FIG. 2 *Discosauriscus*, a small, probably larval seymouriamorph from the Lower Permian of the Czech Republic. Calibrated scale bar, 5 cm. (Science Museum of Minnesota; photograph by A. M.)

apparently centred on equatorial Euramerica, was largely a process of ecological niche-hopping within a single continent. The new material raises the possibility that different tetrapod groups diversified in parallel in different regions of the equatorial belt and subsequently extended their geographical ranges, interacting with each other as they did so. Given that we have a reasonably coherent Carboniferous-to-Lower Permian record only in Euramerica, we might look to it to provide circumstantial evidence of immigration of groups from elsewhere. This would manifest itself as the sudden appearance in the fossil record of abundant or diverse distinctive groups with no apparent antecedents or close relatives within Euramerica. The tetrapod group that most plausibly fulfils this criterion is the Seymouriamorpha.

The seymouriamorphs are agreed to be close relatives of the true amniotes, although they retain gill-bearing larvae and lateral-line canals. The best-known genus, *Seymouria*, was for many years considered to be the earliest reptile. Well-dated seymouriamorphs first appear suddenly and simultaneously in the earliest Permian of Euramerica (New Mexico, Utah, Texas, France, Germany and the Czech Republic), with no Late Carboniferous relatives whatsoever. Their consistent position on recent cladograms (see ref. 11, for example) implies that they were already been present in the Early Carboniferous, and yet several rich Late Carboniferous vertebrate assemblages in Euramerica include relatives of almost every other Early Permian group, but no seymouriamorphs. Not only this, but populations of seymouriamorph larvae ('discosauriscids'; see Fig. 2) are found in Permo-Carboniferous beds of imprecise age on the Kazakhstan and Tarim continental plates, in strata where no other tetrapods have been found. Several of these central Asian 'discosauriscid' genera (*Ariekanerpeton*[12], *Urumqia*[13], *Utegenia*[14]) have been named, and one of them, *Utegenia*, appears to be one of the most primitive seymouriamorphs[15].

An orthodox interpretation might be that seymouriamorphs filled a niche that made their preservation unlikely until the beginning of the Permian, at which point taphonomic circumstances changed and they were suddenly abundantly preserved, both in Euramerica and in those plates newly accreting to Euramerica in the Lower Permian. However, with tetrapods also diversifying in East Gondwana in the Early Carboniferous, it is equally possible that seymouriamorphs first appeared there and, instead of spreading westwards, spread or hopped north across the chain of North China, Tarim and Kazakhstan plates during the Upper Carboniferous (Fig. 1*a*), bursting onto the Euramerican scene in the Early Permian when the Kazakhstan plate finally sutured with Euramerica[8] (Fig. 1*b*). These alternatives are potentially testable, depending on where well-dated Carboniferous seymouriamorphs are ultimately demonstrated to have occurred. □

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Erratum

In Laurence Hurst and Gilean McVean's News and Views article published last week (*Nature* **381**, 650–651; 1996), dealing with asexuality in endosymbiotic bacteria, the bars in the diagram were incorrectly described in the caption. Blue shows the ratio of mean non-synonymous to mean synonymous substitutions per nucleotide site in the endosymbiont *Buchnera*; red the ratio in the free-living enterics *Escherichia coli* and *Salmonella typhimurium*.

DAEDALUS

Noise annoys not

These days, our ears are too sensitive for their own good. Primitive tribes, with only natural sounds to listen to, retain their acute hearing into late age. Modern civilization, however, batters our ears into early deafness. They have a natural protection mechanism, but it badly needs upgrading.

It uses two tiny muscles, the tensor tympani and the stapedius, which reduce the ear's sensitivity by stiffening the joints of its transmission bones. They are tensed automatically by loud noise. They worked well in prehistoric times, when most noises built up slowly. But they cannot react fast enough to modern bangs and crashes, and sustained uproar fatigues them. Daedalus wants to warn them of noise in advance.

A sound wave launched upwards into the atmosphere, he notes, can be tracked by radar. The density gradient of the wave reflects the radar beam. So he is scaling the idea down. He is devising a little diode-radar placed next to the ear, which scans the nearby air for the density signature of an approaching noise. A mere metre of range would give 3 milliseconds of advance warning, ample time to tighten the defending muscles against the coming crash.

At first Daedalus intended to tense the muscles with a small electric shock, but soon realized that this would be more distressing than the noise itself. He then recalled the odd fact that many people can hear audio-modulated microwaves. The tissues of the ear must be electronic rectifiers, able to demodulate a high-frequency carrier. Now high-frequency currents are not painful. So Daedalus's 'Radar Earplugs' will react to loud sound by injecting a painless high-frequency current into each ear, via electrode pads strategically placed around the ear. The ear's gain-control muscles nestle in insulating corridors of bone. Proper siting of the pads could funnel their current largely through those muscles. They will rectify the current and tighten in the resulting d.c., thus turning down the gain before the racket arrives. They will keep it down as long as necessary — long after the nerve serving them would have succumbed to fatigue.

Radar Earplugs will be small and neat enough to masquerade as earrings, or fit on spectacle frames. You will hardly notice their action; your hearing will seem just as acute. Yet sudden loud sounds will cease to startle you, and sustained cacophony will seem far less fatiguing. Wear them regularly, and you will retain pin-sharp hearing well into senility — unless you foolishly bypass your own defences with a personal stereo.

David Jones