

# Pre AP Biology

Geologic Time and Processes (7.3)

Part 1

# James Hutton

## Theory of Gradualism



# Young Mountains Appearance





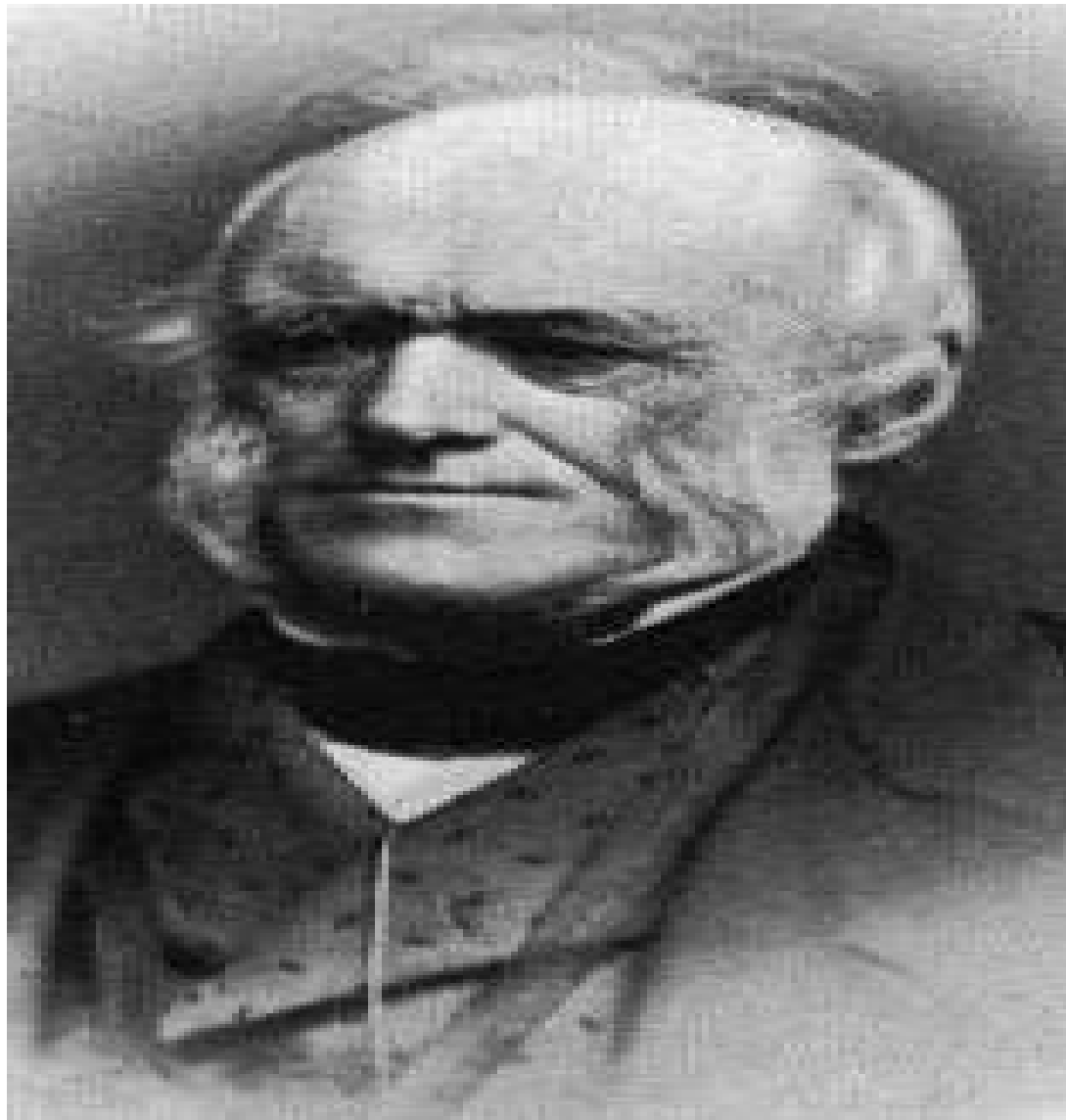
# Old Mountain Appearance

After Hundreds of Thousands year of weathering  
and erosion



# Charles Lyell

## Theory of Uniformitarianism





# New Erosion on a roadside





# Erosion over Millions of Years in the Grand Canyon of Arizona



# Thunderstorms with Rain now





# Thunderstorms Billions of Years Ago



# Examples of fossils





# Examples of fossils



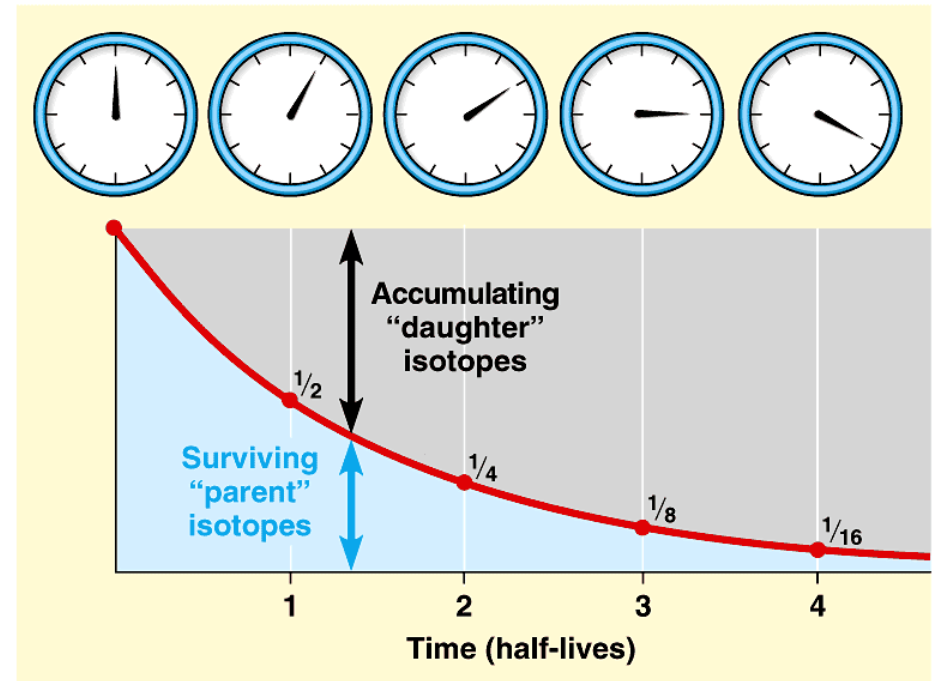


# Absolute “radiometric” dating

## Half-life of elements






















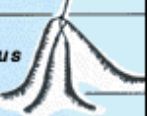


Isotope		Half-Life of Parent (y)	Effective Dating Range (y)
Parent	Daughter		
uranium-235	lead-207	710 million	> 10 million
potassium-40	argon-40	1.3 billion	10 000 to 3 billion
carbon-14	nitrogen-14	5730	up to 50 000

