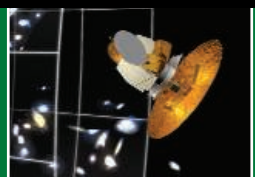


LETTERS

edited by Jennifer Sills

User Feedback Shapes Internet Progress

IN HIS POLICY FORUM "CAN WE REINVENT THE Internet?" (24 July, p. 396), V. Mayer-Schönberger concludes that current connectedness of the Internet impedes software coders' ability to innovate. I disagree.

Whether for commercial or for open-source purposes, software coders' motivation and inspiration for innovation originate primarily from user feedback, including expectations, demands, and even complaints. Frequent software upgrades reflect constant innovation. These upgrades should not be considered simply minor improvements. They are solid and steady steps to advanced evolution. The more heterogeneous the users, the more individualization will be required, and the more innovations coders will devise to meet these needs. Software written by coders who are disconnected to the users will likely be novel but impractical.

There is no scientific tool to measure or quantify objectively whether an improvement is incremental or radical. Can we deny the magnitude of previous innovations that constitute integral parts of and lead to subsequent innovations? In Internet history, different versions of e-mail applications, Web browsers, search engines, Web logs, iPhones, and e-commerce represent different stages of development on one innovation continuum.

If software coders who are isolated from social ties did build a radical program or reinvent the Internet, in addition to a series of technical problems such as compatibility and data conversion, users' learning cost would be substantial. The cost would be felt by consumers worldwide, including African students who have just learned how to use computers and software because of financial support from the international community.

Current innovations are changing the face of the Internet, even though they may not be radical.

SHESEN GUO

Qianjiang College, Hangzhou Normal University, Zhejiang 310012, People's Republic of China. E-mail: guoshesen@126.com

Introductory Biology: Let's Train Lecturers

I WAS DELIGHTED TO READ THE NEWS OF THE Week story "Universities begin to rethink first-year biology courses" (J. Mervis, 31 July, p. 527). However, having taught introductory college biology for 40 years, my experience has been that this corner of pedagogy is remarkably resistant to change. I have seen waves of "reform" washing over Intro Bio through the years, from Audio-Visual (the educational theory, not the equipment), to programmed instruction, to Personalized System of Instruction, to Keller Plan, to inquiry, ad infinitum. After all that, and millions of dollars, Intro Bio is still pretty much an instructor on a stage in front of hundreds of more or less disengaged students. Another constant is that the instructor has no training in public speaking, nor has he or she been shown how to make effective visual presentations. Forty years ago, we had illegible Kodachromes; now we have illegible PowerPoints.

Given that the lecture format has been with us for a long time and shows no real sign of disappearing, why not try to improve lectures instead of trying to get rid of them? Institutions could start by holding workshops on presentation skills for new faculty (especially adjuncts) before the semester begins. Pay the participants enough to make them happy, and throw in some tips on course management that will save them time and aggravation. Most large campuses have a teaching and learning center that could arrange this training, perhaps with the help of a communications department.

FRANK HEPPNER

Department of Biological Sciences, University of Rhode Island, Kingston, RI 02881, USA. E-mail: birdman@uri.edu

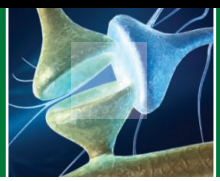
Introductory Biology: Top-Down Teaching

I READ WITH NOSTALGIA AND MALAISE THE News of the Week story "Universities begin to rethink first-year biology courses" (J. Mervis, 31 July, p. 527). From 1992 to 1994, I was co–principal investigator on an NSF grant in undergraduate education. The grant supported the development of integrated materials for thematically integrated freshman chemistry and biology. We taught biology, top-down, with no study of nucleic acids or proteins until students in our integrated curriculum understood intra- and intermolecular bonding. I had been astounded by the traditional approach to freshman biology, wherein students are thrown into macromolecular biology without a clue as to why protein folding occurs in thermodynamic terms. I still firmly

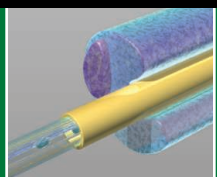
Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the previous 3 months or issues of general interest. They can be submitted through the Web (www.submit2science.org) or by regular mail (1200 New York Ave., NW, Washington, DC 20005, USA). Letters are not acknowledged upon receipt, nor are authors generally consulted before publication. Whether published in full or in part, letters are subject to editing for clarity and space.

