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Demographics show that populations are growing older, a situation that is putting a strain on the social and economic resources of countries around the world. The outlook for those gray populations as well as the biological and physiological causes of aging are explored in News stories (beginning on page 42), a Perspective (page 80), and Articles (beginning on page 54) in this special issue on aging. [Image taken from Gustav Klimt’s Three Ages of Woman (1905). Scala/Art Resource]

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Quantum dot spectra
In a quantum dot, a nanometer-size semiconductor structure, exciting an electron across the band gap produces an exciton (the electron interacting with the hole left in the valence band) that is confined in three dimensions. These excitons can act like atomic states. Gammon et al. (p. 87) measured photoluminescence exciton spectra from individual gallium arsenide quantum dots and were able to measure homogeneous (nonbroadened) linewidths of these transitions, which allows exciton lifetimes and dynamics to be explored.

Different waters
Water can form different amorphous solids—for example, condensing water vapor at 100 kelvin (K) produces amorphous solid water (ASW), which if cooled and compressed can form a different phase, a high-density amorphous (HDA) solid. Johari et al. (p. 90) show that both ASW and hyperquenched glassy water (formed by rapidly cooling water droplets) form viscous water (water A) at 136 K. Heating HDA water forms a low-density amorphous phase that at 129 K forms another viscous water phase, water B. These two viscous water forms do not thermally interconvert even when they are heated to 148 K. The existence of this barrier between liquids can provide insight into the configuration relaxations that occur in liquid water.

River to Nevada
The general paleogeography of a continent can often be determined from the distribution of sediments, but it is much more difficult to reconstruct the origin and course of ancient rivers. Riggs et al. (p. 97; see the news story by Wuethrich, p. 31) used the distinct uranium-lead isotope signatures of detrital zircon grains, in conjunction with sedimentologic features, to show that a large river flowed from Texas to Nevada in the Late Triassic (about 200 million years ago) and trace the overall drainage of the region.

Deep and hot
Komatiites are volcanic rocks that are enriched in MgO relative to basalts. Found almost exclusively in the Precambrian deposits, they are considered to represent deep, hot magmas generated at hot spot plumes that erupted early in Earth's history when temperatures were higher. Richard et al. (p. 93) found an enrichment of helium-3 in several fresh olivine crystals in komatiites, indicating that komatiites indeed contain at least a component of a deep mantle plume.

Seeing the Bose condensate
Although Bose condensates of alkali metals have been recently observed, this new state of matter has not been directly observed. Such states are distinct in momentum or energy space and thus can coexist spatially with normal solid state. However, application of a potential can force the real-space separation, and Andrews et al. (p. 84) now report the observation of light scattering of a Bose condensate of sodium atoms in a magnetic trap.

Potassium in the core?
High-pressure, laser-heated diamond anvil studies of the alkali metals by Parker et al. (p. 95) show that when potassium is compressed to pressures above 30 gigapascals, it behaves like a transition metal. Compounds of alkali metals and transition metals such as iron and nickel may form at high pressure, and some potassium may be present in Earth's iron-rich core.

Graft protection
Transplanted tissues will normally be rejected unless the T cell response to nonself cells can be avoided. Lau et al. (p. 109; see the news story by Wickelgren, p. 33) show in a mouse model that pancreatic islet transplants can be protected by co-transplanting myoblasts that express the Fas ligand, which triggers cell death in T cells and is the signal that maintains immunoprivileged sites such as the eye. Graft tolerance was maintained until transgenic expression of Fas ligand ceased.

Cell fate partner
Members of the LIN-12/Notch family of receptors function in cell fate decisions during development. When looking for other components of the LIN-12 signaling pathway in the nematode, Hubbard et al. (p. 112) isolated a protein, EMB-5, that interacts with the intracellular signaling domain of LIN-12 and functions in the LIN-12 pathway. Sequencing revealed that EMB-5 is a homolog of a yeast protein SPT6p, that is involved in chromatin structure. Thus, the function of EMB-5 in the signaling cascade could be to alter chromatin structure in order to modify gene activity.