## Half-life relative to time



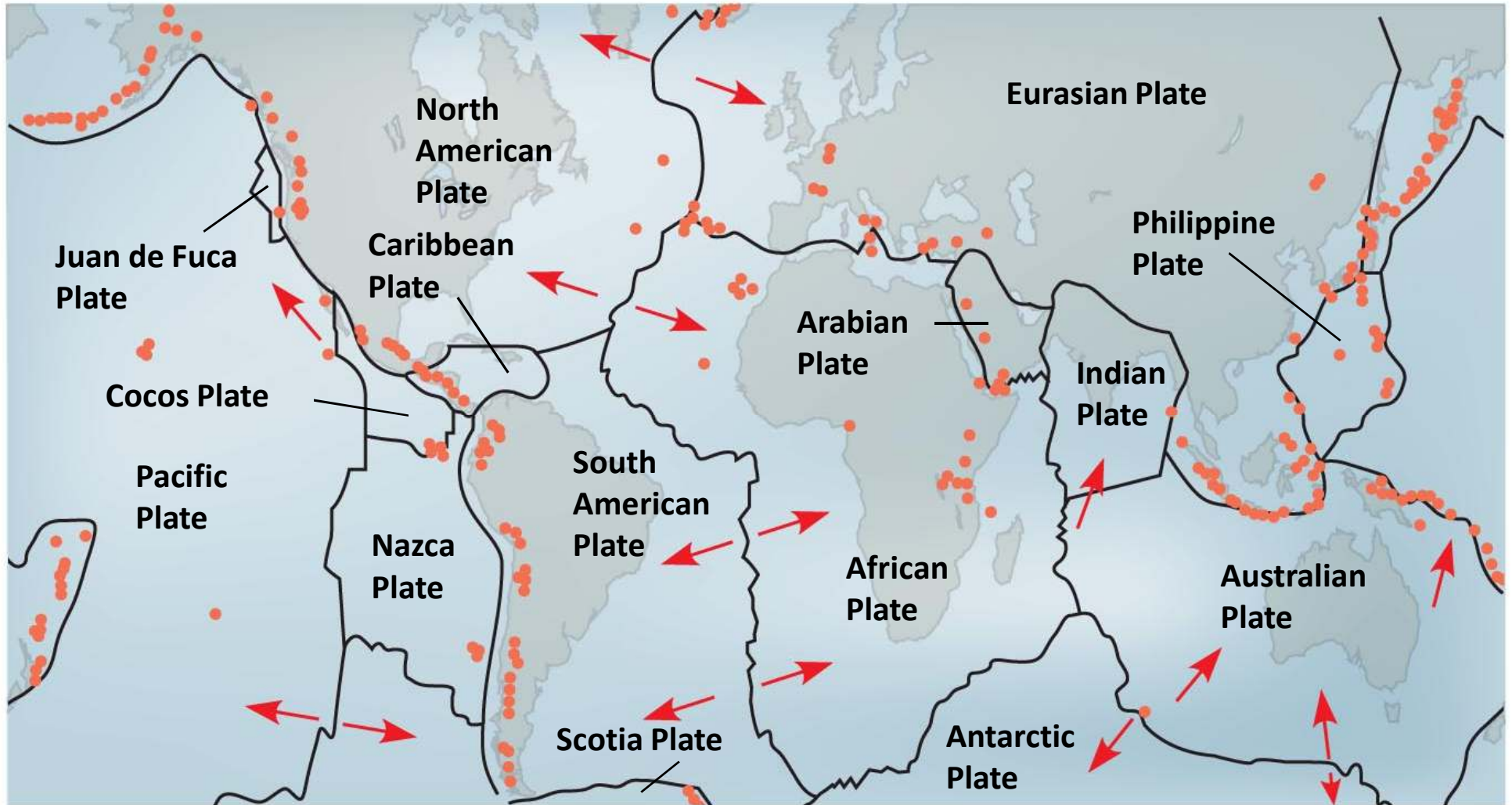
Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.

# Relative fossil dating using index fossils

CENOZOIC ERA (Age of Recent Life)	Quaternary Period	<i>Pecten gibbus</i>		<i>Neptunea tabulata</i>	
	Tertiary Period	<i>Calyptrophorus velatus</i>		<i>Venericardia planicosta</i>	
MESOZOIC ERA (Age of Medieval Life)	Cretaceous Period	<i>Scaphites hippocrepis</i>		<i>Inoceramus labiatus</i>	
	Jurassic Period	<i>Perisphinctes tiziani</i>		<i>Nerinea trinodosa</i>	
	Triassic Period	<i>Trochites subbullatus</i>		<i>Monotis subcircularis</i>	
PALEOZOIC ERA (Age of Ancient Life)	Permian Period	<i>Leptodus americanus</i>		<i>Parafusulina bosei</i>	
	Pennsylvanian Period	<i>Dictyoclostus americanus</i>		<i>Lophophyllidium proliferum</i>	
	Mississippian Period	<i>Cactocrinus multibrachiatus</i>		<i>Prolecanites gurleyi</i>	
	Devonian Period	<i>Mucrospirifer mucronatus</i>		<i>Palmatolepus unicornis</i>	
	Silurian Period	<i>Cystiphyllum niagarensis</i>		<i>Hexamoceras hertzeri</i>	
	Ordovician Period	<i>Bathyrurus extans</i>		<i>Tetragraptus fructicosus</i>	
	Cambrian Period	<i>Paradoxides pinus</i>		<i>Billingsella corrugata</i>	
	PRECAMBRIAN				

