Letters

More on Amazonian Fauna

I agree with Fletcher's concern (Letters, 4 Oct.) for the Indians of Colombia who hunt vanishing species deep into the Amazon rain forest. . . . At the present rate of decimating the Amazon fauna, according to the Colombian scientists for whom I am trying to speak (Letters, 9 Aug.), there will be dramatic losses of whole species. What will the Indians do then? These scientists call for a moratorium on hunting until they can establish good game management techniques. Then there should be hunting for the Indians for many years to come. Informed scientists at the University of Bogota request that their Bureau of Indian Affairs act to prevent further exploitation of the indigenous tribes, and that Colombia set up training centers such as those Venezuela operates for her Indians.

The Leticia Indians get but a tiny fraction of the $2500, the price reportedly paid for a jaguar coat in New York. If the Indians themselves were trained to handle this resource, and were aided by competent and sympathetic game managers as counselors, and with suitable hunting regulations, both wildlife and Indians could survive together. In other words, the Indians would have a real stake, and not just a few centavos, in good wildlife management. Perhaps they would resist overkill as well as oppose excessive destruction of wildlife habitat, another major factor in wildlife losses.

The government corporation, CVM, a kind of Fish and Wildlife service, believes it has had success with this approach on its Salamanca game reserve, where the Indians now are staunch supporters of good wildlife management and help in controlling poaching. Rachel-Dalmatoff, anthropologist at the University of the Andes, told me that some of the Colombian tribes have evolved better conservation practices than those of us with "superior civilizations."

Perkinson (Letters, 4 Oct.) notes that Colombia still needs to ratify the 1942 Convention and to supply the Organization of American States with lists of endangered species. It is significant that, at the Latin-American Conference on Conservation of Renewable Natural Resources (IUCN) last April, South Americans favored control at the ports of entry of receiving countries which desire to prevent traffic in vanishing fauna. If Colombia and the U.S. Congress, as well as the OAS and the IUCN can act in time, the breeding stock of most species can be saved. Other aspects of this problem will be considered in the symposium of the Association of Tropical Biology meeting in Colombia in January.

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Based on my 15 years in this area, I would like to explain some of the animal-collecting practices in Leticia which Quaintance claimed were causing a scarcity. There are no professional skin hunters here that I know of. Deer, pig, and capybara are killed by local Indians for food and the skins are sold for money or merchandise to boat traders who then resell them in Leticia. If a law were passed to prohibit the hunting of these animals (the only source of meat for the natives), I believe the Indians would continue their ways and would simply discard the skins and thus lose their principal income. Only caiman, I feel, need regulation to prevent over-hunting, as they are killed mainly (about 70 percent) for skins, not for food. The Indians, largely from laziness, are unwilling to hunt more than 10-15 kilometers from their homes, but there are thousands and thousands of acres of bush and many animals between Leticia and the Caquetá River which have never been seen by man.

As a dealer in primates for research, I first bought all my monkeys from one nearby island. In the last 6 years, they have come from the mainland area not over 50 kilometers up and down the river from Leticia and not over 3 kilometers from the bank into the bush. Again, the Indians will not set traps more than a few yards from their homes, banana, or corn patches. In this area where there is no industry other than the animal, fish, or skin trade, they are wholly dependent on the income for their food, clothing, and drugs.

I have leased one large island in the Amazon where we hope to establish a population of virus-free monkeys. In the last 2 years, we have turned loose on it 2037 adult squirrel monkeys, mainly pregnant females, and we estimate that another 1500 babies have been born. Another 700 monkeys were added last summer. The island is planted with over 25 acres of banana and other local fruit to provide the monkeys with their customary jungle diet.

In captivity, the living conditions for our primates are unsurpassed. No measure is omitted in the compounds that would contribute to the health of the monkeys. Purina monkey chow is flown in from the United States, as well as milk, pablum, and drugs. Our stock is so superior that our animals are sold for five times the amount paid to a competitor in Iquitos, Peru. As proof of the care given to the monkeys, their mortality in transit is less than 1 percent. I have had to make claims only twice against the airlines for negligent transport. Both shipments were misdirected by error causing the animals (or fishes) to die. Each time my claim was fully reimbursed.

The best means, I believe, of preventing inhumane treatment of primates by shippers would be the establishment of minimum health standards for animal compounds. These standards should be subject to local enforcement. If the authorities find that they are not being maintained, they should be empowered to revoke the shipping licenses of the owners of the compounds. . . .

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The intent of my letter (4 Oct.) was to forestall any precipitate action that could have serious consequences. What is needed is a three-nation (Colombia, Brazil, and Peru) program of wildlife management that would allow a reasonable animal harvest. Since three nations adjoin near Leticia, and since the local people have little appreciation for national boundaries, action by one nation would be worthless.