Overlap and disjunction
During meiosis, disjunction ensures that each of the gametes contains the correct number and type of chromosomes. Recombination between homologous chromosomes helps ensure proper disjunction but not all chromosomes undergo recombination. Karpen et al. (p. 118; see the news story by Marx, p. 35) examined disjunction of chromosomes that have not undergone recombination by using minichromosomes in Drosophila. They find that 1000 kilobases of overlap in the centric heterochromatin was necessary for efficient disjunction. A reduction in heterochromatin increased non-disjunction.

Tides
Tides on the Earth, induced by the sun, have resulted in the retreat of the moon from the Earth and an increase in day length. Sonett et al. (p. 100) examined several sedimentary rock records that provide an indicator of tidal periods. The day was 18 hours long 900 million years ago, and the moon has retreated at a roughly constant rate since the Precambrian.

This Week in Science
In Perfect Balance

According to the ancient Chinese philosophy of yin and yang, the universe is composed of opposing but interdependent forces. Interestingly, this philosophy resembles the concept of homeostasis, the natural balance that occurs within living organisms, including the harmony between antagonists and agonists that regulate vital functions. Thus, an important factor in the search for new medicines is developing compounds that work together with the body’s own restorative and regenerative abilities.

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Information for Contributors

Editorial & News Contacts

North America
Address: 1200 New York Avenue, NW, Washington, DC 20005


Europe
Headquarters: 14 George IV Street, Cambridge, UK CB2 1HH; (44) 1223-302067, FAX (44) 1223-302068
Paris Bureau: 33 1 49 29 09 01, FAX 33 1 49 29 09 01

Asia
Japan Office: Carl Kay, Esaka-cho 5-chome 11-10, Suita-shi, Osaka 564 Japan: 81-6-369-1925, FAX 81-6-369-0982

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The funding of research on cardiovascular disease is encouraged by the president-elect of the American Heart Association, who calls for an end to this "major public health problem." Another reader expresses caution about "misplaced confidence" in cholesterol-lowering drugs, asking whether they can effectively lower the incidence of heart disease in the near future. Two critics of an Australian government program to infect rabbits, considered pests in Australia (at right, Australian rabbit), with a calcivirus which causes rabbit hemorrhagic disease warn that the virus may not be "species-specific" and urge that more research be conducted.

Battling Heart Disease

On behalf of the American Heart Association, I applaud Science for assembling the series of articles in the 3 May issue describing recent advances in our understanding of the molecular basis of cardiovascular disease, the number one killer and major cause of disability of people in the United States. As Michael S. Brown and Joseph L. Goldstein note in their editorial "Heart attacks: Gone with the century?" (p. 629), scientific understanding of the role of cholesterol in atherosclerotic coronary heart disease and medical treatment of hypercholesterolemia has advanced significantly. However, much more needs to be accomplished before the American Heart Association and the National Heart, Lung, and Blood Institute's Heart and Vascular Disease Division (HVDD) can close their doors.

Whether cardiovascular disease retains its deadly ranking into the next century will depend on whether our nation is willing to fund research in this important area in an amount that it deserves. In a recent public opinion survey, the overwhelming majority of Americans want to retain world leadership in cardiovascular and stroke research and are willing to spend more money to do so. Unfortunately, this has not been translated into the budgeting process at the National Institutes of Health (NIH). While the overall NIH budget increased 31.3% in constant dollars from 1985 to 1995, the budget for HVDD actually decreased 5% in constant dollars during the same time period. The fiscal year 1995 budget for HVDD was $669 million, whereas if the division had gotten its fair share of the overall NIH increase it would be $934 million, a shortfall in 1 year alone of $265 million. This persistent underfunding of heart disease research has discouraged young people from entering the field: In 1994 there were 45% fewer RPGs (Research Project Grants) and 63% fewer RO1 (investigator-initiated) grants awarded by HVDD to individuals under the age of 40 than there were in 1984.

Unless the trend of underfunding research in cardiovascular disease is reversed, Brown and Goldstein's vision of ending heart disease as a major public health problem early in the next century will not be realized.

Jan I. Breslow*
Rockefeller University,
New York, NY 10021, USA

*President-Elect, American Heart Association

Response: We emphatically agree with Breslow.

