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LETTERS

Fossil Collecting and Government Regulation

The article "Dustup in the bone pile: academics v. collectors" by Virginia Morell (News & Comment, 16 Oct., p. 391) should be clarified in two substantive respects relating to me.

1) I resigned as president-elect of the Society of Vertebrate Paleontology (SVP) because of broad, deep, persistent, and increasing disagreement with certain of the methods and directions of the society's leadership. I did not resign because of the resolution (which I voted for) of the SVP executive committee calling for prohibition of commercial collecting on federal (not public) lands.

2) The article states that I resigned because the resolution censured "commercial dealers who engage in unauthorized fossil collecting on public lands." This implies directly that I favor unauthorized (meaning, presumably, *unlawful*) collecting. I have never advocated, directly or indirectly, unauthorized collecting anywhere.

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I write in response to Morell's article of 16 October. The Vertebrate Paleontological Resources Protection Act proposed by Senator Max Baucus (D–MT) would limit collecting without permits. Protection of a country's natural material heritage is necessary if sites with natural history materials are not to be commercially mined. Only fossils of exhibition quality are commercially valuable, and their detailed contexts will not be recorded by most commercial collectors. Specimens excavated without rigorous contextual information are virtually useless for research and of limited scientific value.

Morell says there are 40 commercial collectors who are members of the SVP. There are actually about 20 collectors out of 1575 professional members. The society also includes 296 students, 964 university academics and museum workers, and 283 amateurs (with diverse views). The commercial collectors are a small special-interest group whose concerns are considered within the context of the broader interests of other members. The majority of the society is not sympathetic to the "free-market exploitation" model that some commercial collectors advocate.

Protection of fossils as nonrenewable resources is understood in many countries with protective laws (for example, Peru, Argentina, Egypt, Kenya, South Africa, Australia, France, and Canada). The United States lags behind these countries. If U.S. fossils remain unprotected, commercial dealers or unregulated collectors can sell to the highest bidder, and our North American fossils may go to overseas museums.

I am concerned about the preservation of *all* of the world's natural treasures. As past president of the SVP, I am professionally concerned for my discipline and for its future. I do not believe in total regulation; often minimal law is best. However, in this case lack of regulation invites exploitation and loss of information and specimens; thus I support the intent of Senator Baucus's bill.

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An item dealing with importation of bird skins by a museum ("Ornithologists feel beleaguered," Random Samples, 16 Oct., p. 396) and Morell's article about the collection of paleontological specimens for commercial sale describe cases of government regulation of natural science collecting. To be added to these cases are the following ones from my own discipline of archeology, now controlled by legislation based on the professed religious beliefs of American Indians.

- The owner of an archeological site in Indiana was arrested for collecting from his own site.
- A professional archeologist conducting a mandated environmental impact study in California was charged with a felony for reporting some bits of cremated human bone.
- The state of Illinois sealed with concrete an exhibit of ancient bones as exposed in the Dickson Mounds State Park, the reason the park was there in the first place.
- In West Virginia, the state agreed to the demands of a group of self-appointed American Indians to rebury *everything* recovered by a tax-supported $1.8-million excavation of a site scheduled for destruction by a highway.
- Idaho's Historic Preservation Office

gave up for reburial a skeleton dated by radiocarbon at 10,600 years old, possibly the oldest directly dated human remains in the New World.

Our government officials, having been told to lay off the regulation of commercial interests for a while, have discovered a fertile new field of political activity in regulating all aspects of scientific study. The burden of this falls mostly on legitimate scholars and institutions because they are easily identified. Even if the conviction and penalty are dismissed, those caught in this trap will have to pay for attorneys to defend themselves. There is the additional cost to the taxpayers of putting these ridiculous cases into the court system. Scholars should be very worried—it is a short step from what is happening now to the point where a government office will decree what can be studied, who can study it, and what will happen to the scientific evidence.

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Super Collider, 2000 B.C.

In his letter of 30 October, "The pre-druid Super Collider?" (p. 725), Leon Lederman forgets to mention another potential similarity between Stonehenge and the Superconducting Super Collider. After 4000 years it is still not certain that Stonehenge ever had any scientific value.

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Lederman may be trying to argue that we should build the Superconducting Super Collider just as the old Britons built Stonehenge, but his analogy suggests the very opposite. He says that Stonehenge was completed on schedule in 2000 B.C. Glyn Daniel discussed (*1*) the chronological details of Stonehenge: The first phase was from 2800 to 2200 B.C., the second was from 2100 to 2000 B.C., and the third was from 2000 to 1100 B.C. If the Super Collider is our Stonehenge, can we expect it to be completed in 3692 A.D.?