Published by AAAS



Energy budgets in the brain
1349



Signaling in myelin formation
1353

believe in our approach. Of course, biology needs to be inquiry-based, but to teach it in a physical science vacuum is counterproductive.

VIN LOPRESTI

LDRD Program Office, Sandia National Laboratories, Albuquerque, NM 87185–0123, USA. E-mail: vclopre@sandia.gov

Purposeful Learning with Drug Repurposing

HIGH-THROUGHPUT SCREENING (HTS) OF comprehensive approved drug libraries has revealed new uses for old drugs (*1*, *2*). Although repurposing of drugs has been used for decades at the discretion of physicians (*3*), the Policy Forum "Repurposing with a difference" by M. S. Boguski *et al.* (12 June, p. 1394) describes a revolutionary approach to research and development in the drug industry that uses "repurposing pharmacovigilance" to find novel beneficial effects of drugs rather than adverse effects. This is a systematic approach that integrates new business models, patient-as-consumer activism through online social networking, information technology, and genomics as powerful tools.

As educators at the undergraduate and graduate levels, we believe that "repurposing pharmacovigilance" offers an innovative and relatively inexpensive interdisciplinary learning approach that can be used to engage students across the sciences and medicine as well as business and the humanities. Through analysis of case studies, students can learn about neglected diseases from a scientific and public policy point of view. Student project teams can work together in the classroom or laboratory to explore statistical data mining with the use of patient advocacy Web sites such as Resounding Health, pharmacological data, or analysis of HTS results from drug libraries to reveal new repurposing applications. Budding scientists trained in rights-based approaches would not limit themselves to drug development but would strive toward the availability of a public health structure, accessibility of these innovations, and acceptability by the users as well as the high quality of drugs (*4*). The scientific and ethical questions that evolve for discussion and debate around developing and providing these drugs to the target population will prepare the next generation of scientists and physicians for meeting the new challenges of unmet medical needs that lie ahead. Ultimately, patients will benefit from a more efficient drug discovery process that relies on complementary, not conflicting, scientific and human rights principles.

JEFFREY H. TONEY,[1]* JEFFRY I. FASICK,[2] SONAL SINGH,[3] CHRIS BEYRER,[3] DAVID J. SULLIVAN JR.[4]

[1]College of Natural, Applied, and Health Sciences, Kean University, Union, NJ 07083, USA. [2]Department of Biological Sciences, Kean University, Union, NJ 07083, USA.

Published by AAAS

[3]Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD 21205, USA. [4]Department of Molecular Microbiology and Immunology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD 21205, USA.

*To whom correspondence should be addressed. E-mail: jetoney@kean.edu

References

1. C. R. Chong, X. Chen, L. Shi, L. Liu, D. J. Sullivan Jr., *Nat. Chem. Biol.* **2**, 415 (2006).
2. C. R. Chong, D. J. Sullivan Jr., *Nature* **448,** 645 (2007).
3. *The New York Times*, 13 September 1939, p. 20.
4. World Health Organization, A Human Rights-Based Approach to Neglected Tropical Diseases; www.who.int/hhr/activities/NTD%20information%20sheet%20-%20English.pdf.