Michael S. Brown
Joseph L. Goldstein
Department of Molecular Genetics,
University of Texas Southwestern Medical Center,
Dallas, TX 75235, USA

Several facts conflict with the assertion by Brown and Goldstein that "Exploitation of recent breakthroughs ... may well end coronary disease as a major public health problem early in the next century."

First, in the United States alone, the incidence of coronary heart disease is more than 13 million and increasing. It remains the single most frequent cause of death. Despite a decrease in age-standardized coronary death rates of more than 50% since their peak in the 1960s, the number of deaths have remained approximately 500,000 per year and have increased from 1992 to 1993, the most recent years with final tabulations (1). This seeming paradox...
results from growing numbers of the U.S. population attaining ages at which coronary death rates are highest.

Second, the same demographic process brings increasing proportions of the world’s populations, especially in developing countries, to middle and later adult ages, at which coronary rates soar. The effect of this profound demographic change is compounded by adverse changes in diet, physical activity, and use of commercial tobacco products. These changes together are expected to produce major increases in coronary heart disease morbidity and mortality in coming decades and have done so in places as diverse as Scotland and Singapore. The World Bank is examining these trends and the potential for programs to combat them, especially in developing countries, as a major priority (2).

Third, the impressive outcomes of clinical trials with the cholesterol-lowering drugs called statins (3) are rightly hailed by Brown and Goldstein. But it should not be overlooked that the people studied in those trials were largely survivors of an earlier heart attack; those whose initial manifestations of coronary disease were fatal cannot be helped by medical interventions. Further, even under the exceptionally favorable conditions of closely monitored treatment in clinical trials, relative to medication use in the general patient population, the majority of expected deaths (based on rates in the placebo group in each trial) were not prevented in any of the trials. Hence the recent recommendation to the National Heart, Lung, and Blood Institute by its Task Force on Research in Epidemiology and Prevention to place the highest priority for coronary disease prevention on prevention of the risk factors—such as elevated cholesterol concentration—in the first place (4). This is a public health challenge of the first order.

Well-founded optimism is welcome, but misplaced confidence could undermine the intensified public health efforts needed to address the continuing epidemic of coronary heart disease and its risk factors, both in the United States and throughout the world, for the foreseeable future.

Darwin R. Labarthe
School of Public Health,
University of Texas,
Health Science Center,
1200 Herman Pressler Street,
Houston, TX 77030, USA
E-mail: dlabarthe@utsph.sph.uth.tmc.edu

References

Release of RHD Virus in Australia

The defenders of the rabbit hemorrhagic disease (RHD) virus release program (Dan Drollette, News & Comment, 12 Apr., p. 191; ScienceScope, 19 April, p. 341) appear to have confused the concepts of "host switching" and "host range" (1). Alvin Smith and I have raised the concern that the host range of this agent, first described in 1984, is not known. Our concern has been that widespread release of this virus to a continent apparently lacking experience
with it would reveal unfortunate new information about the host range of the agent. While it is possible that the RHD virus might switch hosts, suddenly developing an ability to replicate in another species, we agree that this would be unlikely, although the possibility is enhanced by the ecological conditions in Australia.

The question of host range, while generally applicable, has particular relevance because of our knowledge of caliciviruses as a family. Some caliciviruses, although within a genome group different from that of the rabbit calicivirus, are known to have a broad host range (2, 3). Because it took 50 years to learn what is now known about the host range of some calicivirus strains, it is reasonable to believe that the host range for the RHD virus, described in 1984, is not yet known. The possibility that the RHD virus might find a host among the large number of previously unchallenged species in Australia seems reasonable.

Scientists from the Commonwealth Scientific and Industrial Research Organization (CSIRO) have addressed this concern by conducting challenge experiments in 28 species of animals. These experiments have not been published.

Smith is described as an isolated critic. However, he has isolated more species of caliciviruses than anyone else, from approximately 30 species of animals (2). His work led to the hypothesis that the vesicular exanthem of swine virus (a calicivirus) outbreaks in pigs in the southwest United States from the 1930s to the 1950s were related to San Miguel sea lion caliciviruses. This hypothesis was substantiated by his own work and recently proved independently by others (4).

