LETTERS

edited by Jennifer Sills

Time to Take Action on Climate Communication

ACCORDING TO BROAD INTERNATIONAL AGREEMENT, A GLOBAL WARMING INCREASE BEYOND 2°C is unacceptable (*1*). Because of the physics of the climate system, we must ensure that global emissions of greenhouse gases peak and start to decline rapidly within a decade in order to have a reasonable chance of meeting the 2°C goal (*2*). Humankind has waffled and delayed for decades; further delay risks serious consequences for people and the ecosystems on which we rely.

Because the potential consequences of climate change are so high, the science community has an obligation to help people, organizations, and governments make informed decisions. Yet existing institutions are not well suited to this task. Therefore, we call for the science community to develop, implement, and sustain an independent initiative with a singular mandate: to actively and effectively share information about climate change risks and potential solutions with the public, particularly decision-makers in the public, private, and nonprofit sectors. Moreover, we call on philanthropic funding institutions to endorse and provide sustained support for the initiative.

The initiative must make concerted efforts to provide people, organizations, and governments with critical information, to address misperceptions, and to counter misinformation and deception. In doing so, it will have to overcome psychological and cultural barriers to learning and engagement (*3*–*5*).

The initiative should be judged against two critical outcomes: (i) improved understanding of risks and potential solutions by people, organizations, and governments, and (ii) more informed decision-making—and less avoidance of decision-making—about how to manage those risks. The initiative should be an embodiment of what Fischhoff calls "nonpersuasive communication." It should not advocate specific policy decisions; good decision-making involves weighing the best available information with the values of the decision-makers and those affected by the decisions.

The initiative should recruit a full range of climate scientists, decision scientists, and communication professionals into the effort (*6*, *7*) to ensure both sound scientific information and effective communication. In addition, it should build bridges to other communities of experts—such as clergy, financial managers, business managers, and insurers—who help people, organizations, and governments assess and express their values. Scientists and nonscientists alike inevitably interpret climate science information in the context of other information and values; the initiative should mobilize experts who can facilitate appropriate and useful interpretations.

Despite the politically contentious nature of climate change policy, the initiative must be strictly nonpartisan. In the face of efforts to undermine public confidence in science, it must become a trusted broker of unbiased information for people on all sides of the issue.

At this potentially critical moment for human civilization, it is imperative that people, organizations, and governments be given the resources they need to participate in constructive civic, commercial, and personal decision-making about climate change risks and solutions.

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Overbuilding: Doctoral Degree Surplus

FINALLY AN INFLUENTIAL VOICE IN SCIENCE has spoken out against the short-sighted, self-destructive approach that many universities have adopted to expand their research facilities ("Overbuilding research capacity," B. Alberts, Editorial, 10 September, p. 1257). The use of NIH funds to build evermore research buildings and to hire evermore faculty members is clearly unsustainable. I would like to point out yet another aspect of "overbuilding": the heedless growth of graduate training in biomedical sciences, which is completely out of proportion with the real need for biomedical doctoral degrees.

The imbalance between biomedical Ph.D. production and the availability of research positions in academia and industry has been discussed many times (*1*–*3*). However, two recent developments make the problem more acute. First, the ongoing implosion of the U.S. pharmaceutical industry has led to the loss of thousands of research jobs (*4*, *5*). Second, the current chronic recession has led to a large increase in the number of young people entering graduate school (*6*), not necessarily because they are enthusiastic about science but because they have few other options. As a result, we are training too many students of uncertain quality. An effective solution to this problem would be to ban the support of graduate students on NIH research grants and to instead fund students exclusively through competitive individual or programmatic graduate fellowships.

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University leaders often seem to confuse quantity and quality. They want more grants, more buildings, more faculty, and more students. We need to substitute "better" for "more."

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Overbuilding: Under Pressure

THE EDITORIAL BY B. ALBERTS ("OVERBUILDING research capacity," 10 September, p. 1257) deals with the tangibles of personnel and space in the current university environment. I believe an equally important element is the loss of collegiality and commitment to education and service. My colleagues are under tremendous pressure to support their research infrastructure, including a major portion of their own salary. This pressure leads them to spend a substantial amount of their time and energy continuously applying for grant support. This creates a toxic, uncertain environment that is especially problematic for students, many of whom see academia as an unstable career choice.

