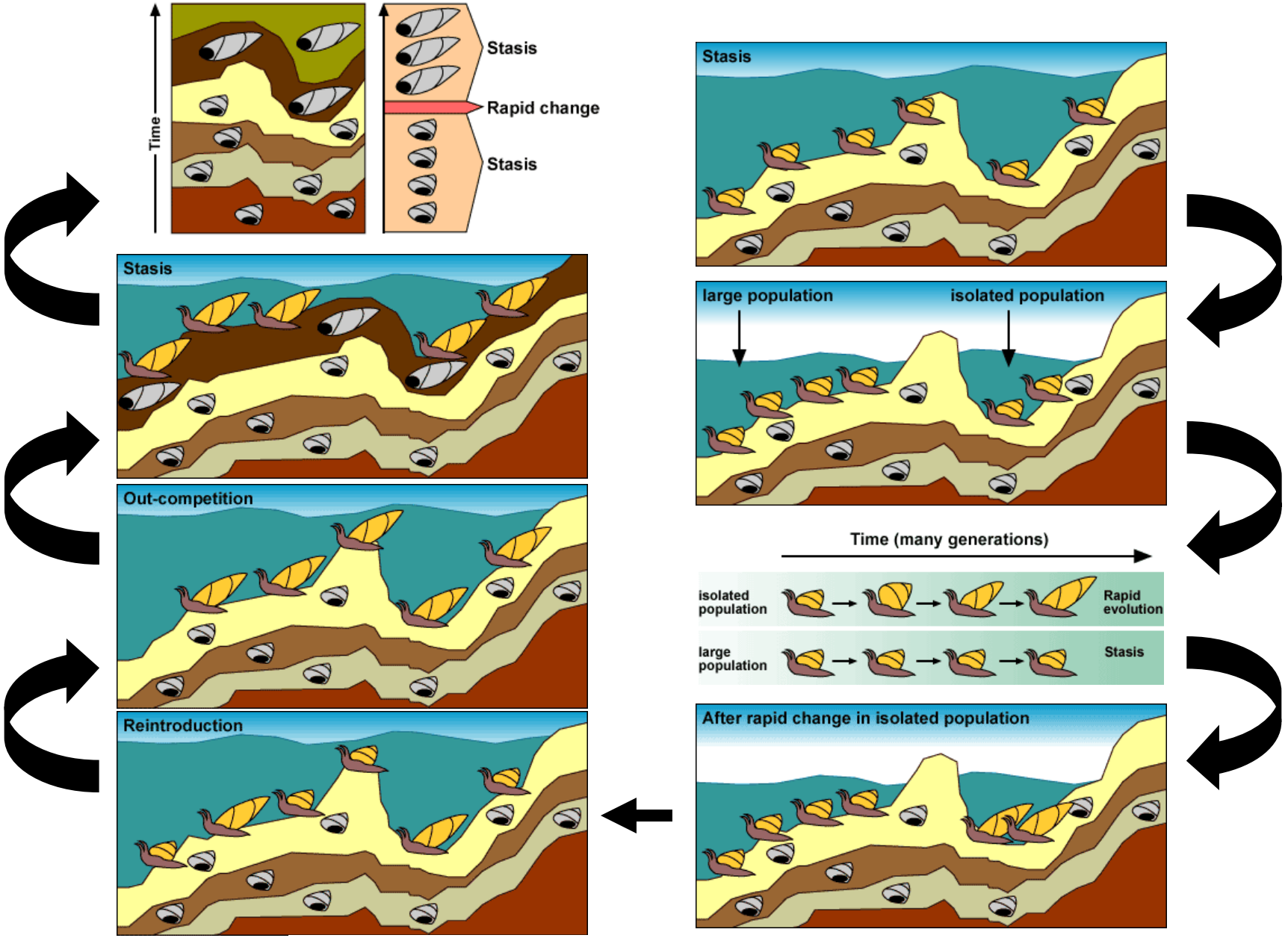
Example of Punctuated Equilibrium in Snails