The plans for studying the RHD viral agent in Australia clearly failed. Release of a lethal agent into the wild without knowledge of its route of transmission was a mistake. On the other hand, Brian Cook of CSIRO makes a valid point, quoted in Drollette's article, that the Australians face a difficult challenge, namely, weighing the potential "risk of a virus which might cross over into another species against the inevitability of losing more of our native species." This is an appropriate concern and certainly justifies the efforts toward studying the RHD virus as a potential biological control agent. However, approval of the RHD virus program after an accidental release would set a poor precedent for future studies of biologic control.

David O. Matson
Center for Pediatric Research,
Eastern Virginia Medical School, and
Children's Hospital of The King's Daughters,
855 West Brambleton Avenue,
Norfolk, VA 23510, USA

References and Notes
1. For example, see B. J. Conran, "Environmental impact associated with the proposed use of rabbit calicivirus disease for integrated rabbit control in Australia. February 1996." This is an environmental impact statement prepared for the Australia and New Zealand Rabbit Calicivirus Program.

If the escaped RHD virus can be declared an official "biological agent" by the Australian government, that would remove liability, but to receive such "approval" the virus must be shown to be species-specific, infecting only the European domestic rabbit Oryctolagus cuniculus (1).

CSIRO scientists, ostensibly investigating host range, gave 30 species of domestic, wild, and laboratory animals a low virus count (1000 rabbit lethal dose40) so as not to "force a response," according to Harvey Westbury, senior veterinary virologist of the Australian Animal Health Laboratory.
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plasmid (quoted in Drollette's article). But this dosage is below the immunogenic and infectivity threshold in 28 of the 30 species tested (four animals per test) — only about 1/30,000 of the dose a predator would receive eating a single infected rabbit liver. To test human susceptibility, Australian authorities examined serum samples from only six people (all were laboratory workers and were antibody-negative) and did not examine high-risk individuals such as ranchers, biologists, and hunters who handle infected rabbits. One laboratory worker tested during an RHD outbreak in Mexico was positive for the RHD antibody (2).

Sudden appearance (3) and high mortality (95%) indicate that RHD almost certainly did not originate in rabbits and is not species-specific. The cause of death (disseminated intravascular blood clots with fibrin-depleted blood oozing from orifices and into tissues) is not described for any other calicivirus. The likelihood of this "hemorrhagic" factor emerging in other species infected with caliciviruses is unknown. The mechanisms of virus movements across land and ocean channels are unknown.

Rabbit calicivirus has yet to be grown in cell culture. Therefore, vaccines and some diagnostic reagents are ground-up livers from diseased rabbits. Koch's postulates are unfulfilled, and, consequently, there is confusion about etiology (3, 4).

Adequate surveys to determine disease or infection in nonrabbit species that have been exposed naturally have not been carried out. Serologic testing of extremely small numbers of nonrabbit species, exposed experimentally and naturally, has yielded antibodies [in the mouse, kiwi, dog, fox, and human (5)], yet without proof (mice excepted), Australian officials have stated that infection did not occur. Despite much evidence suggesting otherwise (6), Australian government agencies declared RHD to be species-specific for rabbits and not infectious to other animals or humans. [Four of the five known calicivirus groups cause disease in humans (7)]. These same agencies have notified the Australian people that it would be safe for them to eat rabbits exposed to RHD and to feed these rabbits to their pets (1).

I discussed these critical factors with Drollette, but he did not mention them in his article. These factors were considered by the recently elected Australian government in rethinking the official position on the targeted March-April 1996 release of this new hemorrhagic disease virus. Additional studies have been ordered before reconsideration of RHD virus as a "biological agent" and a sanctioning of its deliberate spread. If these studies are carried out to truly test the host specificity and zoonotic potential of this new and deadly virus, then scientific credibility could be restored.

Alvin W. Smith Laboratory for Calicivirus Studies, College of Veterinary Medicine, Oregon State University, Corvallis, OR 97331, USA E-mail: smithal@comail.orst.edu

References

1. Media releases, Australia and New Zealand Rabbit Calicivirus Disease Program, Canberra, South Australia, 23 October and 29 October 1995.

2. "Rabbit calicivirus disease and public health" (Australia and New Zealand Rabbit Calicivirus Disease Program, Canberra, South Australia, 1 March 1996).