# The Tectonic Plates of the Earth

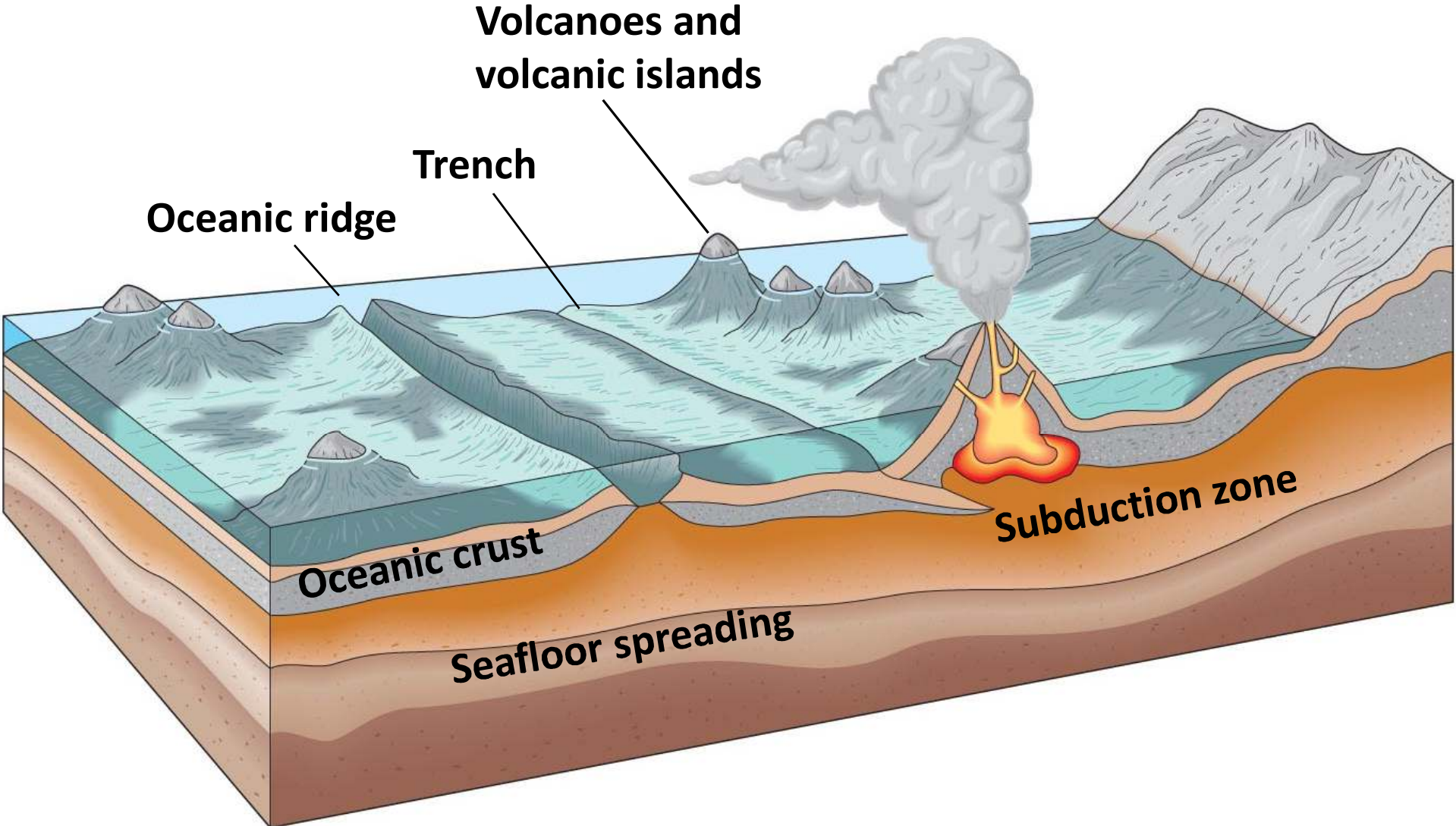
Red Circles are volcanoes



Copyright © 2005 Pearson Education, Inc. Publishing as Pearson Benjamin Cummings. All rights reserved.



Tectonics of spreading or colliding



# Pre AP Biology

Geologic Time and Processes (7.3)