Punctuated Equilibrium

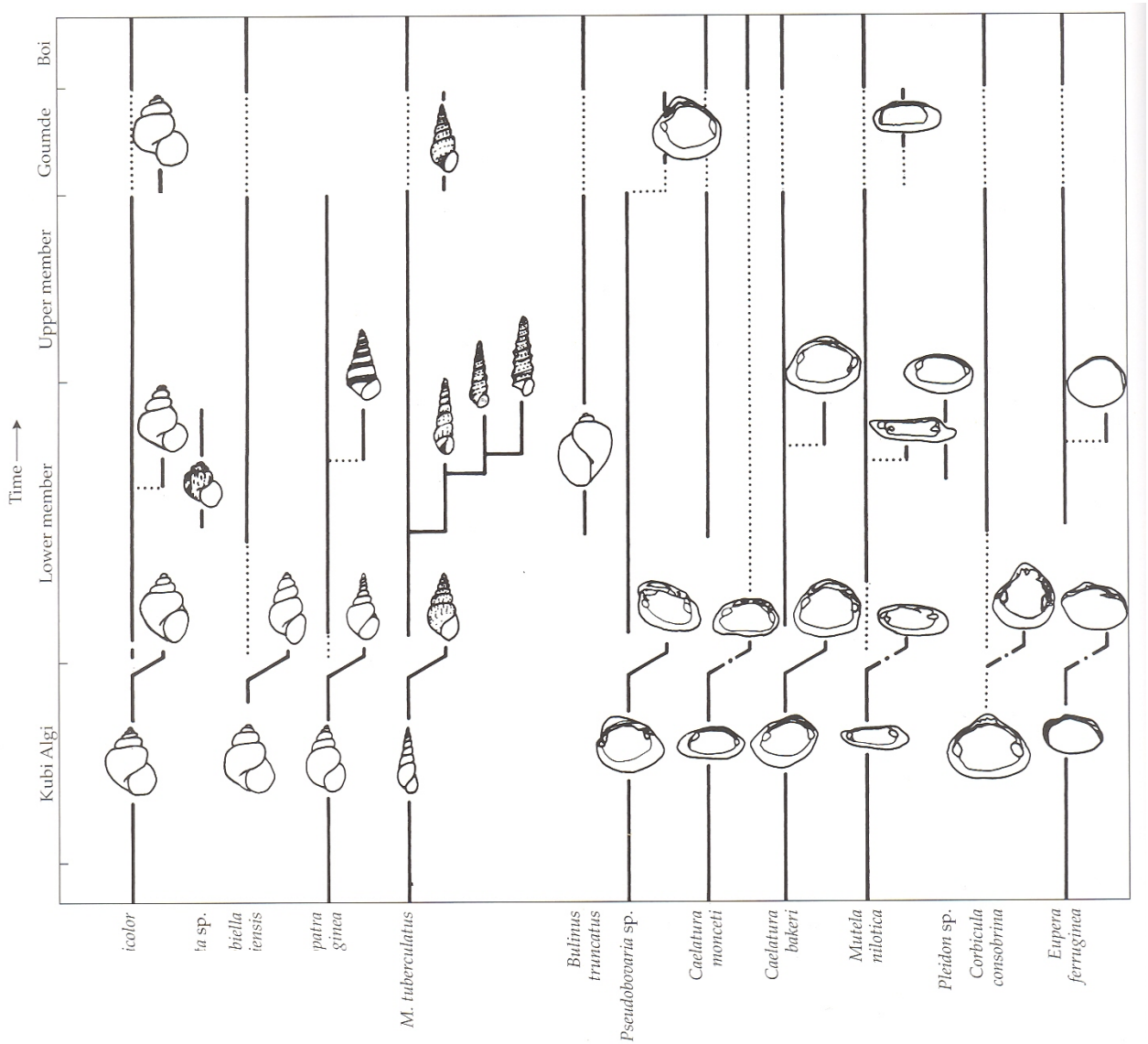


FIGURE 7.4 "Punctuated" equilibrium in the evolution of fossil mollusks in Lake Turkana Basin in eastern Africa. The diagram depicts the reconstructed history of shell morphology in several genera. Dotted lines indicate inferred changes during periods when no fossils have been recovered. Note that most lineages exhibited long periods of virtual stasis followed by rapid, substantial change. The latter, punctuational events often occurred either (1) virtually simultaneously in several different lineages, suggesting major environmental changes, such as shifts in lake level owing to climatic change (confirmed by other evidence); or (2) in association with speciation events, which often left one species virtually unchanged while the other species diverged substantially. (After Williamson 1981.)

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Allopatric Speciation

http://wps.pearsoncustom.com/wps/media/objects/3014/3087289/Web_Tutorials/18_A01.swf

Allopatric Speciation: Vicariance Event

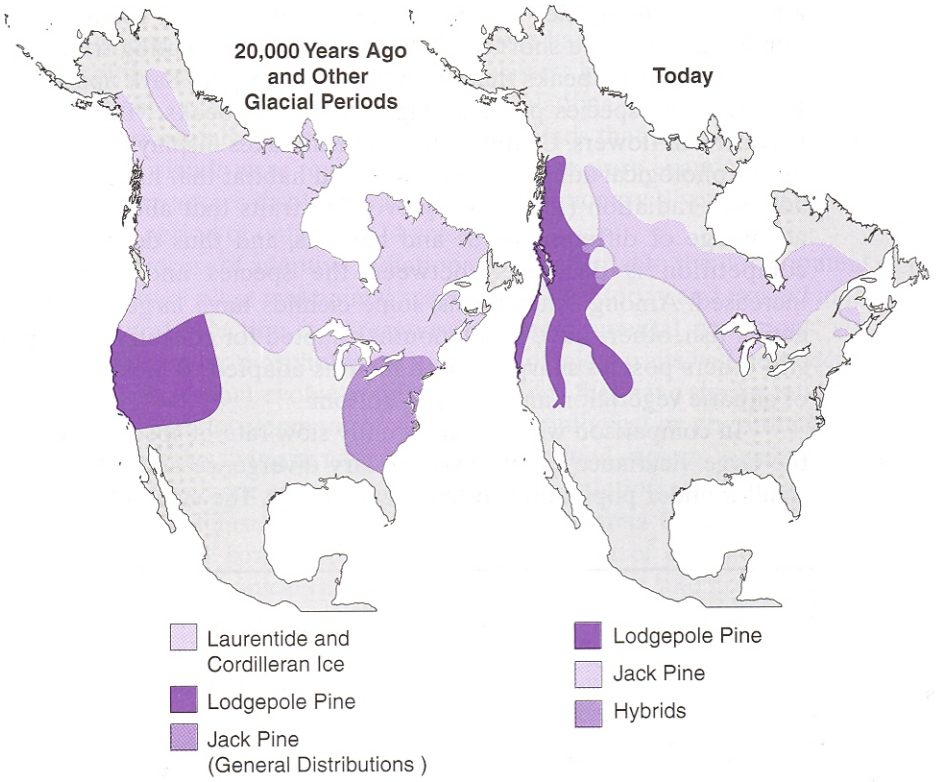
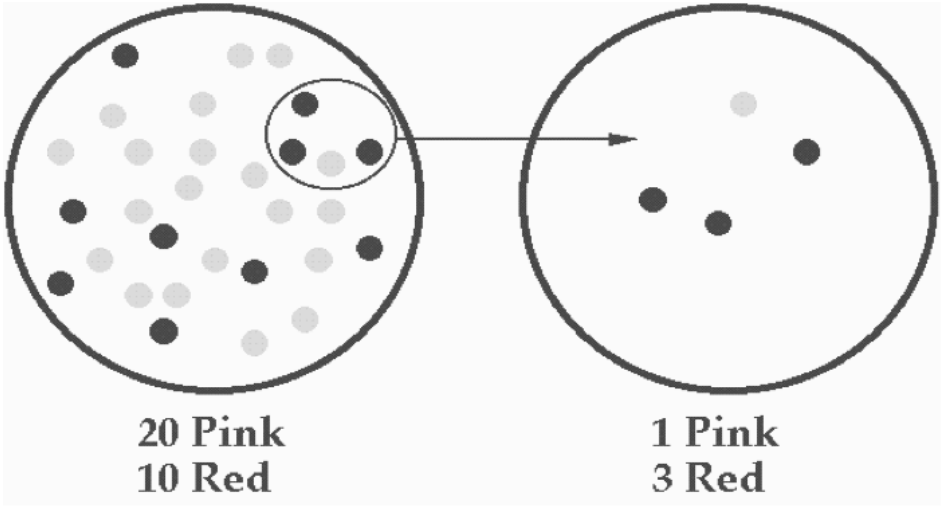


FIGURE 9.6 The modern distribution of two closely related tree species, lodgepole pine *(Pinus contorta)* and jack pine *(Pinus banksiana)*. It is thought that divergence and the development of these two species occurred allopatrically when Pleistocene glaciations split the ancestral pine distribution into separate western and eastern populations.