Corrections and Clarifications

In the third sentence of the next-to-last paragraph of the report "Structure of the atmosphere of Jupiter: Galileo probe measurements" by A. Seiff et al. (10 May, p. 844), "300 μbar" should have read, "0.3 μbar."

Figure 8 (p. 514) of the Research Article "Observations of Saturn's ring-plane crossings in August and November 1995" by P. D. Nicholson et al. (26 Apr., p. 509) was printed upside down.

The caption of table 1 of the report "Fluorescent hydroxy ethanol excited from Saturn's ring atmosphere" by D. T. Hall et al. (26 Apr., p. 516) should have pointed out that the orientation of the Faint Object Spectrograph that acquired spectra at five target locations above Saturn's ring plane can be seen in a figure provided by the authors at the following URL site: http://www.sciencemag.org/science/scripts/display/short/272/5261/516.html.

Letters to the Editor

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Cool reaction. Panel says U.S. should rethink plan to develop this Russian reactor for space.

End of Space Nuclear Reactor Program?
The Russian device seemed like a lucky windfall from the Cold War’s end, but now it seems headed for the scrap heap of history, a victim of agency wrangling and the uncertain future of space exploration. A report released last week urges that the Defense Department’s (DOD’s) Topaz program, which is based on a Russian space nuclear reactor, either be revamped and merged with another DOD program, or killed—and observers say the latter is more likely.

The program began 5 years ago when the United States bought six space nuclear reactors from Russia and set up a joint program for testing them. Such reactors offer one of the few practical ways to send large robotic spacecraft to the outer solar system or carry humans to Mars. Topaz has spent $80 million so far, much of it at Russian research institutes.

Sending nuclear reactors into space is politically unpopular, however, and DOD and NASA don’t have any missions planned that would use the technology. The reactors are currently being tested for use at power levels so low that solar or chemical energy sources can do the same job, making them redundant. And the program has drawn opposition from agency supporters of competing U.S. nuclear power systems.

Now a National Research Council panel says the program “should be discontinued as soon as possible”—unless it is used for long-term studies on reactors within DOD’s thermionics program. Neither NASA nor many DOD officials, however, are likely to support keeping Topaz alive. “I think it’s extremely unlikely,” says one analyst.

United Front For Public Science
In March, it’s the Westinghouse Science Talent Service, sponsored by the nonprofit Science Service. In April, it’s National Science and Technology Week, courtesy of the National Science Foundation. Last month the White House awarded the National Medals of Science and Technology. Wouldn’t coordinating these and other public celebrations of science—perhaps even during the same week—be a better way to foster scientific literacy?

Last week Bruce Alberts, president of the National Academy of Sciences (NAS), convened two dozen leading science policy-makers to consider that question. Their answer was a resounding yes. The group agreed to work together to find ways to make a bigger public splash with the events their organizations sponsor. “The goal is to create a critical mass of events,” says NAS spokesperson Susan Turner-Lowe. “And Bruce is willing to coordinate the effort because public understanding of science is very, very high on his agenda.”

The group hopes to meet again later this summer. With schedules tight and some events planned years in advance, participants say, it may be hard to forge closer links. And some activities are best handled at the local level, they say, and tailored to the interests of a smaller audience. But whatever the venue, there is agreement that the research community needs a united front to improve the visibility of science.

NSF Favors Public Communication in Private
Communicating with the public about science is a top priority for Neal Lane, director of the National Science Foundation (NSF). Perhaps even more important than communicating with the public’s elected representatives.

Lane had agreed to testify on 26 June before the House science committee on the first day of a two-part hearing on how the Administration’s plan to balance the budget would affect federal R&D. The hearing was expected to be contentious, with committee chair, Representative Robert Walker (R-PA), grilling Administration officials on how they could reconcile promises to protect research with a projected 24% decline in R&D spending by 2002 (Science, 17 May, p. 94). Lane was to be joined by the head of the Office of Management and Budget (OMB), and followed on 17 July by NASA director Daniel Goldin.