Part 2

# Stephen Jay Gould






























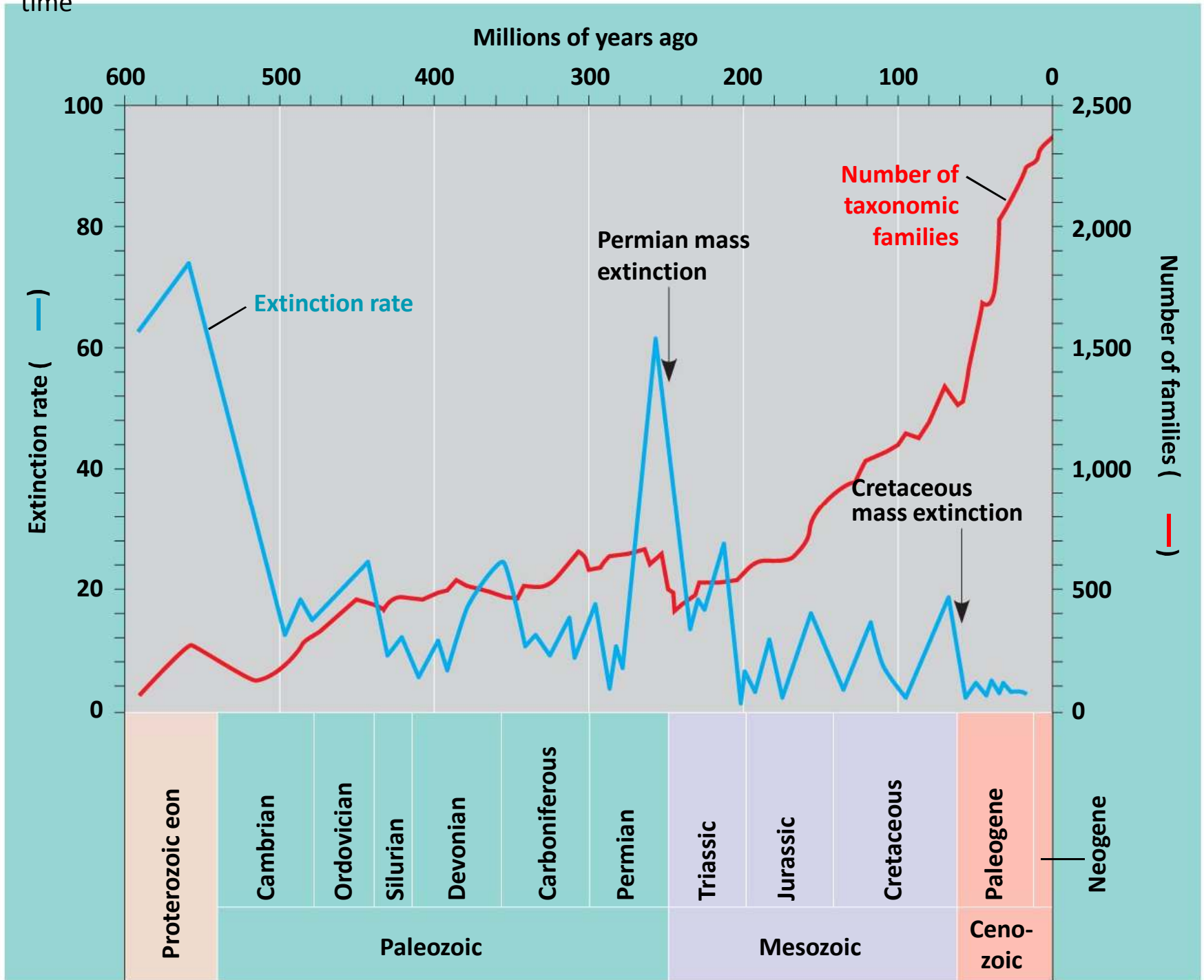
# Pre AP Biology

Geologic Time and Processes (7.3)

Part 3

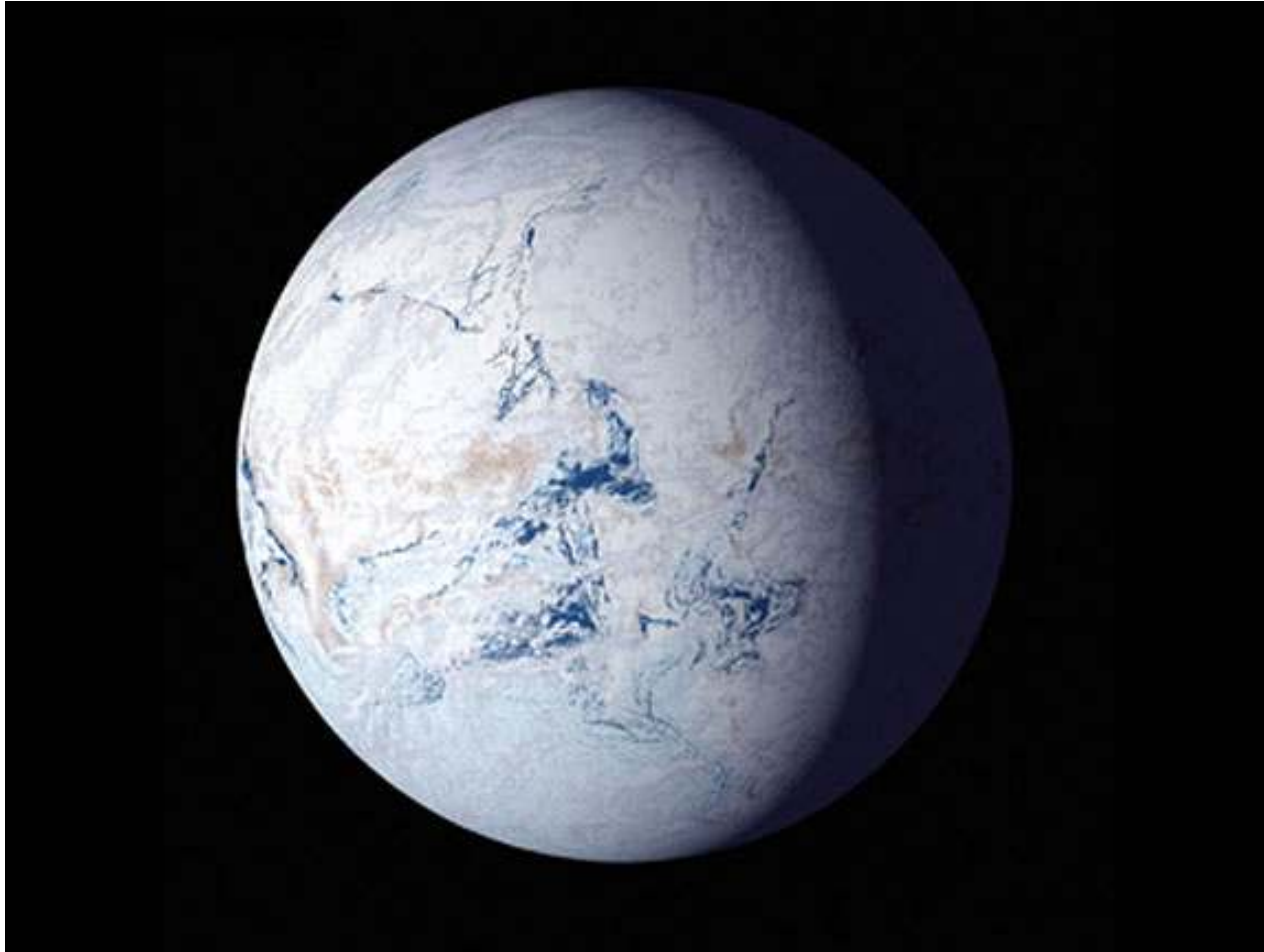
Eon	Era	Period	Epoch	Age MYA	Important Events			
Phanerozoic	Cenozoic	Neogene	Holocene	0.01	Historical time			
			Pleistocene	1.8	Ice ages; humans appear			
			Pliocene	5.3	Genus <i>Homo</i>			
			Miocene	23	Radiation of mammals and angiosperms; apelike ancestors of humans			
		Paleogene	Oligocene	33.9	Primates			
			Eocene	55.8	Angiosperm dominance; radiation of mammals			
			Paleocene	65.5	Mammals, birds, pollinating insects			
		Proterozoic	Mesozoic	Cretaceous		145.5	Angiosperms; Cretaceous extinction	
					Jurassic	199.6	Gymnosperms; dinosaurs	
				Triassic	251	Gymnosperms; dinosaurs; mammal-like reptiles		
Permian	299			Permian extinction				
Carboniferous	359.2			Seed plants; reptiles	 			
Archaean	Paleozoic	Devonian	416	Bony fishes; tetrapods; insects	 			
		Silurian	443.7	Early vascular plants				
		Ordovician	488.3	Colonization of land	 			
		Cambrian	542	Cambrian explosion	 			
			600	Algae; soft-bodied invertebrates	   			
				2,200	Oldest fossils of eukaryotes			
				2,500				
				2,700	Atmospheric oxygen increases			
				3,500	Oldest fossils of prokaryotes			
				3,800	Oldest known rocks			
				Approx. 4,600	Origin of Earth			