Allopatric speciation, founder event

Genes rare in original population are dominant in founding population



research.umbc.edu/~farabaug/biol100/overheads/lect17over.html

Sympatric and Parapatric Speciation

sympatric: extensive overlap

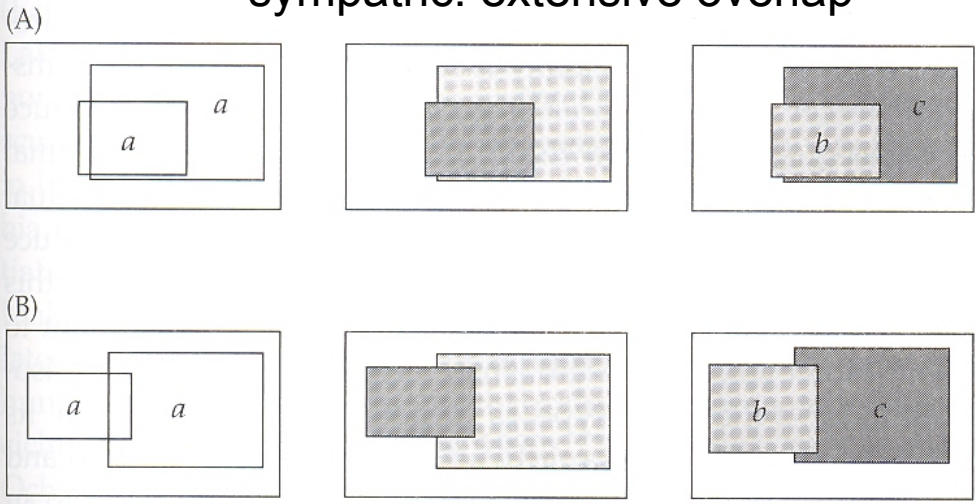


FIGURE 7.15 Illustration of sympatric and parapatric speciation. In sympatric speciation (A), two populations of ancestral species *a* overlap extensively when population differentiation begins and maintain extensive contact throughout the speciation process until new species (*b* and *c*) are recognized. Alternatively, in parapatric speciation (B), overlap occurs only along a narrow zone of contact between populations of ancestral species *a* and throughout the course of the speciation process. (After Brooks and McLennan 2002.)

parapatric: minimal overlap (partial geographic separation)

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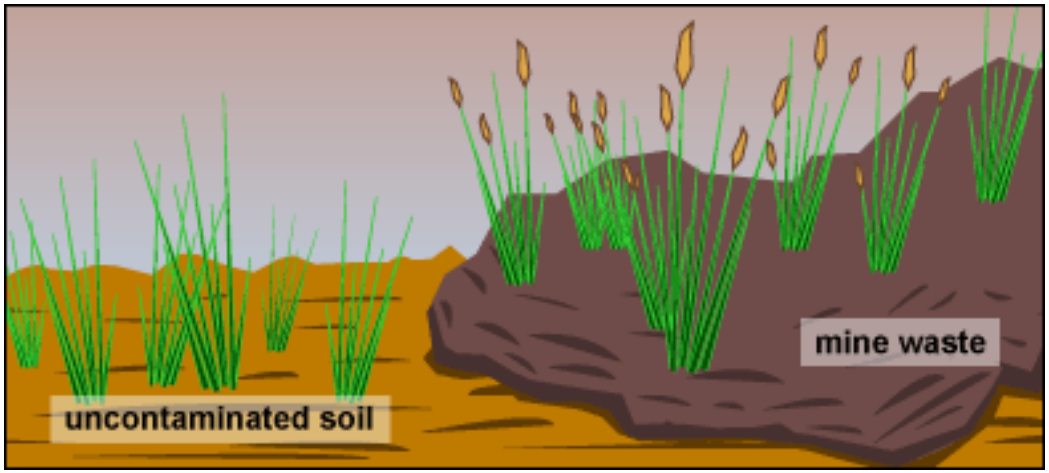
Parapatric Speciation

No extrinsic barrier to gene flow, but…

1. restricted gene flow within population
2. varying selective pressures across the population range



"Although continuously distributed, different flowering times have begun to reduce gene flow between metal-tolerant plants and metal-intolerant plants. "

evolution.berkeley.edu/evosite/evo101/VC1dParapatric.shtml

Example of Sympatric Speciation

apple maggot flies

apples

hawthorns

Gene flow has been reduced between flies that feed on different food varieties, even though they both live in the same geographic area.

- 200 years ago, flies only on hawthorns
- then, introduction of domestic apple
- females lay eggs on type of fruit they grew up on; males look for mates on type of fruit they grew up on
- restricted gene flow
- speciation

