a line at 169 μm—was preceded by the detection of meso emissions in that object in the H26α line at 850 μm and in H21α at 450 μm by ground-based observers (9). Distinguishing a maser in the H21α line from a laser in H15a is subject to some semantic interpretation. The latest discovery in MWC349 is interesting and suggests new directions for probing the disks around young stars. Conditions in them must be evaluated more completely before the circumstellar maser emissions, and the nebular processes revealed by them, can be regarded as completely understood.

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References


Reporting to the Government

The article "NRC pledges faster delivery on reports to government" by Andrew Lawler (News & Comment, 6 Oct., p. 22) states
that the National Research Council (NRC) intends to speed up the production and release of reports, in part because of the demise of the Office of Technology Assessment (OTA). This should be welcome news to policy-makers in Washington, D.C. But the NRC is not the only organization with the ability to provide reports on science and technology issues. Increasingly, scientific societies should be prepared to produce high-quality policy reports for political decision-makers.

Toward this goal, the Association for Computing Machinery (ACM) established the U.S. Public Policy Committee of the ACM (USACM). One of the USACM’s first major undertakings was to commission a study of encryption policy in the United States, a matter of great concern to many members of the computing community. With support from the National Science Foundation, the study committee released the report “Codes, keys, and conflicts: Issues in U.S. crypto policy.” We are now initiating a second study “Design principles to promote public access to government data.”

We are also increasing our presence in the Washington, D.C., policy process. Our motivation is ACM’s belief that computer professionals have an obligation to assist the public and government officials in understanding the technical issues that we now find in many areas.

The USACM has set up a Web page to make available various reports, legislative resources, and statements on emerging policy issues. Anyone who is interested in our work on issues such as universal access to the National Information Infrastructure (NII) or intellectual property aspects of the NII can find this information at http://www.acm.org/usacm/

We encourage other professional societies to engage in similar efforts.

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Light-Emitting Electrochemical Cells

The polymer light-emitting electrochemical cell recently reported by Qibing Pei et al. (Reports, 25 Aug., p. 1086) represents an interesting and potentially useful device. However, light-emitting electrochemical cells have been investigated for more than 30 years, beginning with research by E. A. Chandross at Bell Labs, D. M. Hercules at the Massachusetts Institute of Technology, and our group at the University of Texas at Austin. Although such cells are described by different terminology than that used in the report by Pei et al., electrochemiluminescence (or electrogenerated chemiluminescence—ECL) basically involves the same phenomena and concepts as those in the cell described by Pei et al. The reduced (“n-doped”) forms generated at the cathode react with oxidized (“p-doped”) forms produced at the anode to form excited states that emit light. In fact, ECL in polymer-based systems was demonstrated some time ago (1). Indeed, in a recent paper co-authored by one of the authors of the Science report (2), ECL in a film of a polyphenylenevinylene was demonstrated.

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References

Response: Bard points out the similarities between the light-emitting electrochemical cell (LEC) and the phenomenon known as electrochemiluminescence. We are, of course, aware of this important earlier work. Our understanding of the two approaches leads us to conclude that, although superficially similar, the mechanisms involved in electrochemiluminescence are, in fact, quite different from that involved in the LEC.

The electrochemiluminescent devices described and studied in detail by Bard and colleagues rely on transport of the oxidized or reduced light-emitting molecules (ions) themselves through the electrolyte between the electrodes, rather than transport of the electronic charge carriers between the electrodes. The oxidized and reduced species (ions) then react with each other (or the electrode) to form the original organic or metallo-organic species in an excited state, which may subsequently decay radiatively. Electrochemiluminescent displays have been described in which the electrochemiluminescent substance is dissolved in a solid electrolyte. Nevertheless, after generation of the oxidized and reduced species, the ions diffuse away from their respective electrodes and eventually meet somewhere between the two electrodes. Alternatively, electrochemiluminescent material can be fixed on one of the electrodes in an electrochemical cell and cyclically reduced and oxidized by an alternating potential. A direct current potential can be used only if the cell contains an additional species that serves to interact with the luminescent material in such a way as to oxidize it at the same potential at which it is electrochemically reduced or to reduce it at the same potential at which it is electrochemically oxidized.

In the LEC, on the other hand, the oxidized and reduced macromolecules are immobile; they do not physically move from one electrode to the other. On the contrary, it is the electrons in the π* band and the holes in the π-band (that is, the electronic charge carriers) that move between the electrodes within the immobile semiconductor. When a voltage is applied between the contacts, the semiconductor is electrochemically reduced at the cathode to form an n-type region containing negatively charged carriers (electrons) and electrochemically oxidized at the anode to form a p-type region containing positively charged carriers (holes). Ions move only during the transient formation of the p-n junction; after reaching steady state under a fixed applied voltage, all ion transport stops. Moreover, ion transport is not directly involved in the light emission. Under the steady-state conditions with the voltage on and the p-n junction formed, electrons from the n-type region and holes from the p-type region combine in the compensated p-n junction to form neutral pairs that radiatively decay and give off light.