Mass extinctions over time

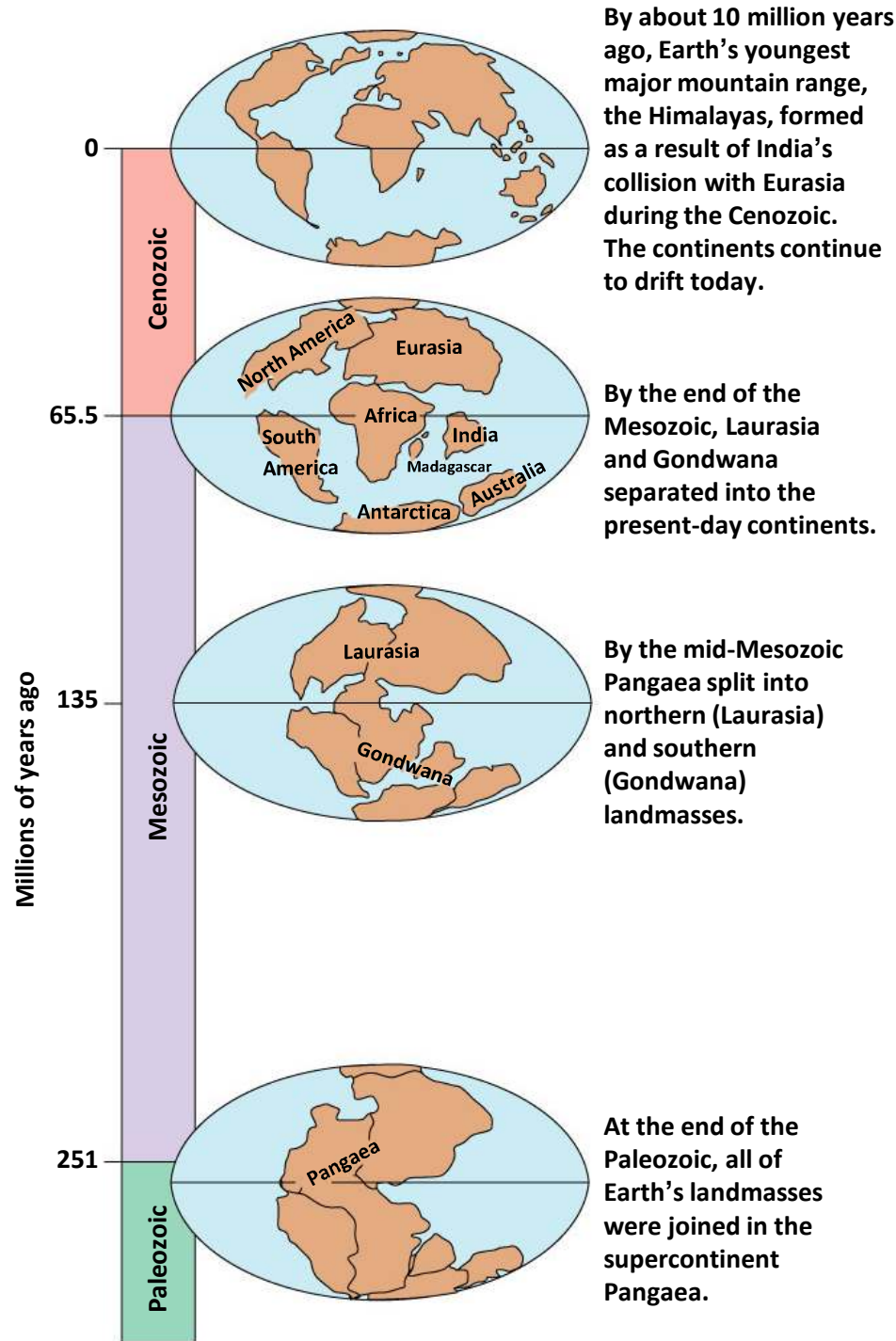




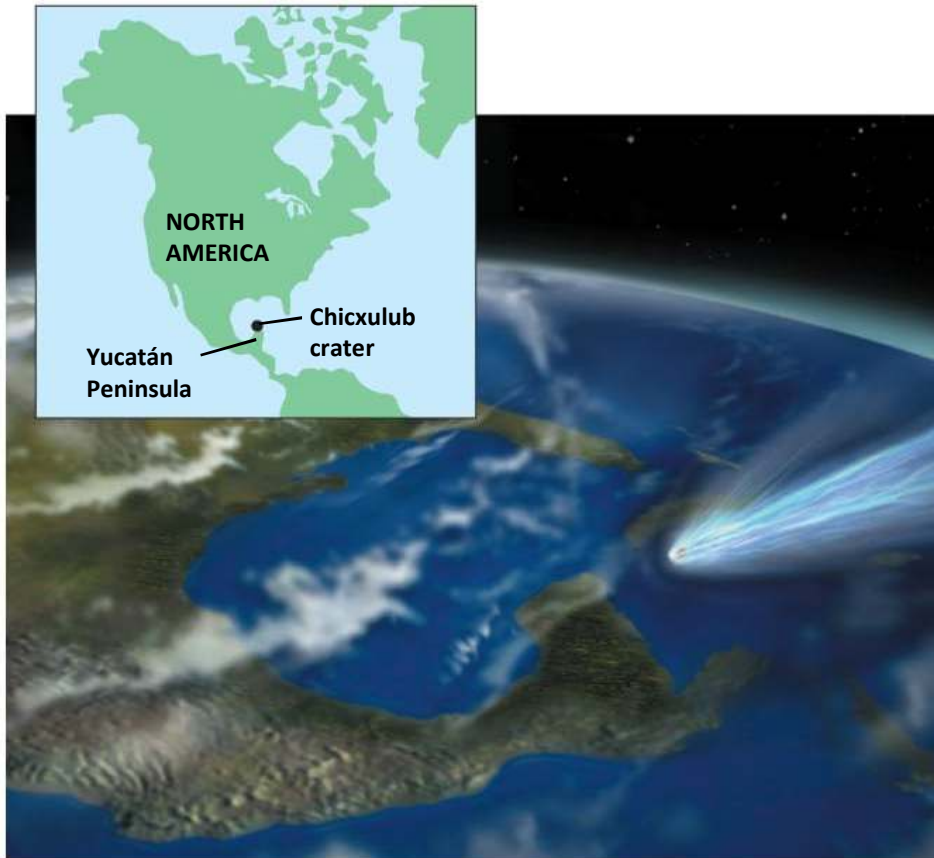