http://evolution.berkeley.edu/evosite/evo101/VC1eSympatric.shtml

Example of Sympatric Speciation

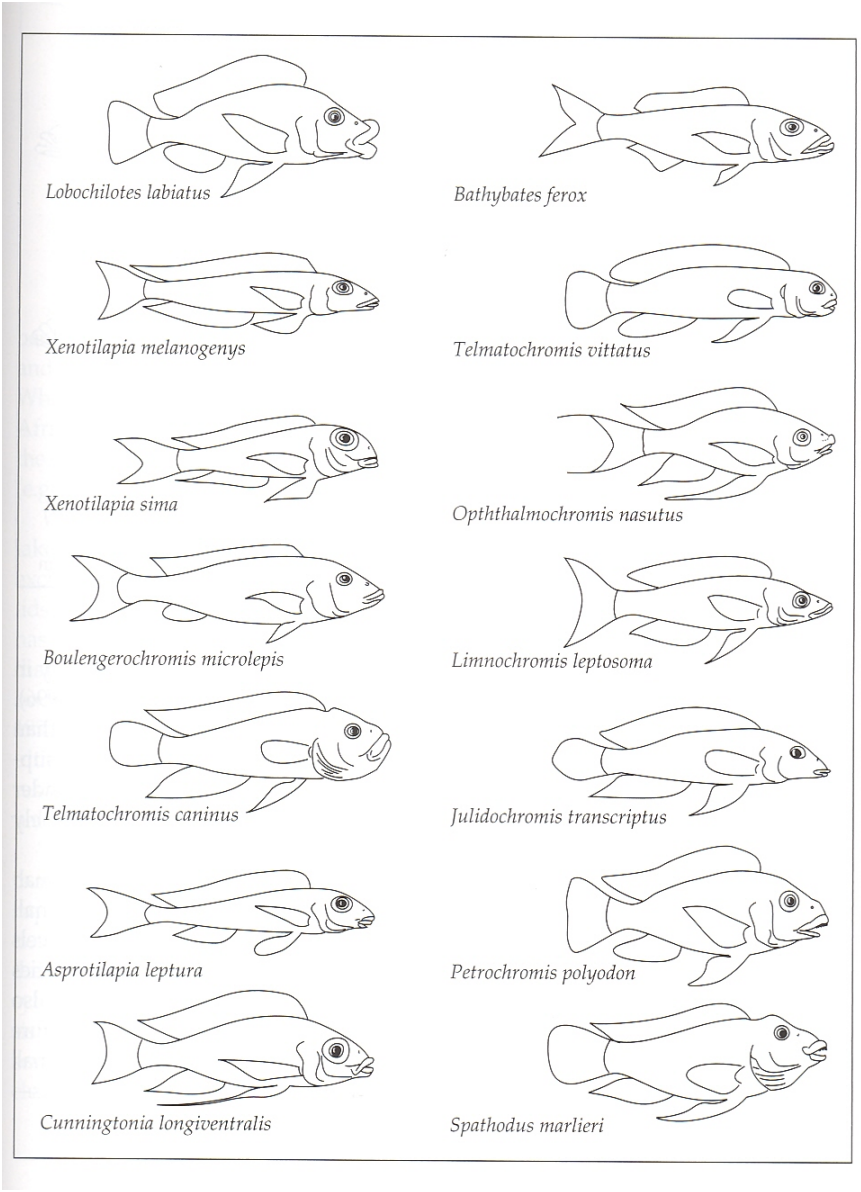


FIGURE 7.16 Examples of the variety of body forms resulting from adaptive radiation of cichlid fishes in Lake Tanganyika in eastern Africa. (After Fryer and Iles 1972.)

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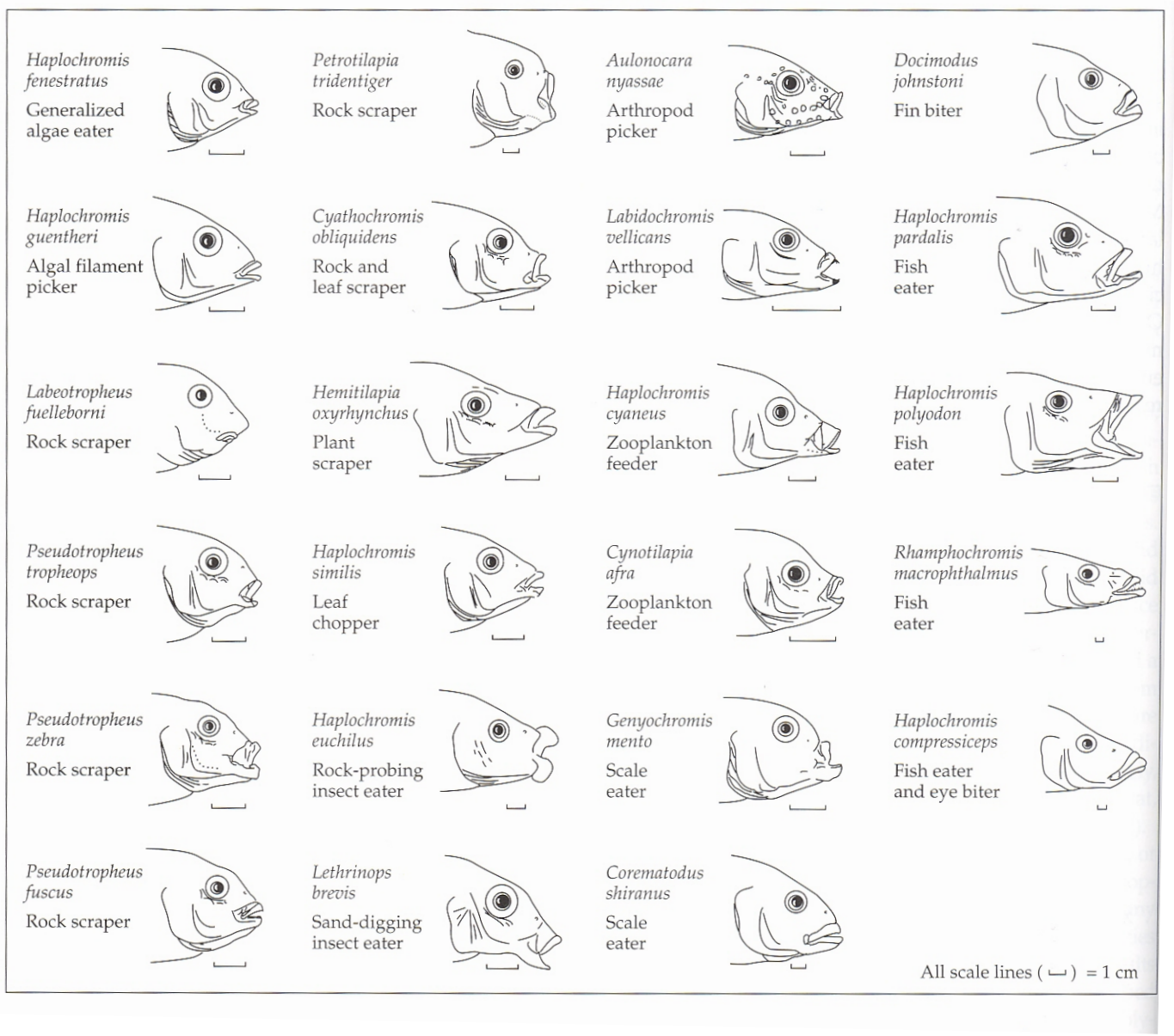
Adaptive Radiation



often rapid speciation:

Lake Victoria: 100s of new species in <12,000 years

FIGURE 7.17 Examples of the variety of head shapes, mouthparts, and feeding habits resulting from adaptive radiation of cichlid fishes in Lake Malawi in eastern Africa. This amazing variation reflects specialization in diet due to natural selection to reduce competition and exploit ecological opportunities. (After Fryer and Iles 1972.)

