❖ 14 Mesozoic and Cenozoic.

➢ *Reading: 7th edition 518-520, 701-707[1]; 6th edition 490-492, 709-715.*

❖ Mesozoic era

➢ *Organisms in the Mesozoic differed greatly from those in the Paleozoic.*

- The recovery from the Permian extinction was led by groups that were present in the Paleozoic but of relatively minor importance during that era. Gymnosperms became the dominant terrestrial plant. Dinosaurs became the dominant land animal.
- By the end of the Mesozoic, flowering plants, birds and mammals had appeared but were not yet dominant.

➢ *Cretaceous extinction*

- At the end of the Cretaceous Era 65.5 mya, the last period of the Mesozoic, (called the K/T boundary), there was a mass extinction affecting terrestrial and marine species.
- The Cretaceous extinction was caused by the impact of a meteorite roughly 10 km in diameter that hit the Yucatan Peninsula. The meteorite-impact theory was proposed after the discovery of shocked quartz and an anomalously high concentration of iridium at the K/T boundary (the iridium anomaly). The crater, known as the Chicxulub structure, created by the meteorite is 200-300 km in diameter. It had been discovered in the 1960s, but its significance was not recognized until later.
- The evidence that a meteorite impact caused the K/T extinction is circumstantial but very convincing. Roughly 200,000 km^3 of material was ejected and vaporized as a result of the impact, undoubtedly affecting the world's climate for a long time.

❖ Cenozoic era

➢ *Modern groups evolved and became dominant early in the Cenozoic.*

- In the Cenozoic, groups that survived the mass extinction — insects, mammals, birds, and flowering plants on land, and fishes, corals, and mollusks in the ocean — diversified, became dominant, and remain dominant today.
- How rapidly these adaptive radiations occurred is debated. A very recent paper[2] used a phylogenetic analysis based on the molecular clock to conclude that orders of living placental mammals did not arise especially quickly after the K/T boundary.

➢ *The fossil record of the immediate ancestors of humans is relatively well understood[3].*

- The lineage leading to humans diverged from the one leading to chimpanzees by 6 mya. From 6 mya to 4.4 mya, there was probably one genus, *Ardipithecus*, found only in Africa. Members of this genus were at least partially bipedal and had

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[1] Information about the fossil record of other groups can be found by consulting the index of the textbook.

[2] http://www.nature.com/nature/journal/v446/n7135/abs/nature05634.html

[3] This section is based on information provided Professor T. D. White. This most recent information available and it differs somewhat from what is presented in the text.

somewhat human-like canine teeth, but they had small brains that were similar in size to those of modern chimpanzees.

- From 4.2 to 2.7 mya, there was one geographically variable species in Africa in the genus *Australopithecus*. It was bipedal but still with a small brain. No tools have been found associated with *Australopithecus* fossils.
- By 2.3 mya, robust (i. e. larger) species of *Australopithecus* had appeared and the earliest members of the genus *Homo* (*H. habilis*) had also appeared. At least two hominid species lived in Africa between 2.3 and 1.2 mya, one in the genus *Homo* and at least one in the genus *Australopithecus*.
- *Homo habilis* had larger brains and were associated with stone tools at 2.7 mya. There is evidence of butchery of large mammals at 2.5 mya. *H. habilis* fossils have been found only in Africa.
- The appearance of the first *Homo habilis* fossils illustrates the punctuated equilibrium pattern. There was a period of stasis during which *Australopithecus* species did not change by much. Then fossils classified as *Homo* appeared quickly.
- *H. erectus* appeared by 1.8 mya in Africa and dispersed from Africa to Europe and Asia soon after. It had a larger brain, more extensive tool use and, possibly began to control fire.
- Modern humans, *H. sapiens* first appeared in Africa 160,000-190,000 years ago. They dispersed to Europe and Asia about 100,000 years ago (the out-of-Africa theory) and coexisted in Europe and western Asia with Neanderthals (*H. neanderthalensis)* for at least 70,000 years.

❖ **Sample questions**

➢ *During what geologic era did insects first appear?*
   a. Precambrian
   b. Paleozoic
   c. Mesozoic
   d. Cenozoic
   e. None of the above

➢ *Which of the following best describes the recovery from a mass extinction?*
   a. New phyla appeared and became dominant.
   b. Groups that became dominant were already present before.
   c. Groups that became dominant were separated by vicariant events.
   d. Groups that would dominant before the mass extinction were dominant afterwards also.
   e. None of the above.

➢ *Which of the following is **not** true about the fossil record of hominids?*
   a. Fossil hominids first appeared roughly 6 mya.
   b. Several species were living in Africa at the same time.
   c. Several species were living in Asia at roughly the same time.
   d. Tool use began roughly 2.5 mya.
   e. *Homo erectus* lived in Europe, Asia, and Africa.

   Correct answers: b, b, c