# Snowball Earth



# Pangaea



# Asteroid Impact



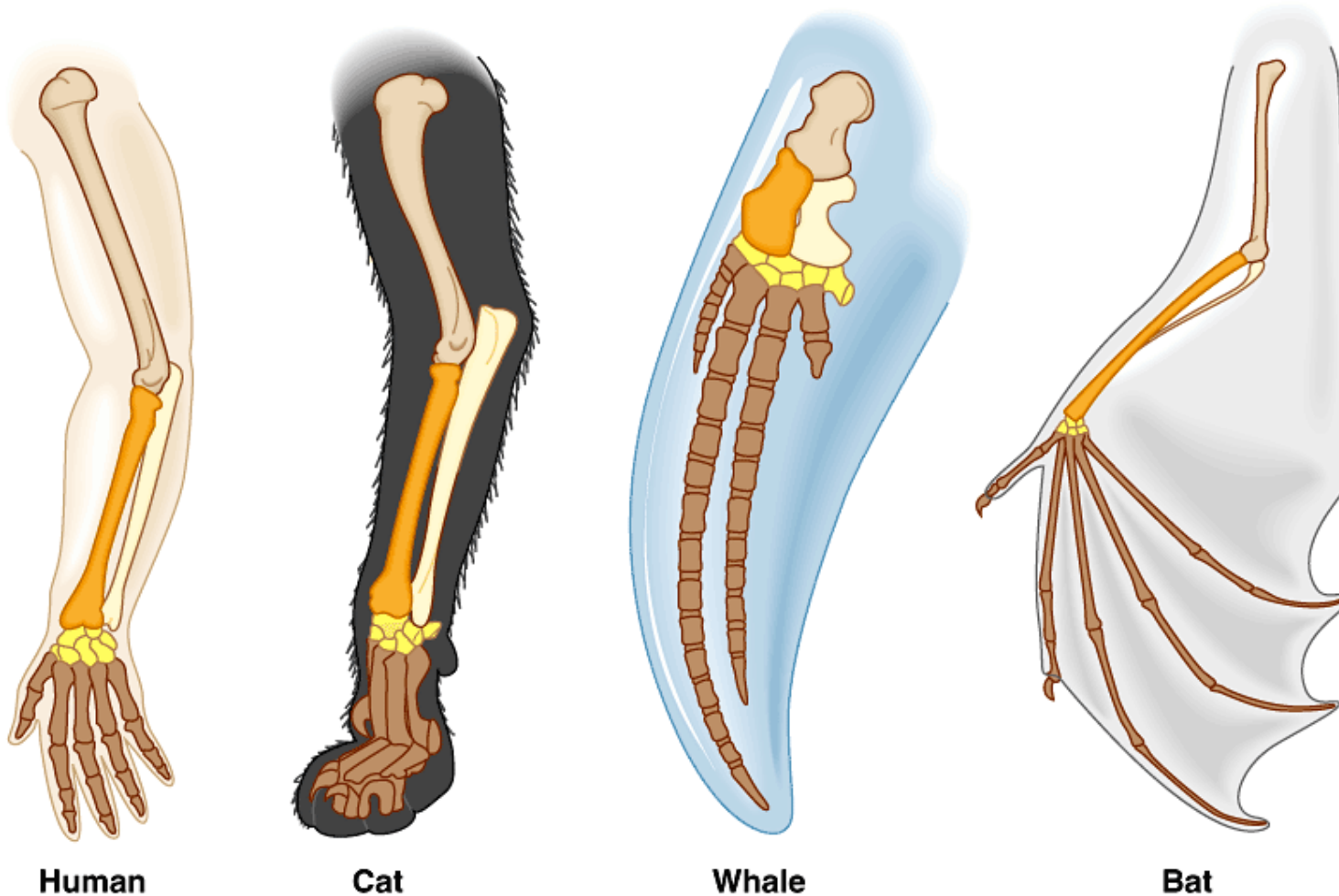


# Pre AP Biology

Geologic Time and Processes (7.3)