But 2 days before the hearing, Lane informed the panel that “a scheduling conflict” would prevent him from appearing. The conflict? A gathering of the National Academy of Sciences’ (NAS’s) Government-University-Industry Research Roundtable, which meets three times a year to discuss the health of the U.S. research enterprise. The closed meeting, planned for weeks, featured tips from media experts on how policy-makers could improve their communications skills. Lane was a major organizer of the event, say NAS officials. The same day, OMB told Walker’s panel that the appointment of its director, Alice Rivlin, to the Federal Reserve Board would force it to bow out, and NASA said Goldin would be in Russia with Vice President Gore on 17 July.

Walker blasted the no-shows in a press release, saying he was “frustrated” and “concerned,” and vowed to reschedule the hearing. NSF officials say Lane was not pressured by the White House to drop out, although a senior aide confesses that Lane did not relish being alone in the hot seat.

Varmus’s RAC Attack Worries Congress
Even before it hit the streets, a proposal to abolish a decade-old government forum that reviews human gene therapy is drawing fire from Congress. On 26 June, four congressmen led by Senators David Pryor (D-AR) and Mark Hatfield (R-OR) wrote Harold Varmus, director of the National Institutes of Health (NIH), to “express our concerns” about Varmus’s announced plan to do away with the Recombinant DNA Advisory Committee (RAC) and replace it with a smaller advisory panel (Science, 17 May, p. 945). The letter, also signed by Representatives Henry Waxman (D-CA) and Ron Wyden (D-OR), urges Varmus to reconsider.

The lawmakers’ interest may have prompted NIH to delay publishing its proposal to overhaul RAC. But Varmus’s staff says no substantive changes are being made in the plan, which was first disclosed in May. Instead, NIH is adding a longer explanation of its goals and allowing more time for public comment. (The text was to appear in the Federal Register in May with 15 days for comment; now it seems likely to run in July.)

The flap arose after Varmus announced that he wanted to replace the unwieldy 25-member RAC with a smaller group that would think about ethical and technical issues in experimental therapies and offer its advice. Unlike RAC, this panel would not conduct detailed, case-by-case safety reviews. NIH officials say the new panel might still examine a protocol in detail as a case study if it wished. Meanwhile, NIH will continue to collect data on gene therapy trials and make them available to the public.

Senate staffers say they were concerned that ending RAC might create a perception that NIH grantees wanted to avoid scrutiny. Instead of proposing to abolish RAC, they say, NIH might focus on improving it.
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I feel so strongly about the wrongness of reading a lecture that my language may seem immoderate. The spoken word and the written word are quite different arts. I feel that to collect an audience and then read one's material is like inviting a friend to go for a walk and asking him not to mind if you go alongside him in your car.

—Lawrence Bragg

The most prominent requisite to a lecturer, though perhaps not really the most important, is a good delivery; for though to all true philosophers science and nature will have charms innumerable in every dress, yet I am sorry to say that the generality of mankind cannot accompany us one short hour unless the path is strewed with flowers.

. . . With respect to the action of the lecturer, it is requisite that he have some, . . . for though I know of no other species of delivery that requires less motion, yet I would by no means have a lecturer glued to the table or screwed to the floor. He must by all means appear as a body distinct and separate from the things around him, and must have some motion apart from that which they possess.

—Michael Faraday

Quoted in David Crystal’s *The Cambridge Encyclopedia of the English Language* (Cambridge University Press)

The book’s argument is admirably clear and is never lost in the wealth of detail that flows from the author's obvious immersion in the sources. Mazumdar is attetive to the philosophical resonances of her themes of unity-simplicity and pluralism-specificity. She cites Kant and explores the vogue for Ernst Mach’s philosophy in turn-of-the-century Vienna. But she never reduces the controversies to the philosophical pre-dispositions of her protagonists. In each episode, in each generation, the dispute is embodied in the problems, issues, and scientific language of the day. The volume is generously illustrated, and the illustrations are well placed in relation to the text.

