Microelectromechanics In their report "Design and fabrication of topologically complex, three-dimensional microstructures" (26 June, p. 2089), Rebecca J. Jackman *et al.* point out the wide range of potential applications in microelectromechanical systems (MEMS) and other miniature devices that will require the fabrication of small three-dimensional (3D) structures. We have explored another method for generating micron-scale, 3D structures with the use of a variant of photolithography with electroplating (*1*). In this technique, a photo-sensitized gel is exposed through a gray scale mask, cross-linking the gelatin in proportion to exposure. The resistance to ionic transport through the gelatin increases with cross-linking. Therefore, on electroplating through the gelatin, the gray scale of the original optical mask is translated into thickness variations on the final surface; that is, darker areas on the optical mask lead to thicker electrodeposits. The method provides a convenient additive method for generating 3D surface relief.

John C. Angus
Uziel Landau
Department of Chemical Engineering, Case Western Reserve University, Cleveland, OH 44106–7217, USA

References

1. J. C. Angus, U. Landau, S. H. Liao, M. C. Yang, J. *Electrochem. Soc.* **133**, 1152 (1986).

Response

The fabrication of microstructures is one of the most pervasive of modern technologies. Almost all microfabrication is now based on photolithography and its dependent technologies, and the dominance of this family of technologies is genuinely remarkable. Photolithography is intrinsically planar, although it can, with difficulty, be induced to produce certain types of nonplanar structures. The development of flexible, economical methods that would have the power of photolithography, but would build 3D microstructures, would open the door to a host of applications in microfluidic systems, MEMS, optical devices, and structural systems. Angus and Landau correctly emphasize the potential of the field of 3D microfabrication and provide an elegant example of another approach to the fabrication of microstructures having 3D character.

George M. Whitesides
Department of Chemistry and Chemical Biology, Harvard University, Cambridge, MA 02138, USA.
E-mail: gwhitesides@gmwgroup.harvard.edu

Federal Research Priorities In his thoughtful and pointed editorial "Making the case for federal support of R&D" (12 June, p. 1671), Franklin D. Raines poses five fundamental questions regarding such support for academic research and development (R&D). Most of these questions have been asked repeatedly, over at least the 25 years I have followed the issue, without much response from the scientific community. Nevertheless, the questions have clear-cut answers.

How large a scientific enterprise does the United States need? One criterion sets a floor: Enough university-based research to train the scientists called for by an increasingly technology-based industry. This amount is much less than current federal support. A different criterion—enough to make the United States competitive with other countries—is not useful: most federally funded R&D does not translate quickly into proprietary advantage. And increasing the pool of mankind's knowledge should be collaborative, not competitive. One sensible criterion would be to allocate a small, relatively stable fraction of the U.S. Gross National Product.

How can we set priorities in the nation's R&D enterprise? Raines's call for the scientific community to help set fund-

ing priorities will be unheeded, as usual. The community is structurally unable to ration itself. Priorities will and should continue to be set by federal officials, usually nonscientists, who continue to weigh the conflicting claims of various scientist proponents against each other and against nonresearch activities

How can we measure the success of our nation's research programs? I believe we cannot, and so we should not try. Federal research support is an investment in a distant and unspecified future, although we hold on to faith that it will be better than the present. Look back to the scientific discoveries that underpin today's great advances. The quality of federally supported research can only be safeguarded by funding the most able and productive scientists, as judged by peer review, a process that must be kept as uncompromisingly serious and objective as possible.

How can we strengthen the government-university partnership? Raines appropriately emphasizes peer review and deemphasizes entitlements and earmarks. I would only add a call for greater federal incentives for university research that involves collaborations with industry, so as to increase the rate of personnel and knowledge transfer one to the other.

How do we engage the American people in the excitement and wonder of science? This is difficult: research is highly abstruse and its eventual implications for people's lives are unclear. It is easier to explain how science discoveries of the past have led to the vast and amazing technologies of our civilization today. This story, the science behind how things work, can provide motivation for improving school curricula and for the backing of federal research programs by policymakers and voters. I believe that communicating this story is among the key responsibilities of any federal R&D program, despite the expense of high-quality mass media products.

N. Richard Werthamer*
Chelsea Technologies, 43 West Sixteenth Street, New York, NY 10011–6321, USA

* Former Executive Secretary of The American Physical Society

Raines seems to abdicate nearly all responsibility for the management of science and budget in the United States, in spite of his past service as director of the U.S. Office of Management and Budget. He suggests that scientists should interpret the federal budget, prioritize science spending, engage the people, teach the children, and lobby congress. Raines and his peers should realize that that is not what scientists do. At the risk of stereotyping, scientists study science all the time and well above the heads of average Americans or politicians. Politicians study people and laws, so it's no wonder the two have problems communicating.