Part 4

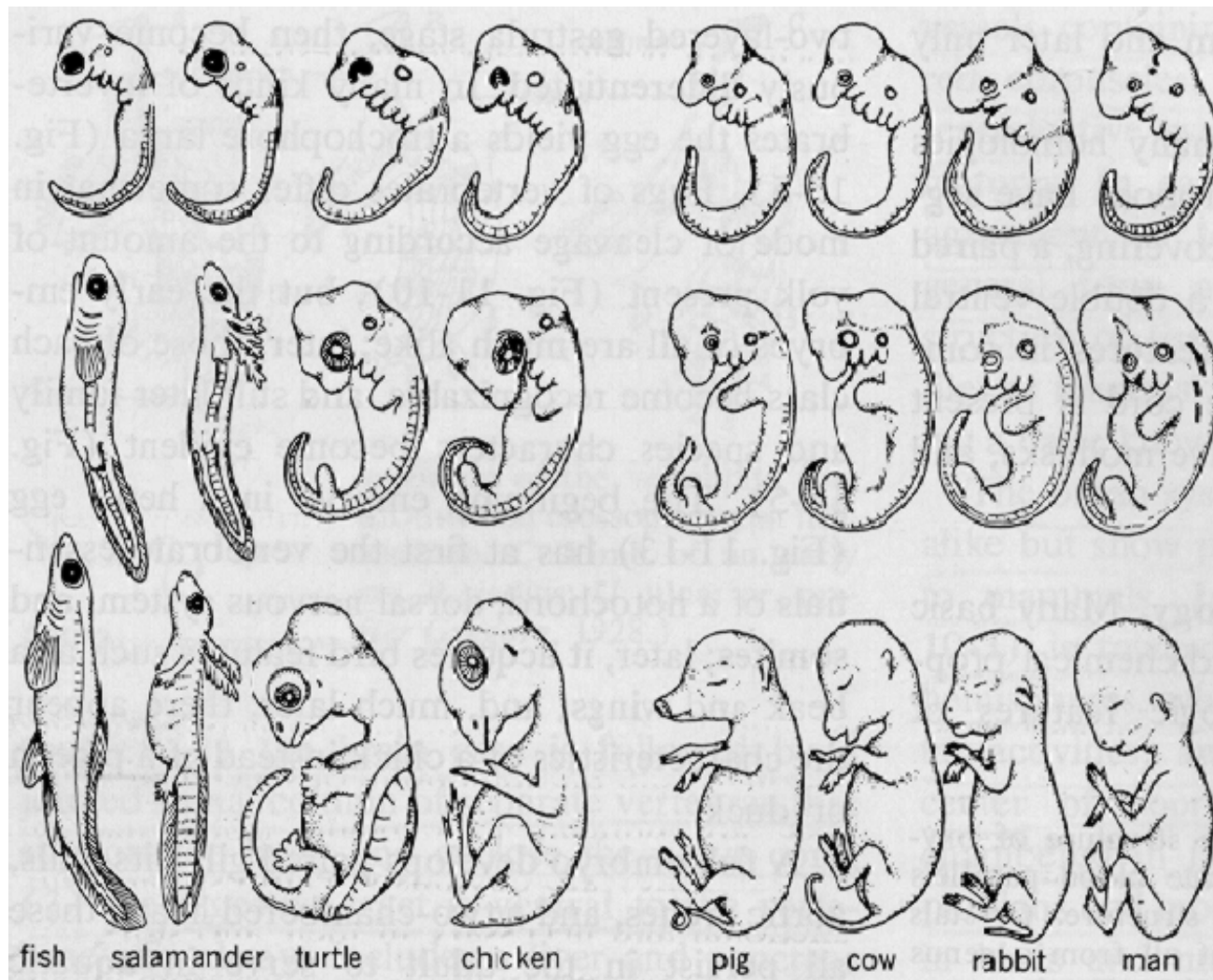
# Supporting Evidence Homologous Structures



Copyright © Pearson Education, Inc., publishing as Benjamin Cummings.

# Supporting Evidence

## Embryological Homologies











# Supporting Evidence

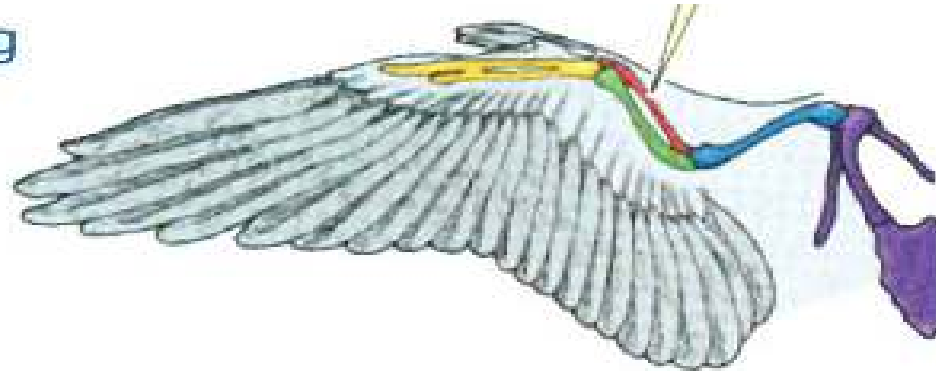
## Molecular Homologies

**Table 22.1 Molecular Data and the Evolutionary Relationships of Vertebrates**

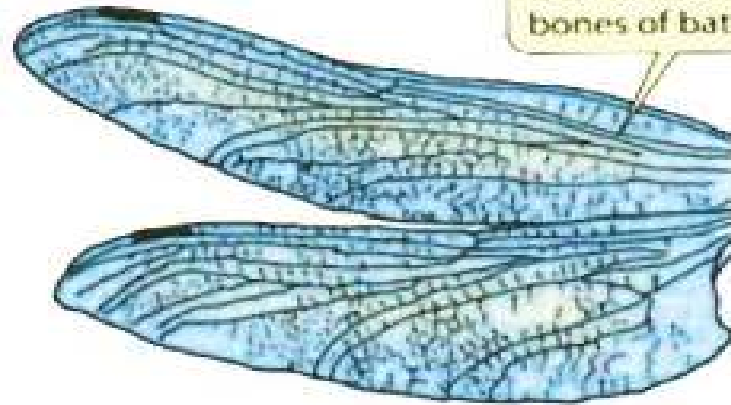
Species	Number of Amino Acids That Differ from a Human Hemoglobin Polypeptide (Total Chain Length = 146 Amino Acids)
Human 	0
Rhesus monkey 	8
Mouse 	27
Chicken 	45
Frog 	67
Lamprey 	125

