Letters

Genetics of Small Populations

Like George B. Rabb and Robert Lacy (Letters, 10 Aug., p. 612), I too have been concerned about overly simplistic assertions on the subject of the genetics of small populations.

Recent surprising data and theoretical calculations (*1, 2*) suggest that small single population bottlenecks, from which a sexual population rapidly rebuilds size after one or two generations, may be important in evolutionary change. Such a bottleneck appears to be accompanied by release, to the action of natural selection, of new recombinational genetic variability. Novel character change may result over a moderate number of immediately ensuing generations. Judging a sexual population to be genetically invariable from quasineutral loci (detected by DNA analysis or electrophoresis) can be mistaken. A more sensitive measure is the pattern of genetic variation in quantitative characters that underlie Darwinian fitness.

With regard to measures to save endangered species, the bottom line is the prevention of serial bottlenecks that extend over five or more generations. Maximal opportunity must be provided for natural and sexual selection to operate in the populations of the species, whether in the wild, in captivity, or in the garden plot. Intervention by genetic engineering should be confined to the most serious cases, in which loss of variability in quantitative traits affecting reproductive capacity has occurred and depression due to inbreeding is already present.

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Venus Phenomena

In his Research News article "Catching Venus in the act" (17 Aug., p. 742) Richard A. Kerr states, "an increasing mass of data . . . has most [planetary scientists] convinced that the planet [Venus] has active volcanoes that erupted on a massive scale as recently as the 1970s." He then quotes Larry Esposito of the University of Colorado as saying: "It's absolutely well established. There are not only active volcanoes but also volcanoes with enough heat energy output to drive the gas into the upper atmosphere." What is established is a temporal variation in sulfur dioxide above the cloud tops. This variation may or may not be related to current volcanic activity, but there is no mention in Kerr's article of the fact that many members of the scientific community believe that atmospheric dynamics is a much more plausible mechanism for the sulfur dioxide variations. Among the several significant arguments against explosive volcanism being responsible for variations in the upper atmosphere are the extremely high surface density and temperature (making even a large volcano's heat output unlikely to produce the convection to high altitude) and the observed relative scarcity of solid particulates in the Venus atmosphere expected to be produced by copious volcanism (*1*).

The radio noise attributed by Fred Scarf and Chris Russell to Venus lightning and said by them to be topographically clustered over volcanic highlands consisted of transient events seen only in the lowest frequency (100 hz) channel of Scarf's instrument. Harry Taylor and I, using Scarf's own data set, found in 1985 that these data showed no topographic clustering, while Russell was still strongly defending that position. The argument that these signals were ionospheric in origin was based on their spatial coincidence with ionospheric troughs and their peak occurrence near 170 km altitude. We did not attribute these signals to telemetry noise. In 1986, Russell, working with R. N. Singh, changed the definition of Venus "lightning," stating that simultaneous bursts at all frequencies was the correct signature of lightning events (*2*). When Taylor and I examined the corresponding data set, we found that Singh and Russell had mistakenly tabulated telemetry interference spikes as real events. Our comment (*3*) was published without a reply from Singh and Russell. Subsequently, Russell has undertaken to analyze broadband events, which he continues to call "Venus lightning," stating, as Kerr indicates, that these events show temporal clustering in the late afternoon and evening. However, these signals are highly improbable as an indicator of lightning in the atmosphere of Venus, since they exhibit zero dispersion and hence must be produced very close to the spacecraft. It has recently shown (*4*) that such signals have been seen in earth orbit, not related to terrestrial lightning, and presumably produced very near the spacecraft.

The arrival of Magellan at Venus is certainly a newsworthy event, and *Science*'s coverage has undoubtedly reached a wide audience. Unfortunately, Kerr's article lends undeserved credibility to controversial claims.

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Response: My article does not address the credibility of Russell's claim of detecting Venusian lightning. It merely points out that, as Cloutier must agree, no one is any longer claiming a connection between Venusian lightning and volcanoes. The quote from Esposito—"It's absolutely well established"—refers to the preceding discussion of a decrease in atmospheric sulfur but was inappropriately juxtaposed with the following quote about volcanoes.