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Overbuilding: Overhead Revisions

IN HIS EDITORIAL "OVERBUILDING RESEARCH capacity" (10 September, p. 1257), B. Alberts discussed the counterintuitive management of overhead grant funding. I would like to suggest two additional changes to overhead policy. First, overhead should be a fixed percentage of grant dollars for all institutions, regardless of what the institution claims to require. This would minimize negotiations and would put an end to rewarding institutions with higher administrative costs. Second, the institution receiving a grant should be free to spend the overhead however it wants (within some general

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legal constraints, of course). This would lower administrative costs for both the NIH and the recipient because there would be no need to audit how overhead is spent.

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Overbuilding: Boosting School Ratings

IN HIS EDITORIAL "OVERBUILDING RESEARCH capacity" (10 September, p. 1257), B. Alberts highlights how institutions evaluate their research capacity needs and acquire funding. One factor he omitted was school ratings. NIH dollars (as well as funding from other government entities such as the Department of Defense and the National Science Foundation) have become a benchmark for rating medical schools and research institutions. As a result, schools feel they must keep building in order to maintain their good ratings, which in turn attract donors. In addition to NIH's role in determining a rational and supportable biomedical infrastructure, new high-profile measures of success must be established that are not overly dependent on grant dollars.

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CORRECTIONS AND CLARIFICATIONS

Research Articles: "Hemispheric aerosol vertical profiles: Anthropogenic impacts on optical depth and cloud nuclei" by A. Clarke and V. Kapustin (17 September, p. 1488). The lead author and article title of reference 2 were incorrect. The correct reference is as follows: 2. R. J. Charlson, J. Langner, H. Rodhe, *Nature* **348**, 22 (1990).

Perspectives: "Concentrating on solar electricity and fuels" by M. Roeb and H. Müller-Steinhagen (13 August, p. 773). In the third paragraph, the authors note that "By the end of this year,…groundbreaking for the construction of 2500 GW of CSP plants will have occurred in the United States." The correct figure is 2500 MW.

Letters: "Response" by S. M. Knowles to "Protect pharmaceutical innovation" by L. W. Musselwhite and J. Andrews (11 June, p. 1354). The response quoted a National Academies study that recommended extending the data exclusivity period to 12 to 14 years. The actual quote from the study was: "In the near term, the United States should adopt the European period of 10–11 years. However, research should be undertaken to determine whether this period is adequate, given the complexity and length of drug development today."

Reports: "Dark matter search results from the CDMS II experiment" by The CDMS II Collaboration (26 March, p. 1619). In the last sentence of the second paragraph, 10^{-6} should be 10^{6}.

TECHNICAL COMMENT ABSTRACTS

Comment on "Single-Crystal X-ray Structure of 1,3-Dimethylcyclobutadiene by Confinement in a Crystalline Matrix"

David Scheschkewitz

Legrand *et al*. (Reports, 16 July 2010, p. 299) reported on the photolytic reaction of an α-pyrone confined in a crystalline matrix. Their structural analysis invoked four products: activated precursor, isomeric Dewar β-lactone, and square and rectangular isomers of 1,3-dimethylcyclobutadiene. The reported x-ray data, however, suggest that all observed structures correspond to only one distinct species, the Dewar β-lactone.

Full text at www.sciencemag.org/cgi/content/full/330/6007/1047-c

Comment on "Single Crystal X-ray Structure of 1,3-Dimethylcyclobutadiene by Confinement in a Crystalline Matrix"

Igor V. Alabugin, Brian Gold, Michael Shatruk, Kirill Kovnir

Legrand *et al*. (Reports, 16 July 2010, p. 299) reported the experimental observation of square-planar and rectangular-bent geometries of 1,3-dimethylcyclobutadiene (Me_2CBD) confined within a crystalline matrix. However, we found no evidence for the Me_2CBD formation. We argue that the experimental x-ray density data are better attributed to the bicyclic β-lactone intermediate where carbon dioxide is covalently bound to cyclobutadiene.

Full text at www.sciencemag.org/cgi/content/full/330/6007/1047-d

Response to Comments on "Single-Crystal X-ray Structure of 1,3-Dimethylcyclobutadiene by Confinement in a Crystalline Matrix"

Yves-Marie Legrand, Arie van der Lee, Mihail Barboiu

Scheschkewitz and Alabugin *et al*. suggest that photolysis under confinement in a crystalline matrix of 4,6-dimethyl-α-pyrone does not yield the crystal structure of 1,3-dimethylcyclobutadiene (Me_2CBD) as we reported, but rather that of a 4,6-dimethyl-β-lactone intermediate. We provide arguments that the square-planar Me_2CBD^S/CO_2 complex and the rectangular-bent Me_2CBD^R molecule are stabilized under confinement by the guanidinium-sulfonate-calixarene host matrix used in our study.

Full text at www.sciencemag.org/cgi/content/full/330/6007/1047-e

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.

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