# Analogous Structures

Bird wing



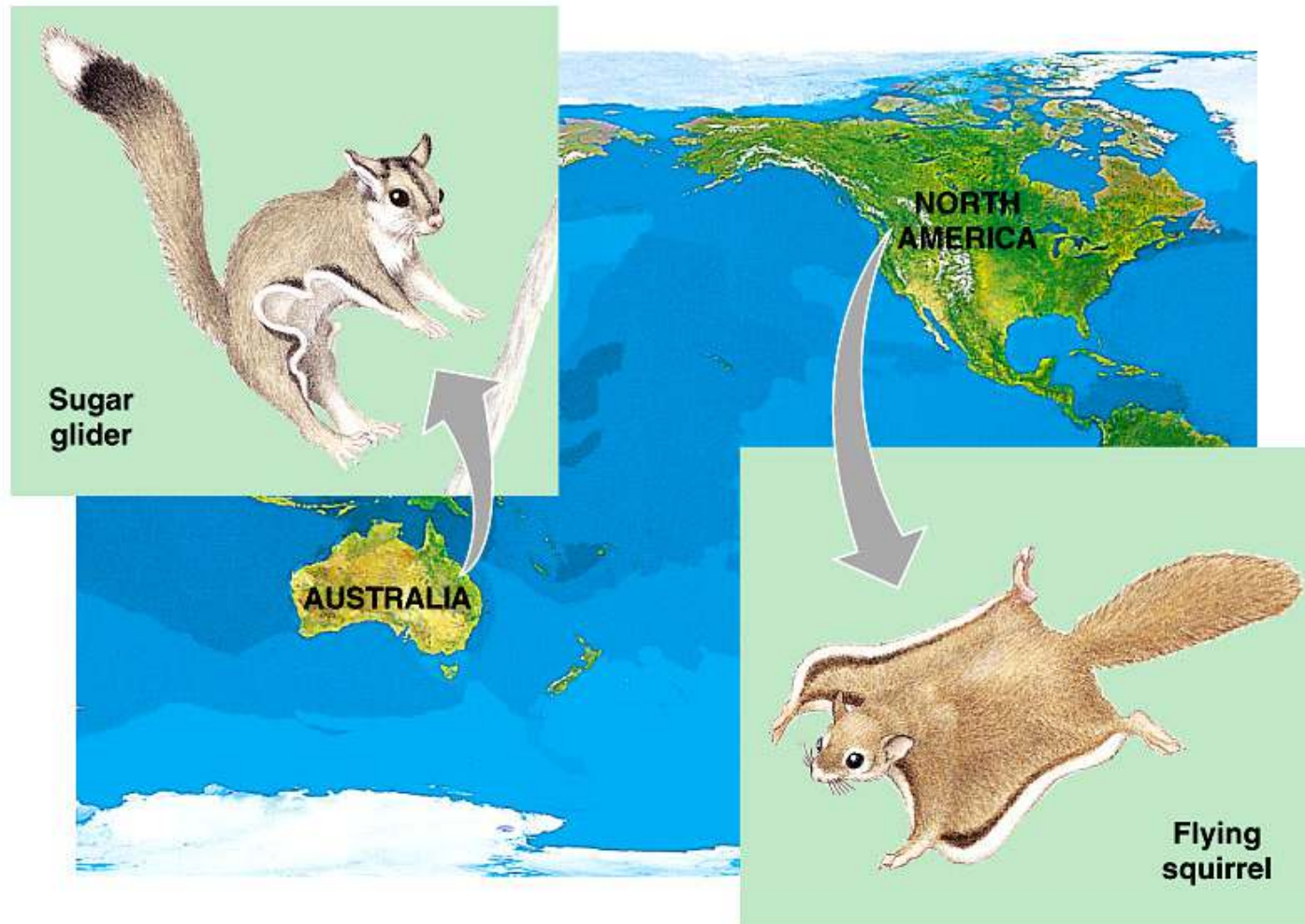
Insect wing



The supports for insect wings are not homologous with the bones of bat and bird wings.

# Biogeography and Convergent Evolution

Similar environments - similar appearance

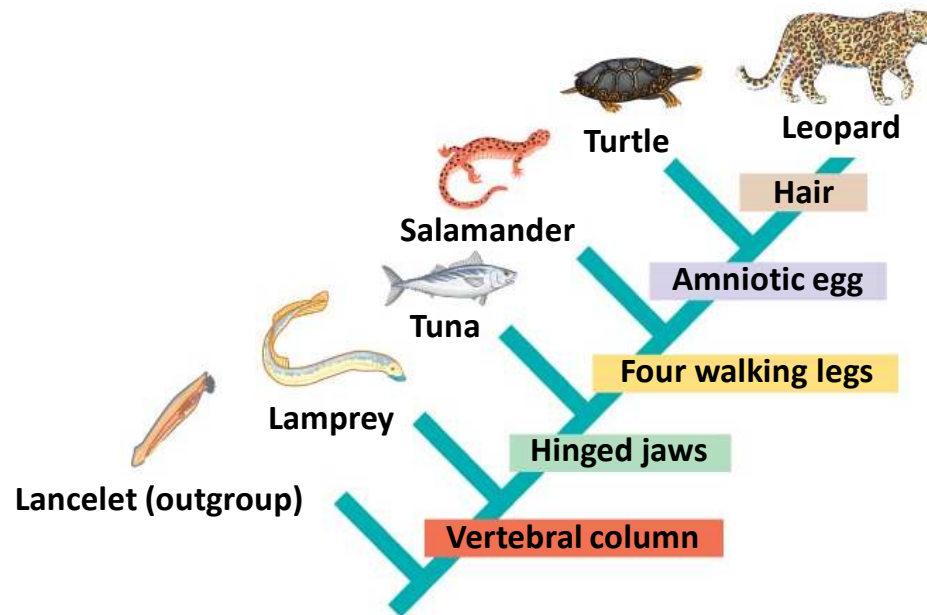




Character Table used to create a Cladogram

		TAXA					
		Lancelet (outgroup)	Lamprey	Tuna	Salamander	Turtle	Leopard
CHARACTERS	Hair	0	0	0	0	0	1
	Amniotic (shelled) egg	0	0	0	0	1	1
	Four walking legs	0	0	0	1	1	1
	Hinged jaws	0	0	1	1	1	1
	Vertebral column (backbone)	0	1	1	1	1	1

(a) Character table



(b) Cladogram