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Women’s Longevity

In his otherwise excellent News article (Women’s health research blossoms, 11 Aug., p. 766), Charles Mann states that “For most of human history, men lived longer than women. That situation began to change a century ago, as modern medical practices came into use. By 1920, the average U.S. female life expectancy of 54.6 years had outstripped the male life expectancy of 53.6.” The problem in assessing these statements is that there are no reliable mortality data for the world as a whole for

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most of human history. Evidence to support the first statement is based on studies of skeletal remains (1). However, there are problems with interpreting paleodemographic data, including whether the skeletons reflect actual mortality by age and sex in the population being studied and whether mortality in the populations being studied reflects mortality more generally. To construct an accurate life table from skeletons would require all or a random sample of deaths to be found at the burial sites, either a stationary population so that the age distribution of deaths in the population is the same as that in the life table or a stable population with known rate of growth, and accurate estimation of age at death and determination of sex. Evidence against both the first and the second statements is provided by estimated mortality rates from more recent populations with very high mortality but with data whose reliability is far more certain. In Sweden, the country with the longest historical series of reliably recorded mortality data, expectation of life at birth (e0) for females has exceeded that for males since the first period (1751–1790, when e0 was 36.6 years for females and 33.7 years for males) that official estimates are available (2). Estimated life tables for other high-mortality populations also show a female advantage; in India [from the first period (1872–1881) for which estimates are available, when e0 was 26.6 years for females and 23.7 years for males, through 1911–1921 (3)], among immigrants to Liberia [1820–1843, when e0 was 24.6 years for females and 22.9 years for males who survived the calendar year of arrival (4)], and among the British peage [from the first period (1550–1574) when estimates are available, when e0 was 38.2 years for females and 37.8 years for males, through 1700–1724 (5)]. The statistics Mann gives for female and male life expectancy for the United States in 1920 are correct, but the differential favoring females also existed for each year from 1900 to 1919 (6). Although there are no official national estimates before 1900, when the national death registration area was established, estimated life expectancy for females has exceeded that for males in Massachusetts since the first year (1850) that estimates are available (5). In 1995, expectation of life at birth for females is estimated to exceed that for males in every country except Bangladesh, Bhutan, India, Nepal, and Pakistan (7). Discrimination against females in South Asia has long been recognized by demographers as the source of this anomaly.

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References

MHC Class I Gene Expression

Harald Neumann et al. (Reports, 28 July, p. 549) elegantly demonstrate that major histocompatibility complex (MHC) class I genes are expressed by a portion of neurons cultured from the rat hippocampus. Cells expressing the MHC class I antigen did not exhibit spontaneous action potentials, while neurons that did not express the antigen had spontaneous action potentials. Treatment of electrically “silent” cells with gamma interferon increased expression of MHC.

We have previously demonstrated (1) that neurons of murine trisomy 16 (mts16) fetuses (16 to 18 days after conception) in vivo expressed large amounts of class I MHC H-2Kk antigen and increased synthesis of messenger RNA that binds a 33-base antisense complementary DNA probe to a region in exon 2 of the H-2Kk sequence. The reactive neurons were from the trigeminal ganglion, thalamus, and cerebellum. This finding is related to the report by Neumann et al. because mts16 animals have an increased gene dosage for interferon alpha and beta receptors (2); both interferons increase expression of class I MHC antigens, and an increased gene dosage for the receptor may cause cells to respond in a manner similar to that observed when high doses of interferons are administered.

An implication of the findings of Neumann et al. is that expression of class I MHC molecules occurs in functionally impaired neurons. The cerebellum is one of the more developmentally disturbed regions in mts16 brain (1). The neural dysgenesis seen in mts16 conceptuses may be a consequence of high numbers of interferon receptors on these cells and the resulting increase in MHC class I expression. Alternatively, it may result from other factors.

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References


Corrections and Clarifications
In the editorial “In transition” by Barbara Jasny (20 Oct., p. 359), the genus of the organism Mycoplasma genitalium was inadvertently given as “Mycobacterium” in the last line of the first paragraph.

In the first report listed in the Table of Contents in the issue of 13 October (p. 211), the name of author C. M. Lieber was misspelled.