Incidentally, the worst sinners in Amazonia are the hide hunters for the fur and leather industries. Live animal collectors are amateurs by comparison. I would like to see jaguar coats and alligator shoes outlawed in the United States.

All this concern for the wildlife of the Amazon is encouraging. Let us hope that the Basin will escape the tragedies we have witnessed on our own continent. There still is plenty of time if they (and we) act wisely rather than impulsively. Our letters will have served a purpose if they help arouse intelligent concern for the largest remaining untouched wilderness in the world.

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Homology as Applied to Proteins

"Do cats eat bats? Do cats eat bats?" and sometimes "Do bats eat cats?" for you see, as she couldn't answer either question, it didn't much matter which way she put it (*1*).

Our article entitled "Evolution of structure and function of proteases" dealing with the biochemical approach to the subject of evolution as exemplified by studies of proteolytic enzymes (*2*) put forth a definition of the term "homology" as it applies to similarities in protein structures. This word has been much bandied about and generally used by many to represent a host of ill-defined concepts. We proposed that the word be taken to connote the occurrence of a degree of structural similarity among proteins greater than might be anticipated by chance alone.

This definition has been criticized by Margoliash (*3*). His position is that since evolution is traditionally the province of the classical biologist, the classical biologist's definition of "homology" should prevail. This would add to our definition the additional qualification that the protein structures in question must have evolved from a common ancestral gene. The problem with this restrictive definition is that the word, although precisely defined, can seldom be used in a precise sense. For example, did ancestral genes common to divergent populations give rise to "homologous" proteins, or does the occurrence of "homologous" proteins mean that they arose from genes having a common ancestor? It really doesn't matter how we put it because like Lewis Carroll's *Alice,* we do not know the answer to either question. The perishable nature of the gene prevents us from obtaining concrete and objective evidence on the nature or existence of ancestral genes. This is in sharp contrast to the position of the classical biologist who has at his service an assemblage of fossil forms to provide independent evidence for the existence of ancestors embodying morphological features common to diverse modern populations. Thus if the evolutionary biologist concludes that the wing of a hummingbird and the foreleg of a gnu exhibit homology, he could present not only anatomical studies based on specimens from extant populations, but also a detailed fossil record substantiating the divergent evolution of these two structures from a common ancestor. The evolutionary biochemist is less fortunate. He can show the similarity of two or more protein structures but he has not and cannot have any independent experimental evidence relative to the question of ancestral genes. Applying the restriction that homology implies common ancestry, it would be impossible to conclude with certainty that two proteins are homologous. Of course, the argument is advanced that the probability of a group of structurally related genes arising independently is so small that they must have evolved from a common evolutionary progenitor. While this argument has validity in most cases, it seems possible that each gene prototype may have arisen more than once. When one considers that the ability to fly, for example, has evolved independently at least several times over the eons, as in the case of insects, birds, and bats, it does not seem in the least amazing that a single structural gene could have had several independent points of origin.

It seems clear that as our approach to an understanding of the living world changes, so must our experimental methods and so must the language we use to describe the results. It would indeed be unfortunate if, in pursuit of the science of change in living populations, it were not recognized that words, like organisms, cannot be allowed to become inflexible. They must either adapt to the changing needs of the scientific community that fosters them or fall into the extinction of disuse.

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3. C. Nolan and E. Margoliash, *Ann. Rev. Biochem.* **37**, 727 (1968).

Regulation of Indirect Costs

The recent furor over the Mansfield Amendment (News and Comment, 18 Oct., p. 337) again reveals the deep confusion by most responsible people in both universities and government on the subject of indirect costs—"overhead." Indirect costs are *real costs* incurred in the support of research activity. The rate is uniformly calculated —and subject to full audit—under Bureau of the Budget Circular A–21 which defines both allowable and unallowable expenditures for an institution and establishes for recovery an appropriate portion of such allowable costs based on level of research activity. The percentage rate, while widely variable as a function of the type and sophistication of a given university's approach to its accounting and budgeting, represents a base for legitimate and real costing.

These allowable costs in support of research are for such necessary functions as operation of the business office and other administrative support, maintenance and amortization of research-related equipment or space, use of library holdings, and so forth. Unfortunately although real institutional dollars are clearly spent for these purposes, many institutions view overhead dollars as a bonus or free money—university accounting systems or university administrators do play strange games at times. The allocation of these "free funds" to "research pools," "football fields," or the "president's contingency fund," is in violation of the intent and purpose of the indirect cost recovery process. If a university does not recognize the real costs of support and administration of research, it is guilty of a serious dereliction morally, and possibly legally, since in reality it is robbing general funds from many other functional areas.

Congressman Daddario and other concerned legislators must have the support of all institutions which have various methods of regulating indirect costs. Both faculty and administrators must understand the realities of the process—for the sake of their university, and for the growth of research on a solid fiscal base. One more definitive hearing on this topic may be of real value to both the universities and the government.

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