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1. G. Daniel, *Sci. Am.* 243, 78 (July 1980).

Lederman is apparently a great believer in the economic wisdom of the ancients, to judge from his estimate of prehistoric inflation and cost accounting at Stonehenge. The estimated cost of the Super Collider is $8 billion. If the cost of Stonehenge were adjusted for inflation by even as little as 1% per year, a present value of $8 billion would imply an original cost of $0.000000045.

Let the new Administration in Washington note: The secret of keeping inflation down while rebuilding our nation's infrastructure lies not in Reaganomics or Clintonomics, but in the pre-druid past!

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Pitohui: How Toxic and to Whom?

I read the report "Homobatrachotoxin in the genus *Pitohui*: chemical defense in birds?" by John P. Dumbacher *et al.* (30 Oct., p. 799) with great excitement. As with many important findings, the defensive chemical was discovered serendipitously. While holding individual hooded pitohuis (*Pitohui dichrous*), the authors appear to have picked up the chemical on their hands, and touching their hands to oral and nasal epithelium, they experienced "numbness, burning, and sneezing." Unfortunately, the bioassay used in the study to further explore the defensive value of homobatrachotoxin is ecologically irrelevant. In brief, subcutaneous injections of either homobatrachotoxin or crude homobatrachotoxin-containing extracts from different body parts were made into the hindquarters of laboratory mice. These injections produced convulsions and death in many of the mice. I have three concerns with this bioassay.

First, why was this chemical applied to the hindquarters rather than the oral cavity? If natural predators respond orally to homobatrachotoxin like humans do, then the irritating oral effect alone would effectively deter many predators. Second, in the event that a predator actually swallowed pitohui tissue, the homobatrachotoxin would have to cross the gastrointestinal wall, which is a major barrier to absorption for many xenobiotics. For example, laboratory mice are substantially more sensitive to subcutaneous (and intraperitoneal) doses than they are to oral doses of many drugs and poisons (*1*). To rationalize the use of subcutaneous injections, the authors need to demonstrate that homobatrachotoxin readily crosses the gastrointestinal wall. Third, why was the laboratory mouse used as the test species? The authors state that the most likely natural predators of pitohuis are "snakes, raptors, and potentially some arboreal marsupials." Given this assemblage of predators, a placental mammal seems to be an inappropriate model. There are large species differences in sensitivity to poisons, even among placental mammals (*1*). Despite the fact that batrachotoxin, which is structurally related to homobatrachotoxin, polarizes nerve and muscle cells in several species of mammal and a mollusk, the key issue is whether the concentration of homobatrachotoxin is high enough to repel the pitohui's natural predators during an attack. I suggest that until a more ecologically relevant bioassay is employed, the jury is still out on the defensive function of pitohui homobratrachotoxin.

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1. R. L. Tatken and R. J. Lewis, Sr., *Registry of Toxic Effects of Chemical Substances, 1981–82* (U.S. Department of Health and Human Sciences, Cincinnati, OH, 1983), vol. 3; C. D. Barnes and L. G. Eltherington, *Drug Dosages in Laboratory Animals: A Handbook* (Univ. of California Press, Berkeley, CA, 1973).

Response: It was not our intention to use the mouse bioassay "to further explore the defensive value of homobatrachotoxin." Instead, we used it in the process of purifying the toxic substance from the skin and feathers of hooded pitohuis. This led to its identification as homobatrachotoxin, a neurotoxin previously thought to be made only by poison-dart frogs in tropical South America. The mouse bioassay also provided a quantitative measure of concentrations of toxin between different tissues and between different species of pitohuis, as it had in earlier studies of poison-dart frogs.

Birds avoided by predators or having unpalatable flesh have been described in the literature (*1*) and have been suggested as plausible examples of chemical defense in birds. These suggestions were based either on "bioassays" with hornets, domestic cats, or humans or on ancedotal accounts. No previous study has identified any toxic substances or performed repeatable experiments showing that a live bird could repel potential predators. Instead, it has been suggested that diet (fish, decaying flesh, or insects) contributed to making the bird flesh distasteful. Our study demonstrates a toxin in the *skin* and *feathers* of pitohuis, external tissues well suited for chemical defense. Additionally, batrachotoxins, including homobatrachotoxin, appear to serve as a chemical defense in *Phyllobates* frogs (*2*). Pitohuis are defended from human hunters in many areas of New Guinea; they recognize pitohuis as undesirable and do not hunt them.

We agree with Glendinning that field studies with potential predators are needed to demonstrate the defensive value of homobatrachotoxin. We are also aware that