The URL address listed for Pete Goldie in his letter of 13 October (p. 218) was incorrect. It should have read, “http://bn.com”

In the Research News article “Designer tissues take hold” by Robert F. Service (13 Oct., p. 230), Katherine Tweden’s name was spelled incorrectly. Also, her experimental results were completed in 3 weeks, not 3.

In Paul Selvin’s article “The future university: Leaner and meaner?” (Careers ’95: The future of the Ph.D., 6 Oct., p. 135) it was reported that the University of Michigan’s Institute for Mental Health Research was closed during the 1980s. In fact, the institute is now celebrating its 40th anniversary. The institute that was closed was the Institute for the Study of Mental Retardation and Related Disabilities, which had formerly been the Institute for the Study of Mental Retardation. Science regrets the error.

In the Book Reviews section of 13 October, the two photographs at the bottom of page 319 were inadvertently interchanged.

The News article “Wing scales may help beat the heat” by Wade Roush (29 Sept., p. 1816), should have described Urania fulgens as a moth, not a butterfly.

Letters to the Editor
Letters may be submitted by e-mail (at science_letters@aaas.org), fax (202-289-7562), or regular mail (Science, 1333 H Street, NW, Washington, DC 20005). Letters will not be routinely acknowledged. Full addresses, signatures, and daytime phone numbers should be included. Letters should be brief (300 words or less) and may be edited for reasons of clarity or space. Beginning in October 1995, our previous policy of consulting with all letter authors before publication will be discontinued.
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NIF Gets Green Light

Advocates of magnetic fusion had long faces last week as they saw their budget cut by a third (see p. 728), but those who back an alternative—inertial fusion—had reason to smile. A House and Senate conference committee approved the full $61 million that the Department of Energy (DOE) asked for to start designing the National Ignition Facility (NIF), a $1 billion arrangement of 192 powerful lasers that would help weapons researchers test the U.S. nuclear stockpile without conducting underground explosions. The facility, which likely would be built at Lawrence Livermore National Laboratory in California, would also allow researchers to study ways to achieve fusion by compressing a pellet of hydrogen to helium.

The House had allocated only half of DOE's request for NIF. The Senate, however, acting after President Clinton pledged to seek a comprehensive test ban this summer, backed full funding. A bipartisan group of representatives from the San Francisco area successfully pushed in conference for the Senate figure. "Yesterday's vote is really the sound of the starter's gun being fired," says Mike Campbell, head of the lasers directorate at Livermore. But don't expect a sprint: Construction of NIF, set to begin in 1997, will take several years to complete.

Countries to Debate Global Biosafety Rules

Mandatory controls on the use of genetically modified organisms will be on the table next week in Jakarta as delegates from 120 countries discuss how to implement an agreement reached at the 1992 UN Earth Summit in Rio de Janeiro, Brazil. The proposal, which rejects a stance taken last spring by a 15-member panel of biosafety experts, favors a more restrictive policy being promoted by developing countries that now lack biosafety standards. And U.S. biotech firms are worried that the parties will adopt rules that "aren't scientifically based," says Richard Godown, senior vice president of BIO, a lobbying group in Washington, D.C. The meeting aims to put teeth into the Convention on Biological Diversity, signed at the Earth Summit, which calls in part for examining the potential threat to biodiversity from the spread of a crop bioengineered to resist herbicides, or the mating of a transgenic fish with wild fish. The United States—which has not ratified the treaty but participates as a nonvoting observer—and some other Western nations have argued for voluntary biosafety guidelines drawn up by the UN and other groups.

That's in line with the stance of an expert panel—mainly government officials—appointed by the convention, which suggested transgenics pose no greater threat to biodiversity than do traditionally bred organisms. But a larger panel of delegates presented with some scientific studies threw out that view in July and has recommended that the convention consider a binding protocol.

The U.S. delegation hasn't settled on a position, but observers say it is leaning toward support of a protocol governing the movement of transgenics across borders. "They have realized if they remain obstinate opponents, they may lose some ability to influence the content," says ecologist Rebecca Goldberg of the Environmental Defense Fund. Whatever is decided in Jakarta, the next step will be for a working group to hammer out the details.

NIH Frets Over Budget Crisis

The legislative logjam that delayed some funding bills could put a dent in what was supposed to be a good year for the National Institutes of Health (NIH). While many researchers may be hoping NIH will get a House-passed 5.7% increase, the Senate has yet to act. Faced with that uncertainty, NIH staffers are preparing a letter to 30,000 extramural scientists warning them to put the brakes on their spending plans until the agency's 1996 budget is final.

