SEGMENT TWO; LECTURE TWO: NATURAL SELECTION

The basic principles of natural selection are likely already familiar to you. These are summarized on p. 458 (p. 444, ed. 7) and below:

1) Organisms over-reproduce and so individuals must compete for limited resources.
2) Survival is not random, but depends on inherited characteristics. A trait that increases the ability of an organism to survive and reproduce is called an **adaptation**.
3) Unequal survival changes the gene pool from one generation to the next. The relative contribution of offspring (genes) to the next generation is called **fitness**. Speciation—the origin of new species—may then occur.

Since the time of Darwin, various scientific advances have clarified our perception of evolution:

1) The study of genetics, beginning with Mendel, explained patterns of inheritance better than "blending inheritance." The discovery of DNA as the molecule of inheritance explained how characteristics were encoded. The discovery of mutation explained how DNA changed.

2) The ability to measure naturally occurring radioisotopes to estimate the absolute dates of sediments, bones etc. allows the construction of fossil time-scales.

3) The discovery of transitional or intermediate forms documents evolutionary relationships. Examples:
   Protomammals, with clear evidence of reptilian ancestry;
   Protohumans, especially from the east African rift valley system;
   Protobirds, which arose from one of the lineages of feathered dinosaurs;
   Protowhales (see Fig. 22.16 (22.18, ed. 7));
   Progymnosperms.

4) Natural selection is somewhat complicated to measure because of conflicting selective constraints. However, it has been measured (see Fig. 22.13-14 (22.12-22.13 ed. 7)). Adaptation, fitness and selection are well defined, readily quantified, and have been repeatedly documented, in spite of the difficulties of doing this in the field.

   For example, in a study by Kessler et al. (2008), adaptations in floral chemistry in the desert tobacco were studied. Two floral adaptations: floral scent and nicotine in the nectar, were studied. Researchers measured differences in fitness between control plants and those bioengineered to lack one or the other of the two floral adaptations. The results were clear: more pollinators visited plants with the adaptations and these plants produced more seeds (a measure of fitness).