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Adaptive Radiation

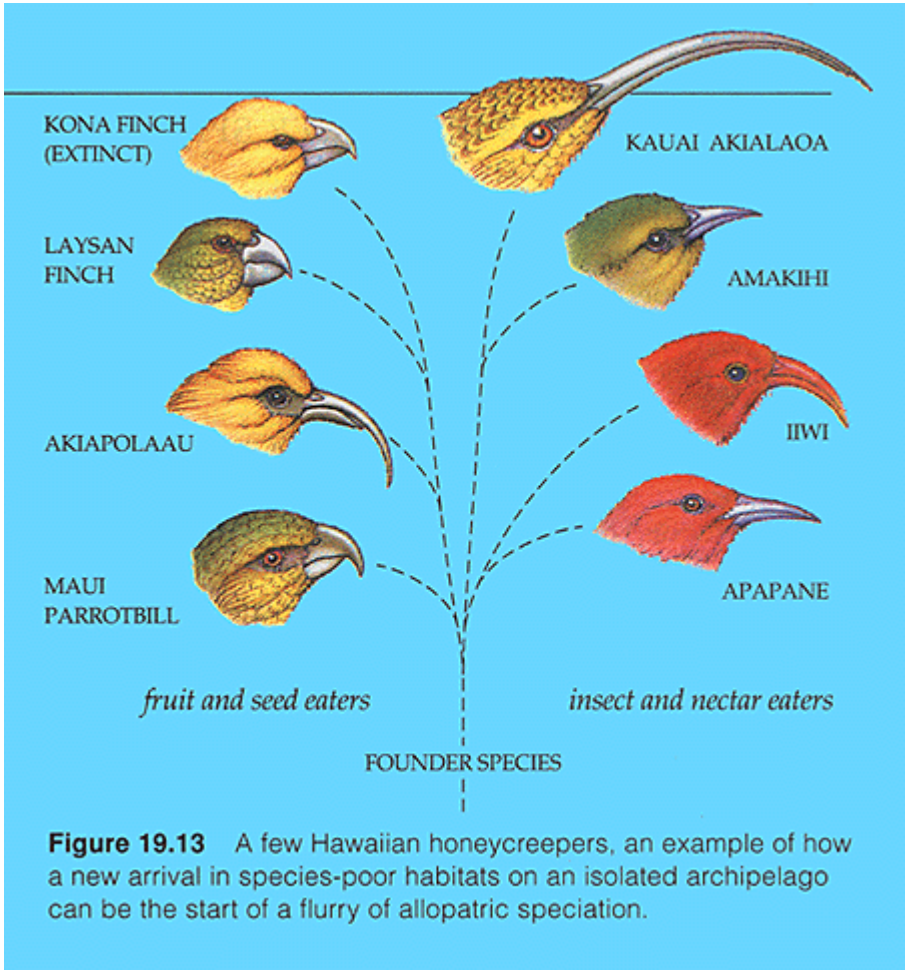
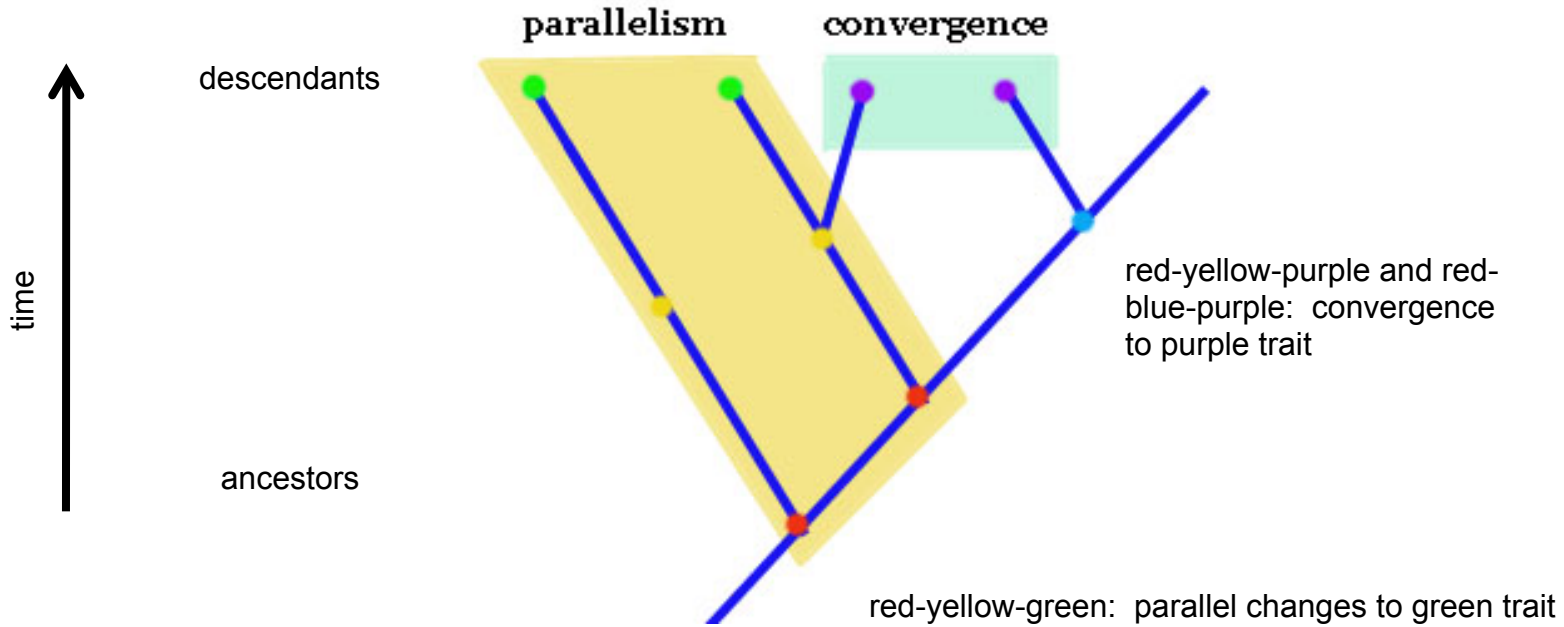


