

SEGMENT THREE LECTURE SEVEN: MOLECULAR CLOCKS AND THE TREE/RING OF LIFE.

The DNA sequences have been used to infer a **tree of life**, which is a phylogeny of all species (Fig. 26.21), using rRNA genes. This tree can be reformed to include known events of **horizontal gene transfers**, which take place when genes are transferred between species by viruses and other mechanisms. Horizontal gene transfers that may have been more common early in the evolution of life can be included in the **ring of life** representation of phylogeny (Fig. 26.23).

Some genes, in which the rate of evolution is approximately constant, can be used as **molecular clocks**. In a molecular clock, the number of mutations between homologous genes of two species is proportional to the amount of time since the species branched from their common ancestor (Figs. 26.19-20). Calibration points in the molecular clock are determined from dated fossils or other information. Using a molecular clock, the **human-ape** divergence was estimated to be about 6 million years ago, much more recently than the fossil data at the time suggested. Additional fossils evidence now supports this date.

Mutation rates of some genes are accelerated by natural selection away from clock-like behavior. To counter this problem, molecular clock results from hundreds of genes can be compared for the same group of species. Estimates from these combined molecular clocks agree with those from dated fossils.

Paleoanthropology is the study of human origins.

Hominins are a narrow group of ~20 species including only humans and their now extinct relatives (*Australopithecus* etc.) Anthropoids are a broader group including monkeys, great apes, and humans.

Selected Paleoanthropologists

Raymond Dart—discovered the Taung child fossil—see below;

Louis, Mary and Richard Leakey—attracted recognition for
Paleoanthropology;

Donald Johanson—discovered Lucy; and

Tim White—found significant older hominids in the past decade.

Many fossils have been found in east Africa. This is significant because:

- 1) Uplift in the rift valley system hastens erosion, exposing fossils;
- 2) Ancient volcanoes in this area deposited readily-dated ash;
- 3) Hominids originated and diversified in Africa.