Mazumdar’s thesis is an important and persuasive one that deserves serious attention from anyone interested in 19th- and 20th-century biology. This is not to say that questions will not arise for some readers. Mazumdar’s emphasis on the role of teacher-pupil transmission in the continuation of the general form of controversy she identifies is credible, especially given the academic culture of the predominantly German-speaking scientists she examines. Whether it is sufficient is another matter, and discussion of other possible reasons for the persistence of the pattern seems called for. By positing two such distinct species of scientists, unifiers and pluralists, Mazumdar seems to betray her own inclinations as a pluralist. Fair enough, but the reader may wonder whether the separation is always so sharp, and whether individual scientists may not often incorporate both continuity and discontinuity, unifying and differentiating tendencies, into their work, as Landsteiner did in his thinking on the specificity of proteins and cellular antigens in the 1920s. Finally, we must ask to what extent the history of blood group immunology can represent the history of immunology in general. This is a question that Mazumdar does not explicitly address but that is evoked by the book’s subtitle. Whatever the answers to these queries may be, there is no doubt that readers will come away from this book with a livelier sense of the controversies that have helped shape modern biology, and of their connections across the generations.

John E. Lesch
Department of History, University of California, Berkeley, CA 94720, USA
estimated points of time for the neap tides decrease the amount of sedimentation even during the times of anomalously high sedimentation that can result from local sedimentary conditions or anomalous weather conditions (2).

Paxton et al. and Hoorn point out that our paleocurrent directions are compatible with the local channel and floodplain geometry in the area. The documented sand-mud couplet sediments are similar neither to the sediments of the modern river system nor to the Quaternary alluvial terraces in the area. They also propose that many of our sedimentary characteristics are reminiscent of the varzea environment of modern Amazonia. According to our field experience in Peruvian, Bolivian, and Brazilian Amazonia, sandwave and dune deposition dominate in the channels, and ripples are occasionally present only in upper parts of point bars. In fact, some modern tidally influenced fluvial systems show processes through which the formation and rhythmicity of the sand-mud couplets may be understood (2).

We also used other evidence to interpret the tidally influenced origin of these sediments (sand-mud couplets with the mud-douplet and the interchannel facies with well sorted sand layers) for which the commentators give no alternative explanation. Of the sand in the detailed studied sand-mud couplets (n ~ 300) in the channel lithosomes, 90% were ripple drifted sands. The remaining 10% were parallel laminated, cross laminated (dunes), or massive. At Acre, this relation seems to be valid for the approximately 20 locations where channel lithosomes were recognized [arrows in figure 5 in (1)]. This indicates how widely and uniformly this type of deposition was present at Acre, as would be expected in a tidally influenced environment rather than in a fluvial regime of the modern varzea type.

Paxton et al. mention that all the fish taxa we cite are typical of modern Amazonian flood plains. As we stated (1), the fish taxa were found 500 km north of our research area (not at Acre), where foraminifera, ostracods, and mollusks indicate an episodic brackish environment and marine influence together with fluvial and fluvial-lacustrine conditions (3). Paxton et al. are correct that only Carcharinus (of the taxa we mention) is euryhaline, while the other groups may have both marine and freshwater species. As Marshall and Lundberg also point out, we must wait for more detailed species determinations to be sure about their indicative value. It is possible that the shark teeth reported from Acre (4) are from animals that had migrated far away from the sea, as is known from modern environments. Considering the restricted amount of paleontological collection work performed at Acre, this is, however, unlikely. The common presence of the species in the paleoenvironment is a more likely explanation.

Our dating of the sediments is based on paleontological data and is thus relative and open to discussion. Although elements from adjacent Land Mammal Ages exist, the most likely correlation was with the Huayquerian Land Mammal Age. Webb suggests in his Perspective (5) an older possible Chacicoan age for the sediments. Also, if a connection with the Caribbean during the Late Miocene is unlikely, as Hoorn argues, this may indicate that the sediments at Acre are slightly older than Huayquerian. If this is the case, our original correlation with the latest Serravallian high global sea levels may be valid and place the event in Middle Miocene, as Hoorn correctly points out. However, as Paxton et al. and Marshall and Lundberg propose, there need not be a correlation with high world sea levels. The Andean tectonic loading on the Brazilian craton margin, resulting in subsidence in the Amazonian Foreland Basin, must be taken into consideration when the evolution of the Pebsesian and Paraná transgressions are discussed. The landscape evolution may well have followed the hypothesis of Marshall and Lundberg.

Matti E. Räsänen
Ari M. Linna
Department of Geology,
FIN-20014 University of Turku,
Turku, Finland
E-mail: mrasanes@utu.fi
ari.linna@utu.fi

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