What's making NIH nervous is the status of a 5% cut imposed last summer as a temporary measure to slow federal spending until Congress and the president finished work on appropriations bills. Many observers assumed that Congress would give back the money "lost" during the hiatus when an agency's final appropriation was approved. But that may not happen for some time, if ever. House and Senate aides now say it's almost certain the continuing resolution, set to expire on 3 November, will be extended into December, or even until next year. In addition, no one knows whether Congress will reinstate the income lost by agencies like NIH. The potential loss of revenue could hit extramural scientists as early as December, when NIH plans to start sending out its first batch of 1996 grant awards. Agency officials have drafted a letter advising grantees to delay big purchases and major hiring decisions. However, NIH's situation is unusual. Most agencies are bracing for sizable cuts in their budgets. As a result, they are in no hurry to see Congress replace the milder temporary plan with a more drastic permanent budget. "We're in limbo," says an aide to Representative John Porter (R–IL), an NIH advocate, with no resolution in sight.

Academy Plans Makeover for PNAS

The National Academy of Sciences (NAS), which has highlighted the plight of underemployed Ph.D.s, is about to add some of its own brainy staffers to the ranks of the jobless. The academy's chief scientific publication, the Proceedings of the National Academy of Sciences (PNAS), is planning a major business shake-up and may dismiss 20 staffers.

According to a PNAS employee, higher-ups took editors and production staffers aside last week to inform them that they should begin looking for new jobs. The staffer, insisting on anonymity, said people in the office were stunned: "It's like when the train hit the school bus; no one knows what to say." Officially, the NAS isn't commenting. Information officer Susan Turner-Lowe says, however, that "we are looking at ways of doing business better—of outsourcing." The academy wants to move rapidly into the electronic age and has decided to sign a contract with a private firm to publish PNAS: "It's the trend in scientific journal publishing," she says, adding that the details will be released soon.

Although several members of the PNAS editorial board told Science they had not been briefed on the overhaul, the new editor of PNAS, Nicholas Cozzarelli of the University of California, Berkeley, said the journal's renovation has been cleared "appropriately" by the NAS hierarchy. The chair of the NAS publications committee, John Hopfield of Caltech, said Cozzarelli was given a mandate by the NAS executive council to move ahead with "broad authority" to create a competitive money-making journal, one that would include advertising and possibly maintain a presence on the Internet's World Wide Web.

Cozzarelli declined to discuss his plans; he intends to present them in letters to NAS members and in a future issue of PNAS.
A Bigger, Better Bose-Einstein Condensate

Since a Colorado team announced the creation of the long-sought state of matter called the Bose-Einstein condensate (BEC) this spring, (Science, 14 July, pp. 152, 182, and 198), other researchers have continued their efforts to do the same. Now another group has made the condensate—and they’ve made it bigger and faster than anyone else’s.

The latest success is reported by Wolfgang Ketterle of the Massachusetts Institute of Technology in a paper to be published in Physical Review Letters. Ketterle has spent 3 years in a quest to induce BECs, in which the atoms in a frigid dense gas are coaxed to renounce their individuality and enter a coherent quantum mechanical state, like photons in a laser beam. Ketterle reports that his team has cooled a gas of sodium atoms to a BEC in just 7 seconds, as opposed to over a minute for his competitors. And whereas the other groups only condensed a few thousand atoms at a time, Ketterle and company have managed to condense a half million. “We have exceeded the previous results by a factor of 1000,” he says.

Ketterle first cools his sodium atoms by sapping their energy with a laser beam, then puts them into a magnetic trap where the hotter atoms evaporate and the colder atoms slip toward the center. Such a trap has a magnetic field hole, however, through which atoms can “leak” out. While the Colorado group solved this problem by adding another magnetic field to move the hole around, this decreased the density of the condensate. Ketterle found a different solution, aiming a laser beam at the hole to gently repel atoms that might slip through.

The result was a fast and dense BEC that has impressed even his competitors. “It’s great,” says the University of Colorado’s Eric Cornell. “They have a very convincing signature, and lots more atoms. This is a big advantage because if BEC is going to live up to its advance press, we’re going to need bigger samples of condensate.”

Newton Goes to Cambridge

Cambridge University, U.K., has long exerted a gravitational pull on scholars interested in Isaac Newton, who was both student and professor there. But now another Cambridge—in Massachusetts—is becoming a new force in Newton scholarship.

A large collection of Newtoniana owned by Babson College in Wellesley, Massachusetts, has been permanently deposited in the Bursley Library at the Dibner Institute for the History of Science and Technology, an independent research institute based at the Massachusetts Institute of Technology. Combined with the library’s existing Newton collection, it will be “the largest collection of Newton material outside the United Kingdom,” says librarian Christine Ruggere.