Taking Educational Research to School

THE 17 JULY REVIEWS BY A. N. MELTZOFF *ET al*. ("Foundations for a new science of learning," p. 284) and J. D. E. Gabrieli ("Dyslexia: A new synergy between education and cognitive neuroscience," p. 280) summarize the enormous progress that has been made in understanding the behavioral and neurobiological bases of learning and dyslexia, respectively. What is remarkable is how little of this research has penetrated educational practice. Teachers are not exposed to this research as part of their training. I often speak with teachers who are surprised that a science of reading exists, not to mention a science of learning linking brain and behavior. Educational theories rely on the work of a small number of psychologists (such as Lev Vygotsky and Jerome Bruner) whose research predates the modern era in cognitive neuroscience. In the case of dyslexia, many school systems do not even recognize that the condition exists. Parents of dyslexic children are routinely told that a child who can speak should be able to read, that the parents have not encouraged reading enough in the home, or that "dyslexia" reflects the medicalization of normal variation. The approximately 25% of American 8th graders who read below even the basic level (*1*) includes many dyslexics who have not been identified in the schools and provided with appropriate remediation. It is admirable that the authors attempted to spell out the educational implications of the research. Whether the educators are prepared to act on this information, or even understand it, is another question. The institutional and ideological barriers to linking science and education are substantial, as are the costs to society.

MARK S. SEIDENBERG

Department of Psychology, University of Wisconsin, Madison, WI 53706, USA. E-mail: seidenberg@wisc.edu

Reference

1. National Assessment of Educational Progress (2007); http://nationsreportcard.gov/reading_2007/r0003.asp.

United States Acting to Conserve Tuna Stocks

THE NEWS OF THE WEEK STORY "PROTECTING the last great tuna stocks" (C. Pala, 29 May, p. 1133) contains errors regarding the position and actions of the United States with respect to tuna conservation in the Pacific Ocean. In particular, the United States does not claim any exemption from applicable conservation and management measures and is currently developing the regulatory framework to implement all measures adopted by the Western and Central Pacific Fisheries Commission (WCPFC). Nor does the U.S. fleet fish "without limits" in the waters of the Pacific Island

States, as reportedly stated by Sylvester Pokajam of the National Fisheries Authority of Papua New Guinea. In addition to the constraints imposed by the WCPFC, the U.S. fleet is bound by the terms of a 1988 treaty with all sixteen independent Pacific Island States. No U.S. ship can fish in the region without a license issued by the Pacific Forum Fisheries Agency (FFA) on behalf of the Pacific Island States. Indeed, these U.S. vessels operate under stricter rules and with a higher level of compliance than any fleet fishing in the region.

In 2003, moreover, the United States accepted and implemented a reduction of 20% in the number of purse seine vessels authorized to fish in the region. Although the size of the U.S. fleet has fluctuated in recent years, the fleet remains below the level of historical U.S. participation in the fishery. The U.S. fleet remains the only fleet in the region to have accepted such an overall reduction. During this same period, the number of licenses issued to some other fleets has grown dramatically, including to fleets from outside the region with no previous fishing history (*1*, *2*). All of this information continues to be readily available to anyone interested in a full understanding of the U.S. commitment to conserving Pacific tuna stocks.

DAVID A. BALTON

Bureau of Oceans, Environment, and Science, U.S. Department of State, Washington, DC 20520, USA. E-mail: BaltonDA@state.gov

References

1. T. A. Lawson, Ed., *Western and Central Pacific Fisheries Commission Tuna Fishery Yearbook* (Oceanic Fisheries Programme, Secretariat of the Pacific Community, Noumea, New Caledonia, 2007); www.wcpfc.int/doc/wcpfc-tuna-fishery-yearbook-2007.
2. Record of Authorised Fishing Vessels (www.wcpfc.int/vrecord/search.php).

CORRECTIONS AND CLARIFICATIONS

Reports: "Generalized models reveal stabilizing factors in food webs" by T. Gross *et al.* (7 August, p. 747). The published image for Fig. 3 was mistakenly a duplicate of fig. S1 in the supporting online material. The correct Fig. 3 is shown here.