The Evolutionary Record

Precambrian

Phanerzoic Eon

Cenozoic Era = Age of the Mammals (last 65 mya) [mya=million years ago]
Mesozoic Era = Age of the Dinosaurs (250,000 - 70,000 mya)
Paleozoic Era = Age of the Fishes (520,000 mya - 200 mya)

"zoic" = "zoo" = animal
"Cen" = recent
"Meso" = middle
"Paleo" = ancient

Age of earth = 4.5 billion years ago

Invertebrates (animals without backbones)

Vertebrate Evolution:

Classification

Kingdom:
Phylum:
Subphylum:
Class:
Sub-class:
Infraclass:
Order:
Suborder:
Superfamily:
Family:
Genus:
Species:

Phylum

Arthropoda (external skeletons e.g., insects, spiders, lobsters, and crabs)
Mollusca (soft, unsegmented bodies usually enclosed in hard shells: Octopi, squids, snails, slugs, clams)
Chordata: elongated bilaterally symmetrical bodies, lateral gill slit, notochord: mammals, birds, reptiles, amphibians, fish, primitive lancelets and tunicates. 3 subphyla:

Vertebrata: bilaterally symmetrical, internal spinal cord surrounded by a series of bones known as vertebrae (i.e. animals with backbones). In most vertebrates, the notochord is replaced by a more complex spinal chord late in the embryonic stage of development.

7 living classes of vertebrates

Agnatha: jawless fish (lampreys and hagfish)
Chondrichthyes (sharks and rays)
Osteichthyes
Amphibia
Reptilia (e.g., turtles, snakes, lizards, alligators) amniote egg
Aves (birds)
Mammalia

First vertebrates: resemble sea lancelets (Amphioxus)
first true fossil vertebrates appear in rocks 435-335 mya. Fishes without jaws, lamprey and hagfish are descendants of early jawless fishes.

Two main problems to live on land: respiration and reproduction.
1. Breathing air.
2. Retention of body fluids.
4. Locomotion.

Lobe fins: first amphibians?
1. A lateral fin structure that permitted short walks.
2. Primitive lungs for breathing air on land and gills for breathing in water.
3. Thick skin.
4. Changes in skull and teeth necessary for feeding on land plants and seeds.
5. Improved sense of smell and hearing.

Living coelacanth.

Reptiles: Amniotic egg: the embryo develops within a liquid filled egg with a hard leathery shell.

65 mya, Cretaceous period, mass extinction.

Mammals: Mammal-like reptile, Therapsida.
1. Internal control of body temperature.
2. More intelligent than reptiles.
3. A new mode of reproduction.
4. Extended postnatal development and care.
5. Immune system to resist infection.

Mammary glands.

Heterodont teeth (incisors, canines, premolars, and molars).

Warm blooded.

Prototheria (Monotremes).

Theria: 2 infraclasses:
1. Metatheria (marsupials).
2. Eutheria: placental mammals.
<table>
<thead>
<tr>
<th>Era</th>
<th>Period</th>
<th>Epoch</th>
<th>Begun Millions of Years Ago</th>
<th>Duration in Millions of Years</th>
<th>Some Important Events in Life of the Times</th>
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</thead>
<tbody>
<tr>
<td>CENOZOIC</td>
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<tr>
<td></td>
<td>Holocene</td>
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<tr>
<td>Quaternary</td>
<td>Pleistocene</td>
<td>1.6</td>
<td>1.6</td>
<td>Early men and many giant mammals now extinct</td>
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<td></td>
<td>Pliocene</td>
<td>6</td>
<td>4.2</td>
<td>Anthropoid radiation and culmination of mammalian specialization.</td>
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<td></td>
<td>Miocene</td>
<td>23</td>
<td>17</td>
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<td>Oligocene</td>
<td>36</td>
<td>13</td>
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<td>Tertiary</td>
<td>Eocene</td>
<td>55</td>
<td>19</td>
<td>Expansion and modernization of mammals.</td>
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<td>Paleocene</td>
<td>65</td>
<td>10</td>
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<td>MIocenean</td>
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<tr>
<td>Cretaceous</td>
<td></td>
<td>135</td>
<td>70</td>
<td>dinosaurs dominant to end; both marsupial and placentals mammals appear; first flowering plants appear and radiate rapidly.</td>
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<td></td>
<td>Jurassic</td>
<td>180</td>
<td>45</td>
<td>Domination of dinosaurs; first mammals and birds; insects abundant, including social forms.</td>
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<td>Triassic</td>
<td>225</td>
<td>45</td>
<td>First dinosaurs and mammal-like reptiles with culmination of labyrinthodont amphibians.</td>
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<td>Paleozoic</td>
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<td>Permian</td>
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<td>270</td>
<td>45</td>
<td>Radiating primitive reptiles displace amphibians as dominant group; glaciation widespread.</td>
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<td>Carboniferous</td>
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<td>350</td>
<td>80</td>
<td>Amphibians dominant in luxurious coal forests; first reptiles and trees.</td>
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<td>Devonian</td>
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<td>400</td>
<td>50</td>
<td>Dominance of fishes; first amphibians.</td>
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<td>Silurian</td>
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<td>440</td>
<td>40</td>
<td>Sea scorpions and primitive fish; invasion of land by plants and arthropods.</td>
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<td>Ordovician</td>
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<td>600</td>
<td>60</td>
<td>First vertebrates, the jawless fish; invertebrates dominate the seas.</td>
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<td>Cambrian</td>
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<td>600(± 20)</td>
<td>100</td>
<td>All invertebrate phyla appear and algae diversity.</td>
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<td>PRE-CAMBRIAN</td>
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<td>Not well</td>
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