Featuring first and subsequent editions of the Principia, the Opticks, and other landmark works—some bearing emendations in Newton’s own hand—the collection will be a boon to Newton scholars, says historian of science I. Bernard Cohen, the Bursley Library’s first resident fellow. “The amalgamation of the two collections means that virtually all the important editions of all of Newton’s writings are available for study in a single place,” says he. “That’s quite extraordinary.”

The institute is planning a symposium next week that will be the largest gathering of Newton scholars in a decade, says Dibner Institute Director Jed Buchwald. Overseeing it will be one of the most unusual items in the Babson collection: a plaster death mask, once owned by Thomas Jefferson, one of eight made from Newton’s corpse. While some scholars admit they’re disturbed by the mask’s sullen countenance, Cohen calls it “the nearest thing we have to being close to Newton himself.”

Nobelist Obliges

His theory of “rational expectations” won Robert E. Lucas of the University of Chicago the Nobel Prize in economics last month. Lucas’s former wife, it now appears, took the theory to heart. When the couple were working out a divorce agreement in 1989, Rita Lucas thought it rational to expect that her husband might well be on the way to a Nobel. She was not alone in that view—“Lucas had become one of the most influential economists of the last 20 years,” says Richard M. Cyert, president emeritus of Carnegie Mellon University. “I had certainly expected him to get at some time.”

The agreement stipulated that, should Lucas win the prize by October 1995, 50% of the money would go to her. She got in just under the wire—and half of the million-dollar prize will go to her. “A deal is a deal,” her ex-husband was quoted as saying in the Chicago Tribune.

The Lucases follow a Nobel tradition established by Albert Einstein. According to Einstein’s biographer, Abraham Pais of Rockefeller University, Einstein in 1919 in anticipation of winning the prize—which he did in 1921—promised the money (about $32,000) to his first wife, Mileva Maric, so he could marry his cousin, Elsa Einstein.

Peace in plaster. Death mask.

(continued on page 741)
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Information Dirt-Track

The information gap between rich and poor nations is increasing as the Internet spreads, according to a report issued last month by the Panos Institute, a London-based group that specializes in development issues. "So far the information revolution has only reached a few universities, companies, journalists, researchers, and governments in developing countries," writes Mike Holderness, author of the report The Internet & the South: Superhighway or Dirt-Track? He notes that most of the world's population is scarcely qualified to join the revolution. The Internet is overwhelmingly the tool of English-speaking nations; 70% of the almost 7 million computers connected to the system are in the United States. As for connectivity, one must have access to a stable power supply, reliable telephone service, and resources to buy the necessary hardware. Yet, reports Panos, 49 countries have fewer than one telephone per 100 people—and 35 of those countries are in Africa. India has 8 million telephone lines for 900 million people.

There are many schemes afoot to help bring poor countries online—AT&T, for example, is soliciting investors for a project to stretch up to 30% beyond its length. Lewis says possible uses for a manufactured version range from artificial ligaments and tendons to material for parachute cords.

Scientists as Managers

Despite the need for technologically sophisticated people in a modern economy, few top managers in Fortune 1000 companies have scientific training, and only half are "technologically literate," according to a poll commissioned by Cornell University's Johnson Graduate School of Management last month. But the school has an MBA program that aims to fix that—by turning scientists into managers.

The poll of 500 senior managers revealed that many perceive a "cultural divide" between employees with and without technical training, and technical types are also perceived as "not understanding a market-driven culture."

But the respondents agreed that science and management know-how are going to have to come together "for the next generation of successful managers."

The Johnson school, in anticipation of this development, has started an MBA program designed just for scientists, which takes 12 months instead of 2 academic years. "We believe people who have advanced scientific training can absorb the stuff faster," says the school's dean, Alan Merton. Basic courses in accounting, marketing, finance, operations, microeconomics, and quantitative methods—ordinarily spread out over an academic year—are jammed into 3 months, leaving the rest of the year for advanced elective courses. The first class, which entered last spring, contains 30 scientists from around the world. Says Merton: "I think this program is going to boom because there are so many scientists out there who would like an MBA but won't come in for a 2-year program."

Northwestern University biochemist Richard Morimoto agrees. "Sounds like the folks at Cornell have been clever to create a timely program," he says. For more information, e-mail merton@johnson.cornell.edu.

Seized Agent Orange Research Released

An international team of biologists whose documents and samples were seized by Vietnamese customs agents this summer have learned their materials have been released, clearing a hurdle to joint U.S.-Vietnamese research on health effects of Agent Orange.

