Proposed Research Budget a Starting Point

CONGRESS SHOULD FUND THE NATIONAL Science Foundation (NSF), the U.S. Department of Energy, and other research agencies at a much higher rate than proposed by the Bush Administration, as Donald Kennedy urges in his Editorial "A budget out of balance" (23 Mar., p. 2275). However, this goal should not impede the effort to double funding for the National Institutes of Health (NIH) by fiscal year 2003.

Last year the Agency for Healthcare Research and Quality, Centers for Disease Control and Prevention, NSF, and NIH all received historic increases (36%, 28%, 14%, and 14%, respectively), and this year's budget should be no different. The Administration's proposed research budget is the starting point. Already this year, Secretary of State Colin Powell has appointed a science advisor as reinforcement of science's role in national security and global health. President George Bush has set forth a $2.8-billion increase for NIH. Senators Christopher Bond (R-Mo) and Barbara Mikulski (D-Md) have introduced a bill to double funding for NSF over 5 years.

Better health, a growing economy, and improved quality of life are national priorities. Congress needs to hear from the entire science community on how engineering, mathematics, life sciences, and physical sciences are the key to maintaining our world leadership in these areas. The historic national commitment to NIH should set the standard, not be the exception to the rule. Scientists must tell the story of how much progress we are making, how many people are benefiting, and how many programs could be funded. When science delivers this message, Congress delivers on the funding. It's a national mandate when one considers that 85% of those surveyed by Research!America (*1*) say it is very important that the United States maintains its role as a world leader in scientific research. It's a mandate to our elected officials, but even more so, it's a mandate to America's scientific enterprise.

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References and Notes
1. Opinion poll results are available at http://www.researchamerica.org/opinions/

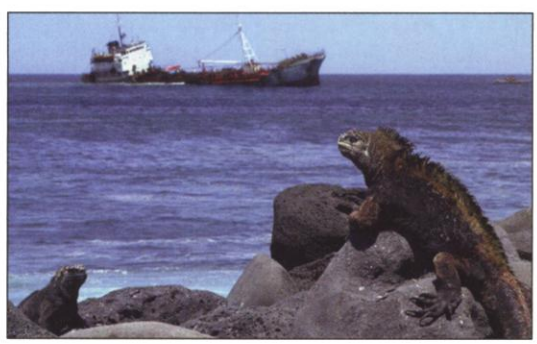
Letters to the Editor

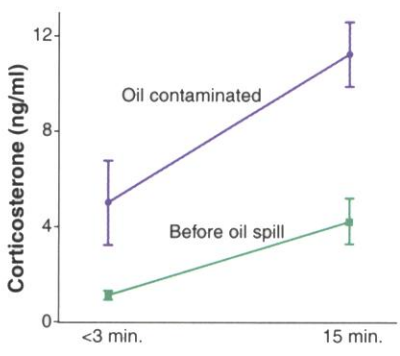
Letters (~300 words) discuss material published in *Science* in the previous 6 months or issues of general interest. They can be submitted by e-mail (science_letters@aaas.org), the Web (www.letter2science.org), or regular mail (1200 New York Ave., NW, Washington, DC 20005, USA). Letters are not acknowledged 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.

Marine Iguanas Oiled in the Galápagos

THE OIL TANKER *JESSICA* RAN ASHORE ON San Cristobal Island in the Galápagos Natural World Heritage Site on 17 January 2001. Several days later, 750,000 gallons of diesel and bunker oil spilled throughout the archipelago. Although few animals died immediately, the long-term effects of oiling might be severe (*1*).

We have studied marine iguanas (*Amblyrhynchus cristatus*) on Santa Fe Island 32 kilometers west of the oil spill since 1981 (*2*). Marine iguanas eat intertidal algae and are extremely sensitive to environmental perturbations such as El Niños. Three days before the oil spill, we conducted a routine blood sampling survey and then collected samples 10 days later to look for hormonal indications of stress. At this time, oil patches were visible in tide pools throughout the study area, and of the 170 individuals examined, 70% had oil residue on their skin. Plasma levels of corticosterone, the species-specific stress hormone, were highly elevated in animals sampled after the oil spill (see the graph). This was true for baseline (with 3 minutes of capture) and constraint stress–induced levels (*3*). Corticosterone levels were indistinguishable between animals that had externally visible oil blotches [5.0 ± 1.7 nanograms per milliliter (ng/ml)] and those without (4.0 ± 1.5 ng/ml). We suggest that corticosterone was elevated because iguanas ingested oil residues while feeding in polluted intertidal areas.