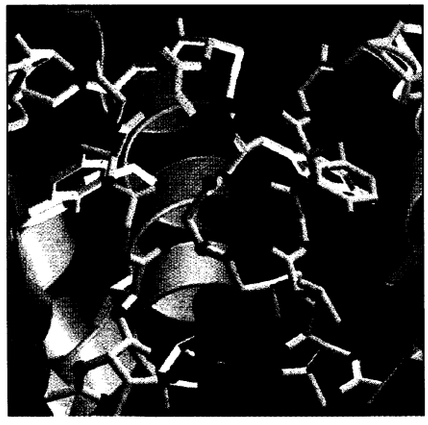
So who do we have trained to use science to solve problems and communicate the solutions? What about engineers? How many engineers were on Raines's staff? Did he consult one of the hundreds of engineering interns (from the American Society of Mechanical Engineers or the Institute of Electrical and Electronics Engineers) or others working in Congress and the White House? Maybe it's time policymakers did just this. Engineers love problems, and the United States has some big ones.

Matthew Diehl, Professional Engineer
Burlington, VT 05406

A Vision of the Pore

In his Research commentary "The vision of the pore" (*Science*'s Compass, 3 Apr., p. 56), Clay Armstrong gives a lucid overview of the structural data in two reports in the same issue by Roderick MacKinnon and his co-workers in the context of the existing body of knowledge on potassium (K^+) channels ["The structure of the potassium channel: Molecular basis of K^+ conduction and selectivity" by D. A. Doyle *et al.* (p. 69) and "Structural conservation in prokaryotic and eukaryotic potassium channels" by R. MacKinnon *et al.* (p. 106)].

I feel, however, that more credit should have been given to H. Schrempf and his



The K^+ channel's selectivity filter is revealed (from D. A. Doyle *et al.*, p. 76).

collaborators, who cloned the KcsA K^+ channel of *Streptomyces lividans* in 1995 (*1*). Their paper is a landmark in several respects. First, at the time of publication, a bacterial two-transmembrane K^+ channel that exhibited homology to the COOH-terminal of a *Shaker* K^+ channel was notable. Second, this study demonstrated functional reconstitution of a K^+ channel in an artificial membrane system. And third, Schrempf and his co-authors pointed out that the *S. lividans* K^+ channel would be an ideal candidate for structural studies—a prediction now borne out by the beautiful work of MacKinnon and his co-workers.

Tilly Bakker-Grunwald
Department of Microbiology, University of Osnabrueck, 49069 Osnabrueck, Germany. E-mail: bakker_t@sfbbio1.biologie.uni-osnabrueck.de

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1. H. Schrempf *et al.*, *EMBO J.* **14**, 1570 (1995).

CORRECTIONS AND CLARIFICATIONS

In the Table of Contents of 7 August (p. 745), under Technical Comments, the groups of authors should have been separated by semicolons to read, "H. Kurz and K. Sandau; T. H. Dawson; *Response* J. H. Brown, B. J. Enquist, G. B. West

In the Policy Forum "Toward safe and effective medical abortion" by W. R. Ewart and B. Winikoff (24 July, p. 520), the map (p. 521) should have shown Korea and Taiwan and indicated that these nations have rates of unsafe abortion within the lowest tabulated category (0 to 4 per 1000 women aged 15 to 49 by United Nations region). Also, the range of the top (red) bar in the map's key should have read, ">34" and that of the bottom (white) bar should have read, "<5."

In the letter "Kenyan wildlife conservation" by A. Kiss (17 July, p. 347), in the tenth line, PAWS should have been spelled out as "Protected Area and Wildlife Service."

The Nota Bene "Monie a mickle maks a muckle" by Richard Gallagher (*Science's* Compass, 10 July, p. 186) should have stated, in the fifth line of the last paragraph, the figure "10^{30} prokaryotic cells per year" as the productivity of marine environments. Also, the heading should have read, "Nota Bene: Microbiology."

In the News article "Ecology's catch of the day" by Karen Schmidt (10 July, p. 192), the caption on page 193 should have explained that the photographs above it showing undisturbed, disturbed, and recovering sections of the sea floor were taken at three different locations on Georges Bank, not at the exact same spot.

In the report "Visualization of the local insulator-metal transition in $Pr_{0.7}Ca_{0.3}MnO_3$" by M. Fiebig *et al.* (19 June, p. 1925), the first names of the third and fourth authors were switched. They should have read, "Yasuhide Tomioka" and "Yoshinori Tokura," respectively.