The nine scientists, sponsored by the National Institutes of Health (NIH) and the World Health Organization, visited Vietnamese colleagues for 10 days in June at the request of Congress to discuss possible joint research on Agent Orange, a dioxin-containing herbicide used by the U.S. Army during the Vietnam War. The visit ended on a low note when airport customs officials confiscated all the team's documents and notes "remotely related to dioxin," says team member Arnold Schecter, professor of preventive medicine at the State University of New York's Health Science Center. Officials also seized food and blood samples collected for dioxin analysis, including 40 vials of blood from Laotians exposed to Agent Orange (Science, 21 July, p. 298).

On 16 October, however, after many diplomatic entreaties, Schecter got a fax from Vietnamese colleague Hoang Dinh Cau saying that the papers and samples had been released. His group expects to receive the documents by mail soon. The fate of the blood samples is less certain. The scientists hope to make another trip to retrieve the samples, which, says Schecter, "may or may not be salvageable" depending on whether they have been kept frozen.

The release lifts a hurdle to getting money from NIH and other agencies for further research, Schecter says. Until now, "instead of being able to recommend moving forward, we could only say we had a really bad trip." He now hopes Congress will target funds for workshops and more scientific exchanges.
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- Presently researching protein expression and DNA/RNA isolation and purification systems.
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- Prior to Sigma, worked four years in the Department of Molecular and Cellular Biology at a major pharmaceutical company.
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We also performed two-dimensional gel electrophoresis (PAGE) and transfer to polyvinylidene difluoride membranes. We confirmed the identity of the γ-sarcoglycan cDNA by isolating the D4G complex using two-dimensional SDS-polyacrylamide gel electrophoresis (PAGE) and transfer to polyvinylidene difluoride membranes. The spot corresponding to γ-sarcoglycan was excised and applied to an automated gas-phase protein sequencer (Applied Biosystems, Foster City, CA). Internal amino acid sequences were determined by an analysis of the peptides released from the γ-sarcoglycan band separated on PAGE after digestion with Acrocomat protease (Wako Pure Chemical Industries, Osaka). We also confirmed the identity of the γ-sarcoglycan cDNA by showing that an antibody to rabbit γ-sarcoglycan–glutathione-S-transferase fusion protein reacts with the 35-kD D4G (S. Noguchi and E. Ozawa, unpublished results).

Abbreviations for the amino acid residues are as follows: A, Ala; C, Cys; D, Asp; E, Glu; F, Phe; G, Gly; H, His; I, Ile; K, Lys; L, Leu; M, Met; N, Asn; P, Pro; Q, Gln; R, Arg; S, Ser; T, Thr; V, Val; W, Trp; and Y, Tyr.

16. The complete sequence has been deposited in GenBank, European Molecular Biology Laboratory database; National Biomedical Research Foundation–Protein Identification Research database; Swiss Protein Sequence database; and the database of Expressed Sequence Tags (as of 5 June 1995).

17. Two genomic phages encoding γ-sarcoglycan were isolated from an EMBL library and used as probes in fluorescence in situ hybridization against human metaphase chromosomes (E. M. McNally, E. Gussani, L. M. Kunkel, unpublished results).

18. We isolated RNA by homogenization of 5 to 10 mg of muscle in guanidinium isothiocyanate and subsequent ceium chloride centrifugation. Total RNA (1 to 2 μg) was reverse transcribed with Superscript (GIBCO BRL). The cDNA was used as a template for PCR with the following primers: P1 (5'-TACTTCTGCCTGTTAGAAGCTGGG-3'), P2 (5'-TTTCATCTTCTGACATCT-3'), P3 (5'-CCTTCTCTTCTGACATCT-3'), P4 (5'-CTTCAGGCAGGTCTCAGAAGCTGGG-3'), P5 (5'-TTTCATCTTCTGACATCT-3'), P6 (5'-CTTCAGGCAGGTCTCAGAAGCTGGG-3'), P7 (5'-TTTCATCTTCTGACATCT-3'), P8 (5'-CTTCAGGCAGGTCTCAGAAGCTGGG-3'), and P9 (5'-CTTCAGGCAGGTCTCAGAAGCTGGG-3'). Conditions for PCR were 94°C for 2 min, 60°C for 1 min, 72°C for 45 s, and 94°C for 45 s for a total of 35 cycles. The PCR products were subjected to Taq cycle sequencing.

22. Primers were designed to amplify the genomic span surrounding nt 645 to 649 of the cDNA sequence, and the PCR products were directly sequenced, showing the same mutation in an affected sibling in this family and in an affected member of two other Tunisian SCARMD families that show linkage disequilibrium with the marker D15S232 (7, 8).