Figure 19.13 A few Hawaiian honeycreepers, an example of how a new arrival in species-poor habitats on an isolated archipelago can be the start of a flurry of allopatric speciation.

www.micro.utexas.edu/courses/levin/bio304/evolution/speciation.html

Parallel and Convergent Evolution



snailstales.blogspot.com/2005/07/sleeping-summer-away-2-converging-in.html

Convergent Evolution

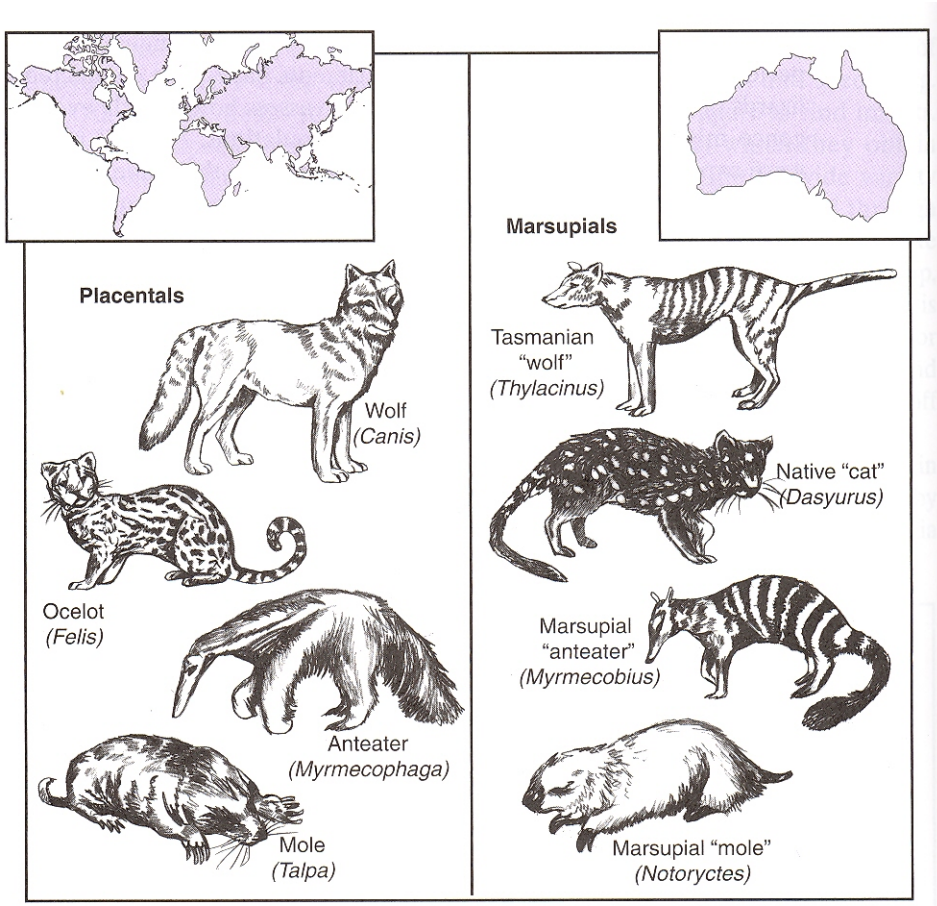
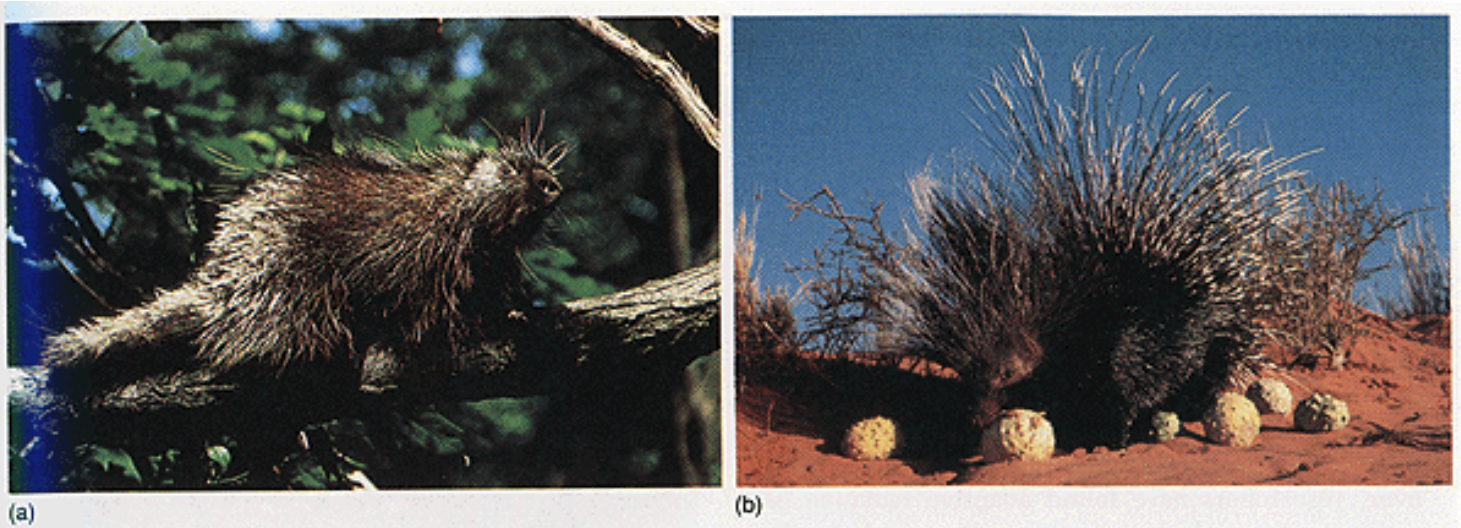


FIGURE 9.8 An example of convergent evolution: mammals and ecologically similar marsupials (after Baker and Garland, 1982).

