volume of subducting material reaches a critical amount, however, it initiates a flushing event, which drains the subducted material into the lower mantle. In this way, the seismic observations can be reconciled.

The endothermic phase change could explain another paradox in the mantle. The lateral seismic-velocity structure seen in tomographic images of the mantle[10,11] is dominated by long wavelengths; this is not what would be expected from calculations of high-Rayleigh-number convection in a uniform fluid[12,13]. But when we add the endothermic phase transformation to 3D calculations, the downgoing flow accumulates in the upper mantle, creating large, spatially coherent anomalies. This new feature could account for the long-wavelength thermal anomalies.

Although the lack of continents and plates on the surface of the modelled spherical shell means that the mantle still retains some mysteries, Tackley and his colleagues have demonstrated that 3D calculations of mantle convection in the Rayleigh number range appropriate for the Earth are now truly possible. Numerical investigations in 3D spherical geometry are important to tie in dynamical predictions with observations, although it would be good to investigate thermodynamic properties closer to those of the real mantle[14]. The greater challenge is to add laterally varying viscosity to 3D calculations. □

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CONSERVATION GENETICS

Breeding like flies

Katherine Ralls and Robin Meadows

BREEDING rare and endangered animals in captivity is like gambling — the stakes are high and the outcome is uncertain. Although theories for breeding animals in captivity are widely accepted and applied, there has been little experimental support for them because of the small numbers of animals involved, their long generation times and the expense of maintaining them. Now a team of Australian researchers led by Richard Frankham provides both welcome confirmation of current captive breeding strategies and some disturbing surprises[1–5].

Scientific consensus holds that captive endangered species such as the golden lion tamarin (see picture, over) must be managed to preserve genetic variation, which will maximize their reproduction and survival in captivity as well as their ability to adapt to future environmental changes when returned to the wild. Current breeding strategies designed to preserve genetic variation in small captive populations are rooted in population genetics theory[6,7]. Because this theory is based on a simple model that fails to account for natural selection, genetic mutation and linkage, and other phenomena[8], it is important to test the theory's predictions experimentally.

To circumvent the problems of using vertebrates, the Australian team used fruit flies (*Drosophila melanogaster*), which can be raised in great numbers easily and inexpensively. Moreover, *Drosophila* have been well characterized genetically and they are good genetic models for vertebrates[9–11].

The experiments began with an outbred *Drosophila* population founded with 202 inseminated females. Although the exact design varied from experiment to experiment, in general several replicate populations were managed according to a specific breeding strategy and their genetic diversity and fitness then compared with those of a randomly bred control population. Measures included genetic variation, which was gauged by allozyme electrophoresis; mean inbreeding coefficient, which was calculated from population pedigrees; and reproductive fitness after several generations of management, which was defined as the number of progeny from the managed *Drosophila* relative to the number from a chromosomally marked baseline strain.

As predicted by population genetics theory, the experiments show that loss of genetic variation in captive populations is slowed by three strategies: equalizing the genetic representation of each wild-caught animal used to found the descendant captive population[1], equalizing the sizes of the families derived from each animal[2] and equalizing the sex ratio of breeding adults (R. Frankham, personal communication).

Equalizing the representation of founders is necessary because some usually produce more offspring than others, making their genetic contributions to the descendant population unequal. Founder representation can be equalized in subsequent generations by limiting the reproduction of individuals descended from prolific founders and encouraging the reproduction of those descended from less prolific founders[1].

RÉSUMÉ

Fishy business

THE discovery of a new kind of antibiotic in the skin of frogs followed when it struck M. Zasloff that *Xenopus* never caught infections when tossed back into the tank after surgery. This set in train a search among the obscurest animal tissues, which turned up alkaloids, lipids and peptides with interesting bactericidal properties. The latest such find reported by Zasloff and colleagues (K. S. Moore *et al.*, *Proc. natn. Acad. Sci. U.S.A.* **90**, 1354–1358; 1993) occurs in the stomach of a shark. Termed squalamine, it is a sulphated bile salt, conjugated to spermidine, and is highly active against Gram-positive and Gram-negative bacteria; it is, moreover, fungicidal and induces lysis of protozoa. The authors speculate that squalamine acts as a systemic antimicrobial agent in the shark, but how it might do so is a mystery.

Winter warmer

PARTS of North America and northern Eurasia may have been warmer in winter as an indirect consequence of volcanic eruptions (A. Robock and J. Mao, *Geophys. Res. Lett.* **12**, 2405–2408; 1992). Looking through temperature records back to 1883, they found that all 12 of the largest eruptions were followed by unusually mild winters in those parts, but colder than average winters in the Middle East. The pattern developed in the first winter following eruptions in the tropics, but could be delayed until the next year for eruptions at higher latitudes. It seems that absorption of sunlight by volcanic aerosols warms the tropical stratosphere, strengthening the Equator-to-Pole temperature gradient; the stronger winds that ensue bring warmer marine air over the continents. On average, though, the overall effect of an aerosol shadow is to lower ground temperatures globally for several years.

Risk perception

THE consequences of an epidemiological study that went off at half-cock are described by T. L. Guidotti and P. Jacobs in the *American Journal of Public Health* (**83**, 233–239; 1993). Early in 1987, a draft report showing a 25% excess of cancers in two suburbs of Edmonton, Alberta, received wide currency. The report was in error, but before that was made public Guidotti and Jacobs enlisted the help of an investigative reporter and carried out surveys of a variety of responses to the perceived hazard. People seem in general to have reacted in a remarkably robust manner, though house prices fell by some 5%. The cause of the error, it turned out, was that the population of one suburb had not been counted in the 'population at risk', though its cancer incidence had been.