24. The PCR was performed in the presence of [α-32P]dCTP and 5′-triphosphate. The products were denatured in a formamide-NeOH mixture and separated by electrophoresis in an MDE Hydrolink (AT Biochem, FM BioProducts, Rockland, ME) gel. Formamides were excluded, eluted, and directly sequenced. The primers P5 and P7 showed the delet ed product. The primers P3 and P6 failed to amplify any product in patient 2.

25. Patient 2 has a known family history of muscular dystrophy and consanguinity and underwent muscle biopsy at 1 year of age for evaluation of elevated serum creatine kinase [18,630 U/ml (normal, <200 U/ml)]. The patient was unavailable for further diagnostic testing. Because the DNA from this patient and her parents is unavailable, we can only confirm that the minimal deletion on both alleles involves nt 630 to 722. It is possible that one allele carries a larger deletion that causes a complete loss of the γ-sarcoglycan transcription unit.


30. We thank S. Selig and J. Scharf. We thank D. Bennett for technical assistance. We acknowledge the support of M. Pericak-Vance. E.O. is supported by Center of Excellence (CDE) and Decade of Brain (DOB) research grants from the Ministry of Health and Welfare, Japan. Y.H. and M.Y. are supported by a research grant (5A-1) from the Ministry of Health and Welfare, Japan. L.M.K. is an Investigator of the Howard Hughes Medical Institutes and is supported by NIH NINDS NS02740. P.H.D., The Institute of Neurology of Tunisia, and The Cyprus Institute of Neurology and Genetics are supported by the Muscular Dystrophy Association, K.B.O. and J.M.V. are supported by NIH NINDS NS02740. M. Pericak-Vance, principal investigator.

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Figure 1. Schematic representation of the approach followed for the annealing of globin mRNA to d(T)₈.
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Vignettes: Dinners with Notables

During a dinner at the Huxleys', Grace [Mrs. Edwin Hubble] was seated next to the novelist's brother Julian . . . . Edwin was given the place of honor beside Bertrand Russell, who confessed to a weakness for Agatha Christie mysteries . . . . Hoping to pass the evening on a high intellectual plane, the Hubbles were disappointed by Russell's preoccupation with his fate. The long-standing pacifist and his wife would soon have to go at great expense to Mexico, provided the authorities would admit them, and then, if they got there, the United States might not let them come back. Grace offered to contact a certain well-connected friend on the Russells' behalf, but the annoying lament continued . . . . She followed Edwin's longed gaze across the room where the actor Ronald Colman, who had a head cold from sitting in a massive refrigeration unit during filming, was reverently listening to a discussion dominated by Aldous.

—Gale E. Christianson, in Edwin Hubble: Mariner of the Nebulae (Farrar, Straus, and Giroux)

We had some time to wait before dinner for Dr. Fitton, which is always awful and, in my opinion, Mr.Lyell is enough to flatten a party, as he never speaks above his breath, so that everybody keeps lowering their tone to his. Mr. Brown, who Humboldt calls “the glory of Great Britain,” looks so shy, as if he longed to shrink into himself and disappear entirely; however, notwithstanding these two dead weights, viz. the greatest botanist and the greatest geologist in Europe, we did very well and had no pauses.

—Emma Wedgwood Darwin, 1839, on a dinner party given shortly after her marriage to Charles, as quoted by Janet Browne in Charles Darwin: Voyaging, Volume 1 of a Biography (Knopf)

edgable about the history of mathematical crystallography and gives a sweeping historical view in order to set the stage for the last 10 years. By lucky happenstance she was the co-organizer of a workshop on mathematical crystallography at Institut des Hautes Etudes Scientifiques in France in January 1985 that had long been planned to feature some intense discussions about modulated crystals, generalizations of the aperiodic tilings of Penrose and Ammann, and crystallography in higher dimensions. All were topics of immediate applicability to quasicrystals. A last-minute invitation issued to some of the discoverers of quasicrystals produced an immediate appreciation of the mathematical opportunities. Senechal became an active participant in this research and an able chronicler. Her several published reports and this book convey both the searches for new directions and the excitement of new results and are worthwhile narratives of ten exciting years.