Parallel Evolution



(a) (b)

Figure 43-13 PARALLEL EVOLUTION IN PORCUPINES.
(a) The American porcupine, *Coendou prehensilis*, and (b) the Old World porcupine, *Hystrix africaeaustralis*, have a common ancestor that lived 70 million years ago, before South America and Africa drifted apart. The porcupines have evolved independently on separate continents to modern forms that are amazingly similar. This is an example of parallel evolution.

www.micro.utexas.edu/courses/levin/bio304/evolution/macroevol.html

Coevolution

flowers pollinated by hummingbirds

- have more nectar and sugar
- are colored to attract the birds
- bloom during hummingbird breeding seasons
- have tubular flowers that force bills to pick up pollen
- have little or no fragrance (hummingbirds have poor senses of smell)

www.montereybay.com/creagrus/hummingbirds.html

Higher rates of extinction for
a) lower population size
b) lower birth/death ratio

higher extinction rate

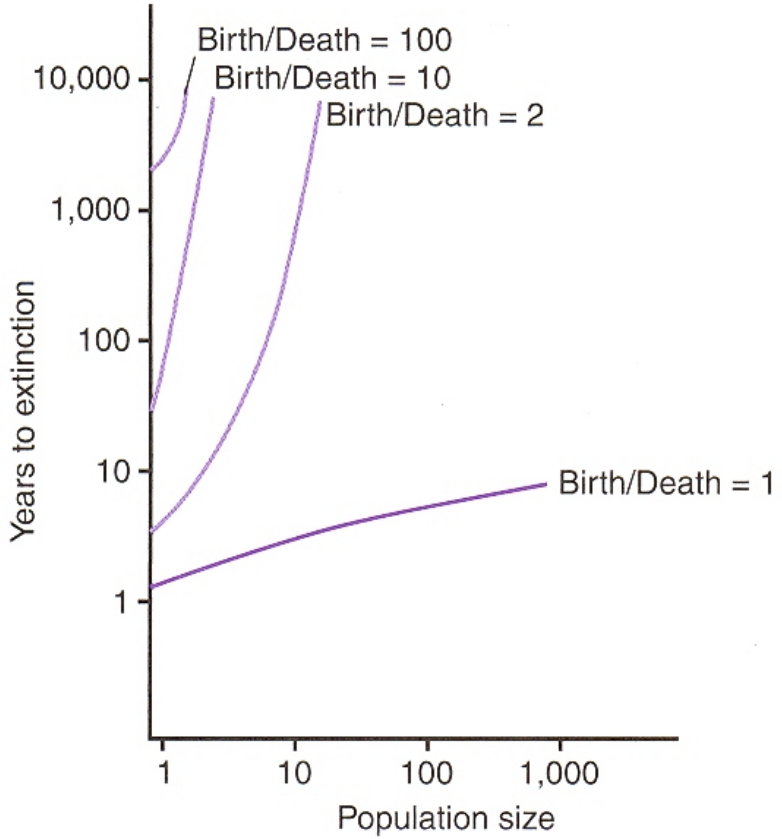
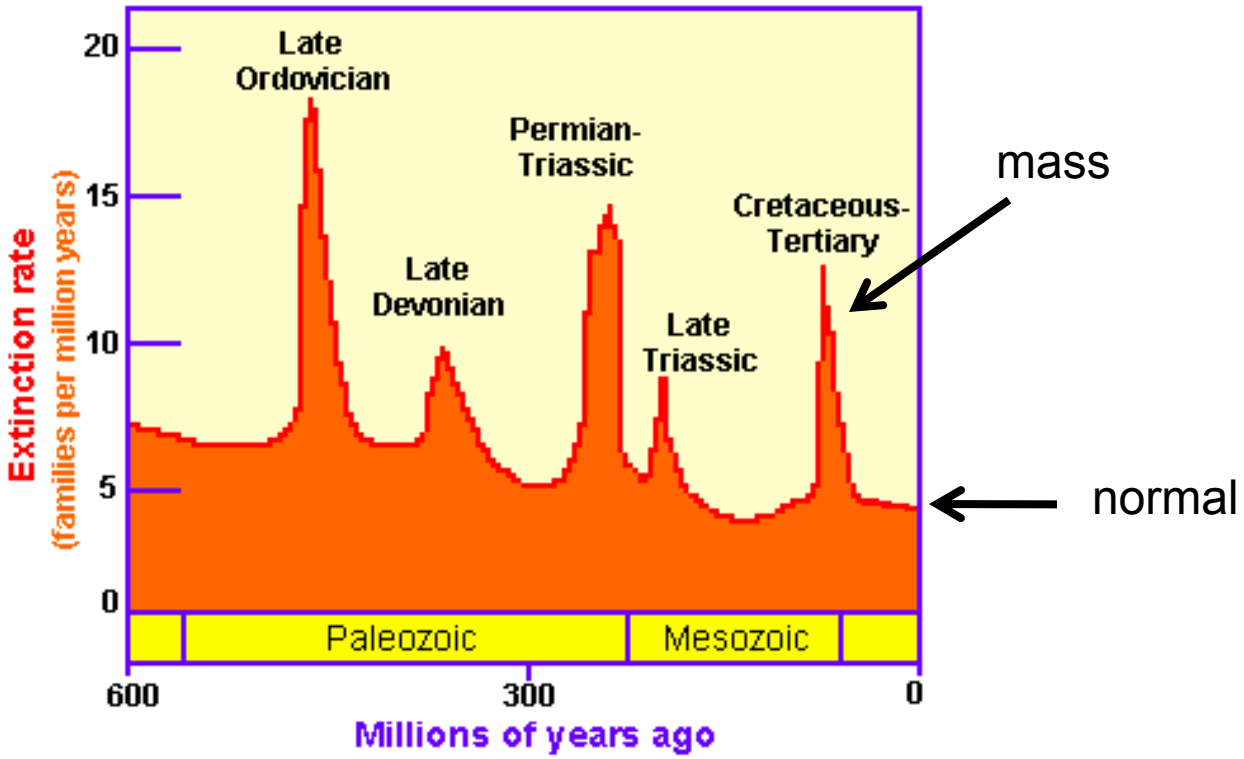


FIGURE 9.11 Mathematical modeling results suggest how the duration of a species prior to extinction is influenced by both population size and the birth rate/death ratio (after MacArthur and Wilson, 1967).

