

Molecular clock hypothesis :-

• Given by Pauling & Zuckerkandl.

Pauling & Zuckerkandl proposed this hypothesis.

→ All though the rate of nucleotide substitution & a.a replacement varies among the different genes, the average rate of molecular evnⁿ can be rather uniform through out the long periods of evolutionary time. Such uniformity in the rate of substitution is known as molecular clock i.e. a.a/nucleotide.

Substitution occur in a clockwise manner over the time. The hypothesis suggests that the underlying mutation rate for a gene is roughly constant.

Molecular clock runs ~~more~~ most rapidly in sequences that are not subjected to purifying selection.
Example - seudogenes, introns etc.

- The clock runs most slowly for the sequences that are subjected to the strong functional constraints.

The phylogenetic tree based on molecular clock data are considered better & such tree are devised by Calibrating the molecular data with available fossils records.

[Mutation rate is high (in case of plant) - Chloroplast
 " " " " (in case of animal) - Mt.]

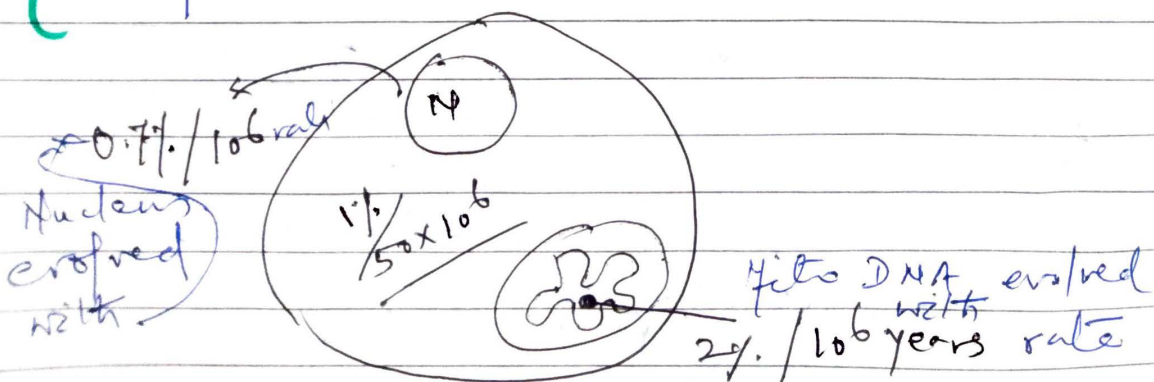
→ The differences b/w the DNA seq. / a.a seq. of different spp. would be proportional to time (largely). Since the two spp. get diversified from the common ancestor.

✓ For the DNA seq. the diversion rate is estimated as 0.7 to 0.8% per million years; for RNA sequence the diversion rate is 1% per 50 million years clearly the diversion rate in the DNA is more than that of RNA, thus DNA sequences are more informative than RNA & proteins sequences for the evolutionary studies. It happens due to -

(a) That the large portion of DNA is not transcribed & translated.

(b) Due to the degeneracy of genetic code.

Till date the most prominent molecular clock is mitochondrial DNA clock which holds that the animal mitochondrial DNA evolved at the rate of approximately 2% sequence diversion per million years.



Mitochondrial DNA used in track - Maternal link
 Y chromosomal DNA " " " Paternal link.

The mitochondrial DNA is used to track the maternal links. On the basis of mitochondrial DNA comparison it is considered that H. Sapiens migrated from Africa about 2 lakh y. ago to populate the other regions of world over the time replace the Neanderthal already living in these regions.

→ Similar Y-chromosomal DNA used to track paternal inheritance ✓

— The Y-chromosomal DNA & the mitochondrial ~~DNA~~ DNA are considered relatively pure form inherited since there is negligible changes of recombination in such DNA. ✓