—RICHARD A. KERR

Snail Toxins

A recent pair of articles by Marcia Barinaga (Research News, 20 July, p. 250) was concerned with the toxins that are used in predation by "voracious killer snails" and the possible significance of those conal toxins for medicine and other disciplines.

The exotic cone snails are generally distributed in tropical or warmer subtropical environments and represent a rather unique group of marine gastropods. There are smaller snails that are distantly related to *Conus* that also use neurotoxins for hunting small temperate water invertebrate animals such as spionid polychaete worms. Their feeding behaviors are every bit as dramatic as those shown by the *Conus* spp., but since the boreal members of the Turridae are smaller and less brilliant in pattern and coloration, they are not frequently noticed or studied.

Some years ago I investigated *Lora trevelliana*, a small circumboreal turrid, in Danish and Scottish waters (*1*). How they located and approached their prey is similar to the behavior of many of the cone shells. The final thrust of the "dart" was also similar, as was the fate of the prey. Since *Lora* and

related forms are in boreal and temperate marine waters, they should be excellent subjects for studies by the neuroscientists located in the northern hemispheres who are concerned with variations in the efficacy of marine neurotoxins.

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Roddier Wavefront Sensor

M. Mitchell Waldrop's article "Astronomers try to put Mauna Kea 'into space' " (Research News, 31 Aug., p. 987) provides an account of some of the gains that astronomers are now seeking by application of adaptive optical systems to telescopes. As has been described many times, such systems compensate for the wavefront distortion that results from atmospheric turbulence (imperfect "seeing"), thereby producing diffraction-limited images at the focus of a telescope; for a brief survey of the field see (*1*).

The two essential components of any adaptive telescope are (i) a deformable mirror upon which a starlit image of the primary mirror is formed, and (ii) a two-dimensional sensor that measures the changing pattern of wavefront distortion across the image of the primary mirror and continually feeds back this information to the deformable mirror to compensate for the atmospheric turbulence. Various types of deformable mirrors and wavefront sensors are in stages of research, development, and testing by different research groups. The best known type of wavefront sensor today is probably the Hartmann-Shack; it measures the *tilt* of elements of the wavefront as imaged on the primary.

Waldrop reports on an innovative wavefront sensor proposed by F. Roddier and C. Roddier (*2*). It responds to the *curvature* of wavefront elements. Unfortunately, Waldrop's account leaves the strong but incorrect impression that F. Roddier's instrument does not rely on reference stars. In fact, any adaptive telescopic system requires a reference star, whether it is the object of investigation, or a nearby star, or perhaps one or more artificial sodium stars generated by a focused laser beam high in the earth's atmosphere. The use of such sodium stars in the mesosphere, at an altitude of about 92 kilometers was proposed by Foy and Labeyrie (*3*) and by Gardner, Thompson, and Welsh (*4*).

The Roddier wavefront analyzer, when further developed, may indeed turn out to be simpler than the Hartmann-Shack. It may also be well suited for driving a membrane-type deformable mirror. No quantitative estimate of the anticipated gain in sensitivity seems to be available, but I know of no reason why a very large gain should be expected. In any event, it is to be hoped that development work on the Roddier wavefront sensor will be speeded so that it can be tested soon.

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Science Curriculum Reform

Marcia Barinaga's article "Bottom-up revolution in science teaching" (News & Comment, 31 Aug., p. 978) distorts the nature of the Scope, Sequence and Coordination (SC&C) project. This project is not simply copying what is done in the Soviet Union. The statement in the title that the program "relies on Soviet principles," referring to my supposed "Soviet epiphany," and equating our project with "Mao's Little Red Book" trivialize what has become the most important reform in science education since Sputnik. And why the excessive references to Communist countries? We discussed France, England, and Japan just as much. Such references convey a certain negative image to some in our society. Thirty-five years ago this was called "red-baiting."

The portrayal of Tom Sachse's California project as somehow being in conflict with the national effort has done all of us a disservice. At no time did I suggest that we needed "control from the top." All of our project centers have teachers central to the development and trial process. My concern was that resources in California might not