Letters

Science in the Persian Gulf

Daniel E. Koshland, Jr., is tragically wrong in his editorial "Science and peace" (12 Apr., p. 189). Deaths were most certainly not "miraculously few" in the Persian Gulf war. Tens of thousands of Iraqi troops and civilians died either directly by our hands or as a consequence of the physical destruction of the country. And it is not over. The killing and dying continues today. If the application of the scientific method is going to help us understand the causes and consequences of the war, it is imperative that our observations be as accurate as possible.

Moreover, if there was anything like an "experiment" in the history of this war, it was the unprecedented attempt by the world community to assert its will on the government and commanders of Iraq without bringing about war. That attempt failed because our government did not want to wait for it to work.

The only "experimental conclusions" to emerge from this tragedy are (i) whoever has weapons of any kind will at some point use them instead of honestly seeking peaceful resolution, (ii) the human species remains shortsighted and vicious, and (iii) wars will arise in the future from these failings of human behavior regardless of the technology of killing involved.

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Math Problems

I noticed that three of the five printed answers in the EMPT sampler math quiz in the 8 March issue (News & Comment, p. 1173) were in error. Assuming that the quiz was designed to test math confidence, rather than ability per se, I gave the quiz to my wife and my daughter. My wife, who was educated in England, said, "That's funny, I didn't realize that I had forgotten so much high school math." My daughter, who has been educated in California, said, "I recognize those problems. I could do them if I wanted to." I conclude that more recent educational techniques are indeed increasing math confidence. The data do not allow any conclusions about ability.

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My gratitude for the sampler from the EMPT test of math proficiency. Imagine my surprise at scoring only 40% on a high school test. Would that I had been diagnosed before spending 20 years in math modeling. On the other hand, perhaps it was a deliberate plant by the psychology section. Your mailbag will tell how many of us are so insecure that we submit to self-tests of our very bread and butter!

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I was about to defend my doctoral thesis, but after missing three out of five on your high school math test I am rethinking my qualifications for higher education.

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Concerning the answers presented for questions 1, 3, and 4 in the five-question sampler of a test designed to assess high school students' math skills, could it be that we have identified the cause of low scores by high school students on such tests?

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Response: The disarrangement of problems and answers (see the issue of 15 March, p. 1305) was not a test to see whether our readers were paying attention, nor one to measure "math confidence." We were, however, delighted to discover so many readers who communicate cleverly and who keep us on our toes.

—DANIEL E. KOSHLAND, JR.

Energy Savings

I'm sorry to disappoint my fellow correspondents (Letters, 15 Mar., p. 1296). Arne P. Olson's lighting–space-conditioning interactions *are* fully included in our analyses (*1*); and Jeremy Cherfas' paraphrase—"Lovins is willing to concede half of his savings" (News & Comment, 11 Jan., p. 154)—isn't, as A. David Rossin assumes, an admission of exaggeration (on the contrary, our estimates now look conservative), but rather a sporting handicap: as Cherfas' next sentence quotes Graeme Pearman, as agreeing that

about half the potential savings would be enough.

Even if Olson's and Rossin's premises were correct, their inferences wouldn't be. Net space-conditioning effects *increase* the total energy savings of efficient lighting by one-fourth (*2*), to a U.S. potential of ~120 gigawatts (a quarter of all electricity); and however costly and slow energy savings may seem, the power plants Rossin prefers are an order of magnitude worse (*3*). Minimizing cost, delay, risk, and regret are precisely why the nation's largest investor-owned utility now plans to get at least 2.5 gigawatts, or three-fourths of its 1990s resource needs, from energy efficiency, and the rest from relatively small, fast, cheap, modular, renewable sources (*4*).

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REFERENCES AND NOTES

1. A. B. Lovins and R. Sardinsky, *The State of the Art: Lighting* (COMPETITEK Service, Rocky Mountain Institute, Snowmass, CO, 1988); pp. 16–19.
2. For typical U.S. buildings and climates, each unit of directly saved lighting energy saves net space-conditioning energy of roughly >0.35 units in commercial, 0.04 in industrial, and −0.055 in residential buildings (*1*). Actual interactions are building-specific, but even in unfavorable cases (all-electric houses in cold climates), incandescent lamps, being both electric and short-lived, are a costly way to heat, especially compared with insulation and superwindows.
3. Presuming that efficiency is at first premature and then too late, with nothing in between, Rossin's prescription—urgently building power plants—would both divert resources from efficiency and create a strong idle-asset incentive not to achieve it. The Electric Power Research Institute's *Impact of Demand-Side Management on Future Customer Electricity Demand* (EM-4815-SR, Palo Alto, CA, 1986) estimated that overbuilt utilities' mid-1980s efforts to recover their costs by ordering their efficiency staffs to market more electricity instead would create about 35 gigawatts of new *on*peak load by 2000, wiping out about five-eighths of utilities' efficiency efforts.
4. *1990 Annual Report* (Pacific Gas and Electric Company, San Francisco, CA, March 1991).

