LETTERS

edited by Jennifer Sills

Editorial Expression of Concern

THE REPORT "COPING WITH CHAOS: HOW DISORDERED CONTEXTS PROMOTE STEREOTYPING AND discrimination" by D. A. Stapel and S. Lindenberg (*1*) reported the effects of the physical environment on human stereotyping and discriminatory behavior. On 31 October 2011, Tilburg University held a press conference to announce interim findings of its investigation into possible data fraud in the body of work published by Stapel. The official report in Dutch (translated into English using Google software) indicates that the extent of the fraud by Stapel is substantial. Pending further details of the Tilburg Committee's findings, *Science* is publishing this Editorial Expression of Concern to alert our readers that serious concerns have been raised about the validity of the findings in this Report.

BRUCE ALBERTS
Editor-in-Chief

Reference
1. D. A. Stapel, S. Lindenberg, *Science* **332**, 251 (2011).

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Competencies: A Cure for Pre-Med Curriculum

IN 2009, THE ASSOCIATION OF AMERICAN Medical Colleges (AAMC), in collaboration with the Howard Hughes Medical Institute (HHMI), reviewed the educational prerequisites for admission to medical school in the United States. Because a large fraction of undergraduate students enroll in science courses to meet the requirements for admission to medical school, courses satisfying these requirements dominate the undergraduate science curriculum. The prescribed course structure has impeded educational innovation, particularly the development of new, multidisciplinary courses.

To address this situation, the AAMC-HHMI report (*1*) recommends that scientific competencies replace specific courses as requirements for medical school admissions. They recommend that students "demonstrate both knowledge of and ability to use basic principles of mathematics and statistics, physics, chemistry, biochemistry, and biology needed for the application of the sciences to human health and disease; demonstrate observational and analytical skills and the ability to apply those skills and principles to biological situations." The report articulates eight competencies in the areas of scientific knowledge and reasoning and provides learning objectives with examples in each of these areas, independent of the identity of the specific courses taken to achieve these competencies. In March 2011, a committee of the AAMC released preliminary recommendations (*2*) for changes to the Medical College Admission Test based on this report, with planned implementation in 2015.

We are HHMI professors who share the goal of promoting excellence in science education through the development of novel approaches to science teaching, curricular design, and mentoring. We strongly endorse the recommendation for transition to a competency-based curriculum for premedical education. There is room for discussion about which specific competencies should be included, and there is a need to ensure that curricular changes do not dilute course content, but we foresee that this innovation will have a substantial positive impact toward the invigoration of undergraduate education in science, math, and engineering. Specifically, it will simplify the development and implementation of course offerings within and between traditional disciplines as well as facilitate greater curricular innovation by science departments and multidisciplinary programs. Adoption of these reforms will provide enhanced opportunities to introduce curricular innovations that match the particular strengths of individual institutions and stimulate a widespread discussion of creative advancements in undergraduate education.

Now is the time for science faculty to convene to reconsider what all future scientists (not just medical doctors) should know and how that material should be taught in their institutions. We encourage discussions within and between science departments of curricular revisions that take advantage of this enhanced flexibility in keeping with the competencies recommended by the HHMI-AAMC report.

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Cycad evolution

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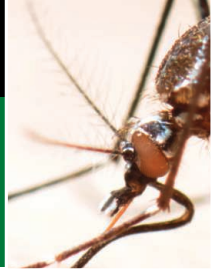

Mosquito intervention

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1. Scientific Foundations for Future Physicians, "Report of the AAMC-HHMI Committee" (AAMC, Washington, DC, 2009); www.hhmi.org/grants/pdf/08-209_AAMC-HHMI_report.pdf.
2. AAMC, "5th Comprehensive Review of the Medical College Admission Test® (MCAT)" (www.aamc.org/download/182662/data/mr5_preliminary_recommendations.pdf).

Drawing Attention to Diagram Use

THE EDUCATION FORUM "DRAWING TO LEARN in science" (S. Ainsworth *et al*., 26 August, p. 1096) makes a convincing case for placing greater emphasis on the cultivation of student skills in drawing diagrams and other forms of external representations. The authors, however, do not mention the crucial problems that students typically manifest in using diagrams, or the fact that very little research has been devoted to addressing those problems (*1*).

Students have a strong tendency to use the wrong diagrams for the task at hand and, when they do construct appropriate diagrams, they frequently fail to derive correct solutions or inferences (*2*–*5*). Even more troubling, most students do not use diagrams unless explicitly told to do so (*1*, *6*, *7*). Student knowledge about diagrams is often insufficient to instigate their use (*8*).

Our own research in this area suggests that, for students to more readily use diagrams, they need to appreciate the actual benefits of their use. Students also need to overcome hurdles associated with thinking that drawing diagrams is too difficult or too costly in terms of mental effort (*1*, *8*, *9*). There are some projects aimed at addressing these problems (*10*, *11*). However, if drawing diagrams is to genuinely take a more central part in science education, we believe that more researchers and educators need to focus on the issues we describe.

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10. Learning Strategies Use Research Project (www.learning-strategies-project.org/).
11. Visual Learning (www.brighton.ac.uk/visuallearning/).

CORRECTIONS AND CLARIFICATIONS

News Focus: "Particle physicists' new extreme teams" by A. Cho (16 September, p. 1564). The article misstates Maria Spiropulu's institutional affiliation. She has appointments at CERN and the California Institute of Technology in Pasadena.

News Focus: "Drug developers finally take aim at a neglected disease" by M. Leslie (19 August, p. 933). The story incorrectly stated that Julio Urbina was the director emeritus of the Venezuelan Institute for Scientific Research in Caracas. He is an emeritus investigator at the institute.

Reports: "Three periods of regulatory innovation during vertebrate evolution" by C. B. Lowe *et al*. (19 August, p. 1019). Affiliation 3 was incorrect. It should read "Howard Hughes Medical Institute, Chevy Chase, MD 20815, USA."

Review: "Dyscalculia: From brain to education" by B. Butterworth *et al*. (27 May, p. 1049). In Figure 2, A, B, and C, the references should be (*49*), (*50*), and (*51*), respectively.

Reports: "p53 controls radiation-induced gastrointestinal syndrome in mice independent of apoptosis" by D. G. Kirsch *et al*. (29 January 2010, p. 593). The study used "super p53" mice (Figure 4D) that were described as p53-tg^{b} with two additional copies of wild-type p53. Further characterization of these mice demonstrates that they are instead p53-tg with one additional copy of wild-type p53. The conclusions of the Report are not affected.

Letters to the Editor

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