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Other Books of Interest


This 100th volume marks the termination of a monograph series of some 20 years' standing. Conceived as an effort to foster the development of a field that at the time seemed peripheral to much of biology, the series comes to its end at a point at which, the editor writes, “mathematical biologists . . . see their work guiding experiments, and shaping the conceptual foundations of almost all areas of biology.” For this final volume Levin has invited a number of contributors to the field to “take a step back from their work, and to give their views on the key issues in their subject areas.” In all there are 36 papers grouped thematically according to what Levin describes as “a convenient if imperfect hierarchy.” The first group, Frontiers in Cell and Molecular Biology, contains discussions of molecular topics ranging from RNA structure to gene mapping by De Lisi and by Waterman and of cellular topics by Oster and Perelson (the mechanics of protrusion) and by Alt (effects of environmental stimuli on movement and orientation). Organismal biology is represented next, with papers on pattern formation in tissue interaction (Murray et al.), neurotransmitter release (Segel), mutual synchronization in neurobiology (Strogatz), ventricular fibrillation (Winfree), and immune networks (Rose and Perelson). Turning to issues in evolutionary biology, Ohta considers the evolution of gene families, Evans gives a “devil's advocate” critique of theoretical population genetics, Otto et al. address the advantages and disadvantages of recombination, Boekstein offers an "intellectual history" of the biometric analysis of size and shape, and Mangel and Roitberg consider the consequences of behavior for fitness with respect to infectious disease. In a section on population ecology two papers (Tuljapurkar, Diekmann and Metz) are concerned with life history. Then models for the dynamics of structured populations are discussed by Cushing, social aggregations of animals by Grünbaum and Akubo, and spatial chaos in ecology and evolution by May. Frontiers in Community and Ecosystem Ecology opens with two papers by Cohen, both dealing with food webs—their future as descriptions of community ecology and the contribution of Lorenzo Camerano, a translation of whose 1880 paper on the subject is also included. In other papers Levin discusses the challenge of incorporating physical environmental factors into population biology; de Angelis et al. concern themselves with "computational ecology," specifically with population models that simulate many discrete organisms; Getz presents a "metaphysical approach" to the analysis of trophic systems; Yodis discusses trophodynamic models of communities, with attention to effects of the way data are aggregated; and Castillo-Chavez et al. take up "contact structures"—those by which diseases, genetic characteristics, or cultural traits are transmitted. Categorized as applied biology are papers on spatial structure in conservation (Hastings), the construction of epidemiological models (Hethcote), fisheries management (Ludwig), and ecological risk assessment (Hallam and Lassiter). A final section, Mathematical Challenges, comprises papers on health information in developing countries (Krickeberg), the Belousov-Zhabotinsky reaction (Tyson), model-building as an inverse problem (Capasso and Forte), and estimation techniques for size-structured population models (Banks), along with a discussion of dynamic systems that its author (Akin) describes as a "conservative haunth" at currently trendy approaches. A subject index concludes the volume. Unfortunately lacking is a listing of the previous works that have made up the series.

Katherine Livingston

The Geological Society, founded in London in 1807, is characterized in the foreword to this volume as "the senior Earth science society in the world." One of the society's goals from the outset was to provide a medium for more extensive geological expositions than the preeminent Philosophical Transactions of the Royal Society would accommodate. Its earliest ventures in publishing proved financially problematic, and in 1845 the society's Transactions and Proceedings were combined to form a journal that continues to this day. Milestones in Geology commemorates this event by bringing together a collection of papers in which leading geologists set out to review the history and current status of "significant topics ... brought to the fore in earlier contributions to the Journal." After an introduction by the editor and a brief historical account of the society's publishing activities by Martin Rudwick, there are 18 contributions, each of which takes as its point of departure a particular paper or group of papers that appeared in the Journal. Invoking Hutton and Lyell, Brian Windley opens the series with a consideration of "uniformitarianism today" in which he offers evidence to argue that, thermal changes notwithstanding, "plate tectonics provides a paradigm" for the very early geological past. In another contribution Michael Brown, referring back to an 1893 paper by George Barrow, discusses issues in the development of metamorphic petrology. A paper by Sedgwick in the initial volume of the Journal dealt with early Paleozoic stratigraphy, and W. S. McKerrow summarizes the prior and subsequent development of that subject. Subjects of the other reviews include early Precambrian crustal development, geochronology of metamorphic complexes, strike-slip motion, issues of bio- and chronostratigraphy, Jurassic geochronology, Mesozoic and Cenozoic vertebrate remains, Ordovician-to-Devonian paleogeochemistry, sedimentary structures, the petrography of limestones, volcanism in the British Tertiary, magnatism, and hydrothermal ore genesis. A sampling of the earlier authors whose work is highlighted includes Henry Clinton Sorby, Charles Moore, Archibald Geikie, Charles Lapworth, S. S. Buckman, Alfred Harker, Arthur Vaughan, and Walter Campbell Smith. Most of the contributions in Milestones have also been published in volume 150 (1993) of the Journal itself, and some include addenda updating the original versions. Each is preceded by a facsimile reproduction of the opening page of the principal Journal paper or papers it discusses, and each has an abstract. There is also an index to the volume as a whole.

Katherine Livingston

Books Received


Early Metal Mining and Production. Paul T. Crad-