Olson notes that light bulbs emit significant amounts of waste heat and suggests that, since compact fluorescents emit less heat than incandescents, energy savings from substituting fluorescents for incandescents won't be as large as expected. He states that "large, modern office buildings receive a significant contribution to their heating plant from the waste heat from lighting systems." However, large modern office buildings are *not* lighted by incandescent lights. Their waste heat from lighting comes from fluorescent lights, so no one will be substituting compact fluorescents for incandescent bulbs in such buildings. Even though the waste heat tradeoff might de-

crease the benefits of compact fluorescents in some applications in cold climates, there is no doubting their benefits in warm climates, since the decreased air-conditioning load for indoor bulb substitutions is a fringe benefit. Regardless of climate, a great advantage of compact fluorescents is in replacing outdoor lighting (for example, night lights) where a 13-watt fluorescent bulb can be substituted for a 100-watt incandescent bulb with no noticeable degradation of light quality or quantity.

Five years ago, over 500 13-watt fluorescents were used to replace 100-watt incandescent outdoor lights at a condominium office complex in San Antonio, Texas. The electric bill dropped dramatically, from about $1100 per month to $200 per month; the investment paid for itself in about 6 months; and the complex has saved over $50,000 on electric bills and incandescent bulb replacement costs.

When one takes a systems viewpoint, the value of compact fluorescents is even more impressive. If every one of the approximately 100 million households in the United States replaced one 100-watt incandescent night light with one 13-watt fluorescent (assuming they are on 8 hours a night), the annual electric demand reduction would be the equivalent of 17 coal plants (500 megawatts each); the annual cooling water saved would be about 136,000 acre feet (5.46×10^{16} liters, enough to supply the water for a city of about 750,000 people); and the annual atmospheric release of at least 2.4×10^7 tons (2.18×10^{10} kilograms) of carbon dioxide would be prevented (estimate based on western coal; more carbon dioxide would be released for eastern coal, which has a higher carbon content).

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EPA Committee

I was concerned to read the description published in ScienceScope of 22 February (p. 863) regarding the Environmental Protection Agency (EPA) subcommittee reviewing the EPA document on electromagnetic fields (ELF) and cancer. The data in the EPA report consist primarily of epidemiology, animal studies, and possibly related cell biology studies. The article indicates that physicists are not welcome on the committee and that the committee is made up of epidemiologists, cancer specialists, and biostatisticians. The article quotes the director of the EPA Science Advisory Board, an unidentified EPA staffer, and Ken Foster, an

admitted skeptic about ELF effects.

Several of the committee members have extensive interdisciplinary experience in bioelectromagnetics, while others are new to the topic. The composition of the committee by doctoral discipline is as follows: engineering, four; epidemiology, three; cancer, three; biostatistics, two; empirical biology, two; biopsychology, one; environmental chemistry, one; and theoretical physics, one. Four engineers and one physicist represent physical sciences on the committee (29%). Seven of the members (three engineers, two biologists, one epidemiologist, and one biopsychologist) have experience in nonionizing ELF research. Five members of the committee (two engineers, one epidemiologist, and two laboratory biologists) are cited in the EPA report.

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Crystal Structure of Bee-Venom Phospholipase A₂: Correction

We would like to call attention to some errors in our report "Crystal structure of bee-venom phospholipase A_2 in a complex with a transition-state analogue" (14 Dec., p. 1563).

1) The legend to figure 2B should have read ". . . bee-venom PLA_2 (blue) superimposed upon that of the uninhibited form of the bovine pancreative PLA_2 (red)."

2) The sequence used to interpret the structure of the bee-venom phospholipase A_2 and cited in figure 2A is in error and differs from that inferred from the published cDNA sequence as follows. Leu should have been Glu at position 20, Arg should have been Lys at positions 47 and 72, Thr should have been His at position 56, Ala should have been Asp at position 92, and Arg should have been Thr at position 57. Lys was typographically omitted at position 124. Re-refinement of the structure with the corrected sequence neither alters the backbone conformation nor affects the disposition of surface residues 20, 47, 72, and 92. Thr57 replaces Arg57 in forming the hydrogen bond with the nonbridged oxygen of the inhibitor's sn-3 phosphate, and His56 replaces Thr56 at the opening of the hydrophobic channel. These changes do not alter our conclusions or those of its companion papers on phospholipase A_2. Corrected stereopairs (figures 3 and 4) are available from the authors on request, and the revised coordinates have been deposited in the Brookhaven Protein Data Bank.

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NOTES

1. We thank T. P. King, Rockefeller University, New York, and G. Kreil, Austrian Academy of Sciences, Salzburg, Austria, for pointing out error 2.

Membrane-Bound Phosphotyrosine Phosphatases

Jean L. Marx reviews the discovery of integral membrane phosphotyrosine phosphatases (Research News, 15 Feb., p. 744) and rightly describes it as a tale of two sequences. However there are omissions on the CD45 side of the story. The sequencing of CD45 was first done for the rat thymocyte molecule at our laboratory (*1*), and the unusual features of the cytoplasmic domain, including the presence of two tandemly repeated similar domains, constituted a major point of interest. In parallel work, cDNA clones encoding extracellular sequence of mouse CD45 were reported by the laboratory of Ted Boyse (*2*), and the subsequent work on CD45 and its related molecules has been done on the basis of the rat or mouse cDNA clones.

CD45 was worth sequencing to resolve questions of molecular heterogeneity, but above that we thought it must have a key function and that having the sequence might bring about a convergence of fields. This happened in 1988, when Charbonneau *et al.* (*3*) sequenced a placental phosphotyrosine phosphatase. Long live serendipity!

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3. H. Charbonneau, N. K. Tonks, K. A. Walsh, E. H. Fischer, *ibid.* **85**, 7182 (1988).