

## THE MOLECULAR CLOCK

From the diagram of the great apes in the previous section, you can see that similarity is proportional to recency of common ancestry, the greater the number of differences, the more distant the relationship, and the more distant in time the common ancestor.

If mutations occur at random resulting in a uniform and constant rate of mutation over long periods of time,

And

If many mutations are neutral,

Then

Mutation rate and the accumulation of genetic changes may behave in a clock-like manner, in the sense that there is a precise correlation between number of nucleotide changes and length of time.

This relationship is referred to as the molecular clock.

The use of nucleotide and amino acid sequences to infer relationships and to date branch points in phylogeny is significant because until molecular techniques became feasible the only source of time inference in phylogeny was through the fossil record.

Of course, molecular evolution techniques can only be applied for the most part to organisms that are alive. That is good and important because most organisms are soft-bodied and have a low preservation potential, which means they are unlikely to turn up in the fossil record. DNA in particular is a delicate molecule that denatures easily when exposed to geological conditions. Therefore, the fossil record of DNA currently is sparse and relevant to only a few species in special circumstances.

Thus, the fossil record and the molecular record can be seen as complementary. The fossils record provides evidence of past life in an objectively datable context and it provides the only record of extinct species lost prior to the advent of human records. Molecular techniques allow the incorporation of all living species in a phylogenetic context that can provide the relative sequence of branching points in a phylogeny and that can provide absolute dates by calibrating the rate of change of the genes under consideration.