The following sources, dating back as early as 1969, beg to differ

PALEONTOLOGY

Homoplasy in the Mammalian Ear

Thomas Martin and Zhe-Xi Luo

The similarity among structures that arose through independent evolution instead of descent from a common ancestor is termed homoplasy and is a major feature of evolutionary morphology. A fascinating but very difficult question facing evolutionary biologists is whether a complex structure would be less likely than a simple structure to undergo independent homoplastic evolution (*1*). On page 910 of this issue, Rich *et al*. (*2*) partially answer this question with their analysis of the dentary bone from the lower jaw of an Early Cretaceous fossil monotreme called *Teinolophos*, an extinct relative of Australia's modern platypus and echidna. The new fossil find offers fresh anatomical evidence to support the hypothesis that a key evolutionary innovation among modern mammals—the separation of the middle ear bones from the mandible—must have evolved independently among the monotreme mammals and the therians (marsupials and placentals).

The tiny bones of the middle ear that are used for hearing render modern mammals—including placentals, pouched marsupials, and egg-laying monotremes—unique among vertebrates (*2*). The middle ear bones are the malleus, incus, and stapes, and in addition there is the tympanic bone, which supports the tympanic membrane, enabling it to receive sound. The tympanic, malleus, and incus are homologous to bones in the mandible and jaw hinge (the angular, articular, and quadrate, respectively), which are required for feeding in nonmammalian vertebrates (*3*–*5*). There is also extensive evidence from fossils of extinct cynodont and mammaliaform relatives of modern mammals suggesting that the angular, articular, and quadrate bones in these creatures were used for hearing while still attached to the mandible and jaw hinge (*6*, *7*). Evolution of the mammalian jaw joint and middle ear represents a classic example of the phylogenetic transformation of a complex functional structure that can be read directly from fossil evidence.

the Mammalian Middle Ear

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The structure and evolution of the mandible, suspensorium, and
mmal-like reptiles and early mammals are examined in an attempt
how, why, and when in phylogeny the precursors of the mamma-
ic bone, malleus, and incus (postdentary jaw elements and quadrate)
ction in the reception of air-borne sound. The following conclusions

ble that at no stage in mammalian phylogeny was there a middle
to that of "typical" living reptiles, with a postquadrate tympanic
ontacted by an extrastapes. The squamosal sulcus of cynodonts and
sids, usually thought to have housed a long external acoustic meatus,
l a depressor mandibulae muscle.
ids an air-filled chamber (recessus mandibularis of Westoll) extended
eflected lamina and into the depression (external fossa) on the outer
angular element. A similar chamber was present in sphenacodontids
deus musculature occupied the small external fossa. The thin tissues
the recessus mandibularis served as eardrum. Primitively, vibra-
d the stapes mainly via the anterior hyoid cornu, but in dicyno-
cephalians, and cynodonts, vibrations passed mainly or exclusively
ble to quadrate to stapes and the reflected lamina was a component
m.