Fig. 26-19

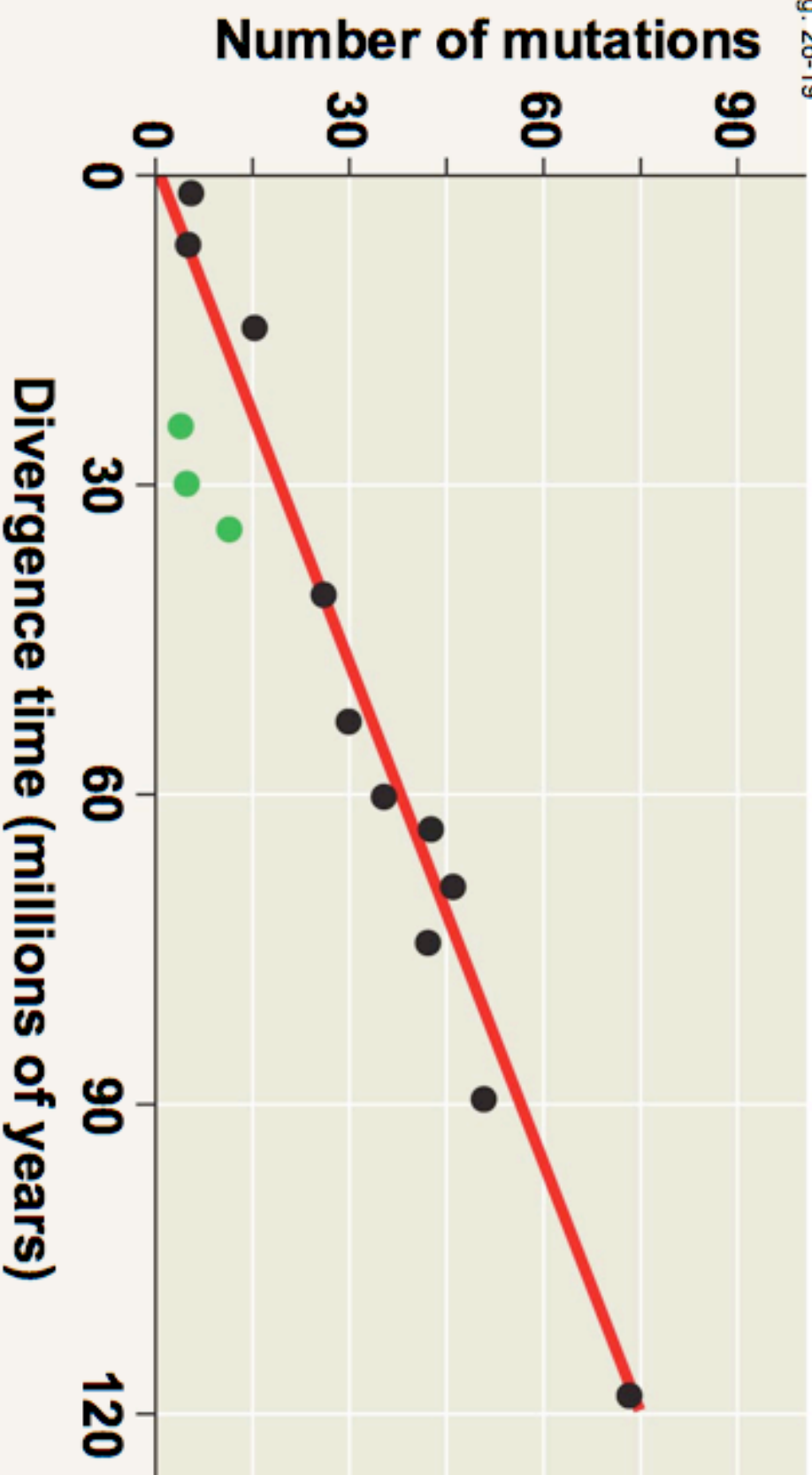


Fig. 26-21

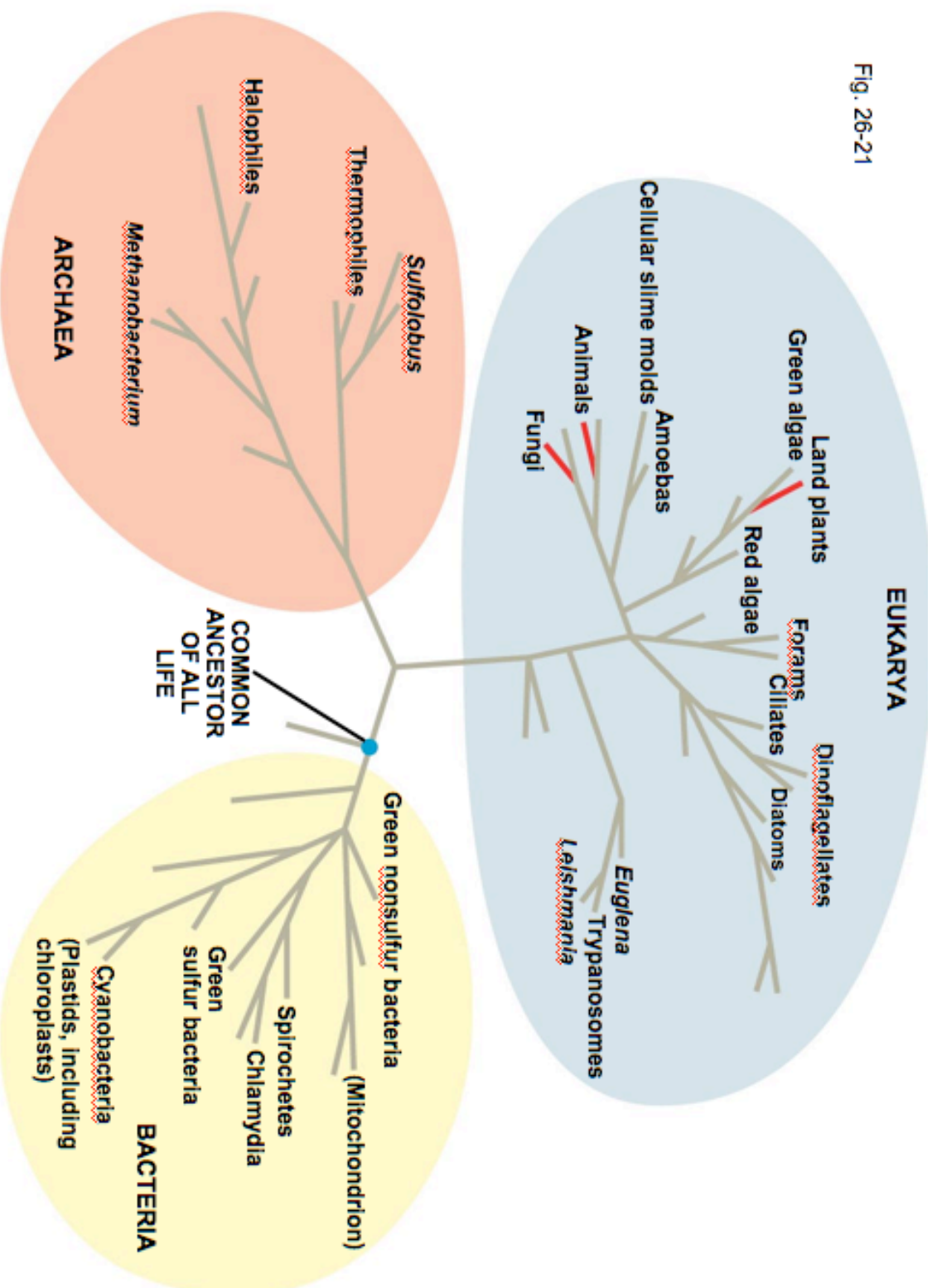


Fig. 26-23