Background (normal) and mass extinctions



www.enchantedlearning.com/egifs/Extinct.GIF

Extinction and Speciation

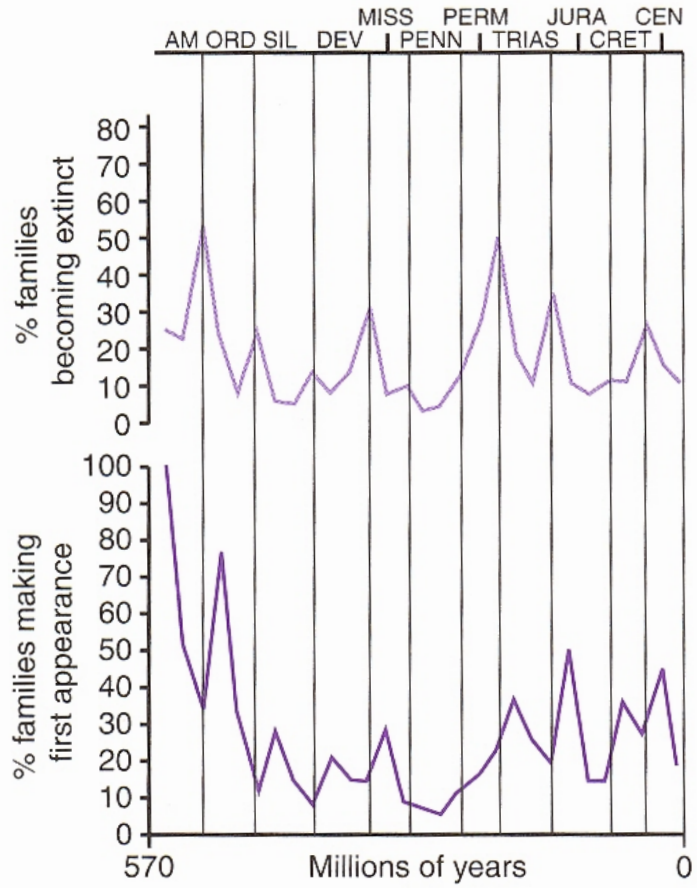


FIGURE 9.12 The relationship between mass extinctions and speciation (after Newell, 1967; Grant, 1991).

Extinction and Speciation

www.paleozoic.org/tucson/gallery-pics/fossils-fs/black-hills-trex-2.jpg

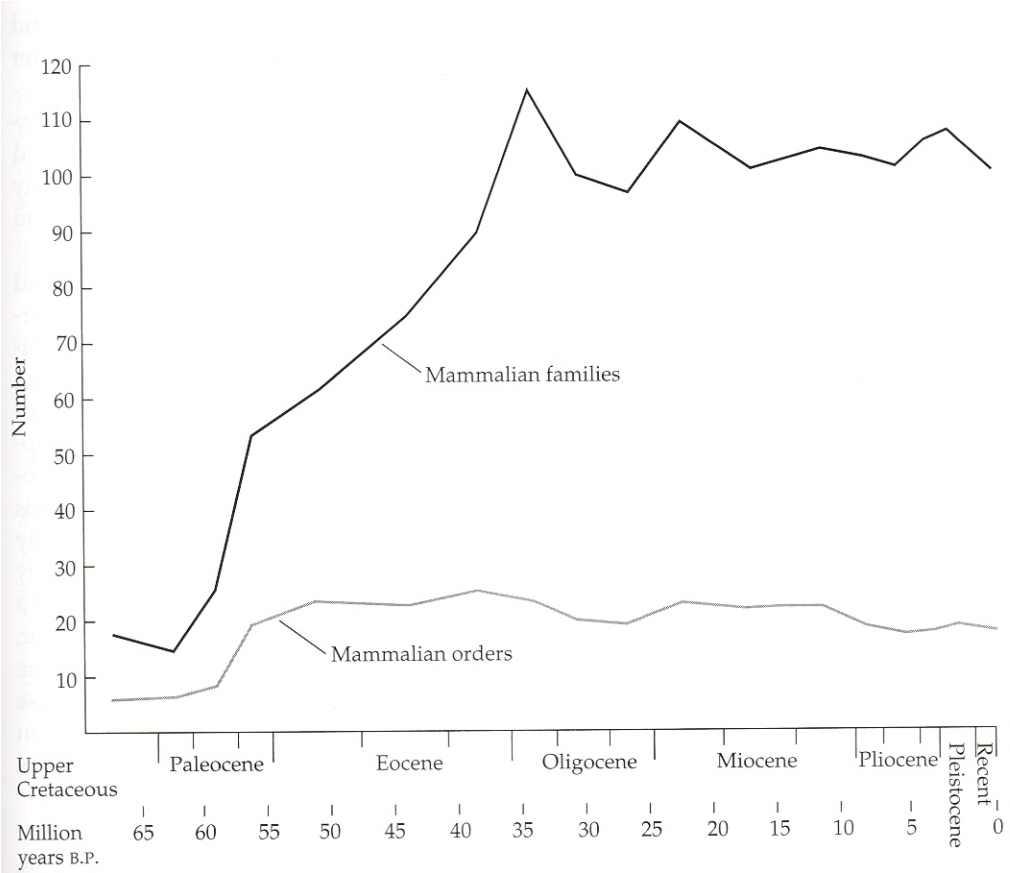


FIGURE 7.25 The "explosive" radiation of placental mammals during the Cenozoic, illustrated by the rapid increase in number of families. This radiation occurred after the K-T mass extinction event as mammals diverged and specialized to take advantage of ecological opportunities presented by the extinction of dinosaurs and other groups of previously dominant reptiles. (After Lillegraven 1972.)

Lomolino et al. , 2006