Galápagos marine iguanas affected by the oil spill from *Jessica* (above) showed highly elevated plasma levels of the stress hormone corticosterone (mean ± SE) (*5*).

In marine iguanas, corticosterone levels are linearly related to survival rates (*4*). During an El Niño event, only individuals that died within 2 to 4 weeks after sampling had levels elevated to the same degree as oiled iguanas; thus, marine iguanas appear to be extremely sensitive to oil contamination.

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References and Notes
1. R. T. Paine *et al.*, *Annu. Rev. Ecol. Syst.* **27**, 197 (1996).
2. M. Wikelski *et al.*, *Ecology* **78**, 2204 (1997).
3. Blood samples were taken within 3 minutes of capture, and then animals were restrained in cloth bags

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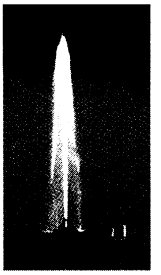
for 15 minutes and samples taken again to determine stress-induced corticosterone concentrations from handling.
4. L. M. Romero and M. Wikelski, *Proc. Natl. Acad. Sci. U.S.A.*, in press.
5. General linear model repeated measures analysis of variance, $F(2,40) = 34.6$, $P < 0.001$; for oil versus non-oil, $P < 0.001$; for visible oil versus no visible oil, $P = 0.17$. Corticosterone levels were determined with a standard radioimmunoassay (assayed in quadruplicate). All samples were analyzed within one assay; intra-assay variation was 6 ± 0.3% SD, and the detection limit was 0.5 ng/ml.
6. The research described here was supported by the National Science Foundation under grant IBN-0118069.

Removing CO_2 from Lake Nyos in Cameroon

THE DEGASSING EXPERIMENT ONGOING AT Lake Nyos, Cameroon, is not "unprecedented," as John Pickrell says in his News of the Week article "Scientists begin taming killer lake" (9 Feb., p. 965). It was proved feasible, with pipes of the same diameter, at Monoun in 1992 and at Nyos in 1995. Water from the lake bottom travels up through the pipes, and the CO_2 is released in a jet of spray 45 meters high as it comes out of solution near the surface. Scaling up this experiment by adding five similar pipes will allow the elimination of most of the 300 million cubic meters of CO_2 currently dissolved in the lake's deep waters within 5 years.

There are concerns, however, that water discharged from the jet might play the role of cold rainwater, sometimes put forward as the ultimate cause of the Nyos and Monoun limnic eruption disasters. Indeed, the ~2500 square meters of the lake surface sprinkled by the jet receive about the equivalent of a heavy tropical rain (~8 centimeters per hour). But the water resulting from the removal of CO_2 is not "dense" water—it is lighter than the bottom water precisely because it is not laden with CO_2. Moreover, it has been found that expansion of the gas en route to the surface through the degassing pipe is almost isothermal because of the low gas/water mass ratio of the fluid being vented—the 1.8°C temperature drop of the two-phase flow along the pipe brings the 25.2°C bottom water to a temperature very close to the mean temperature of surface water (22° to 23°C). Also, because the jet is 0.1 in relative density, it breaks down as a hazy spray that thermally equilibrates swiftly with air and mixes uniformly with surface water. Even in a worst case scenario, the penetration depth of discharged water has been calculated to be above the chemocline currently existing at 44 meters (*1*). Therefore,



concerns about cool water sinking and disturbing deep layers as a consequence of the degassing process are not relevant.

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1. M. Kusakabe *et al.*, *J. Volcanol. Geotherm. Res.* **97**, 241 (2000).

Mutation in Embryonic Stem Cells

A SINGLE HUMAN EMBRYONIC STEM (ES) CELL might be modified in the laboratory to provide an unlimited supply of cells for therapy, according to Geron researcher Melissa Carpenter in the News Focus article "Stem cells: new excitement, persistent questions" (G. Vogel, 1 Dec., p. 1672). This seems, however, unlikely to be true. Mutations accumulate during DNA replication before cell division, at a rate of about 1 in 10 bil-

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