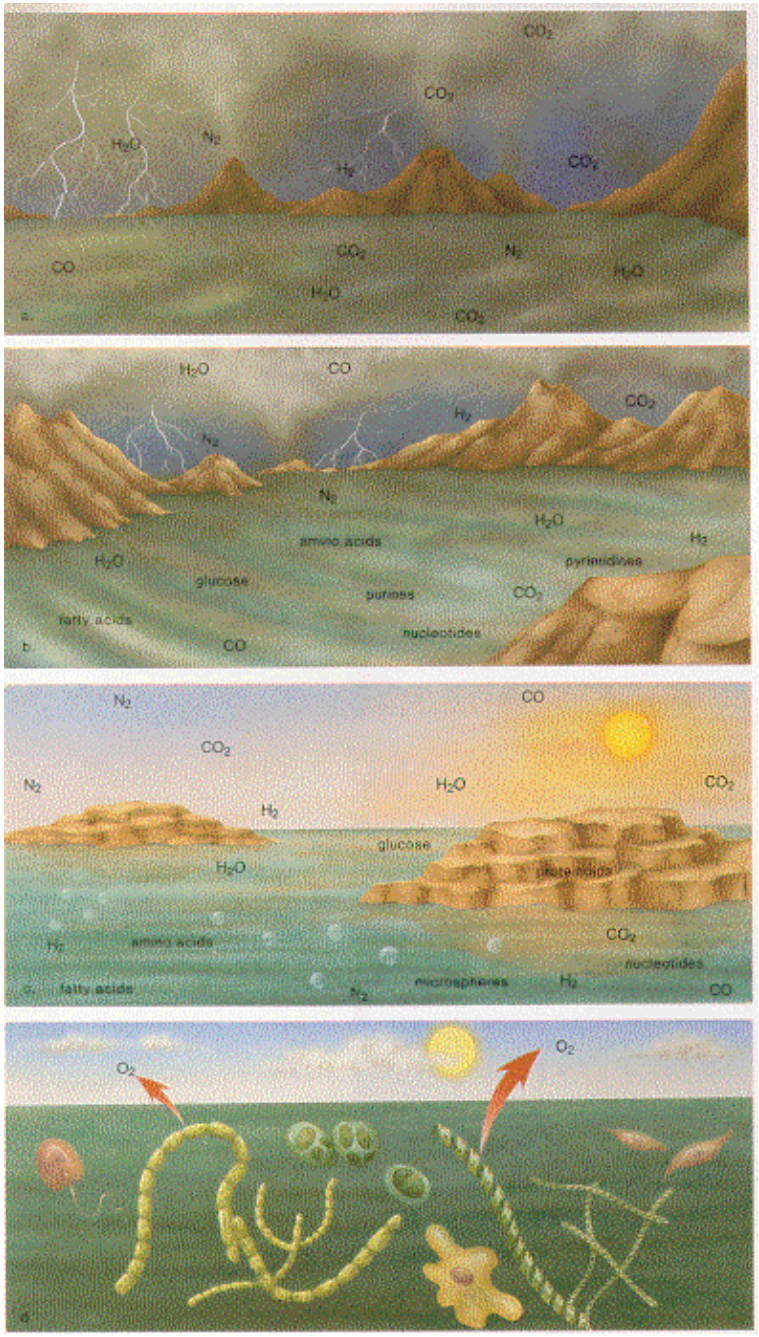
EVOLUTIONSTHEORIE

QUALCHE CONCETTO DI EVOLUZIONE

A possible scenario to describe the origin of life

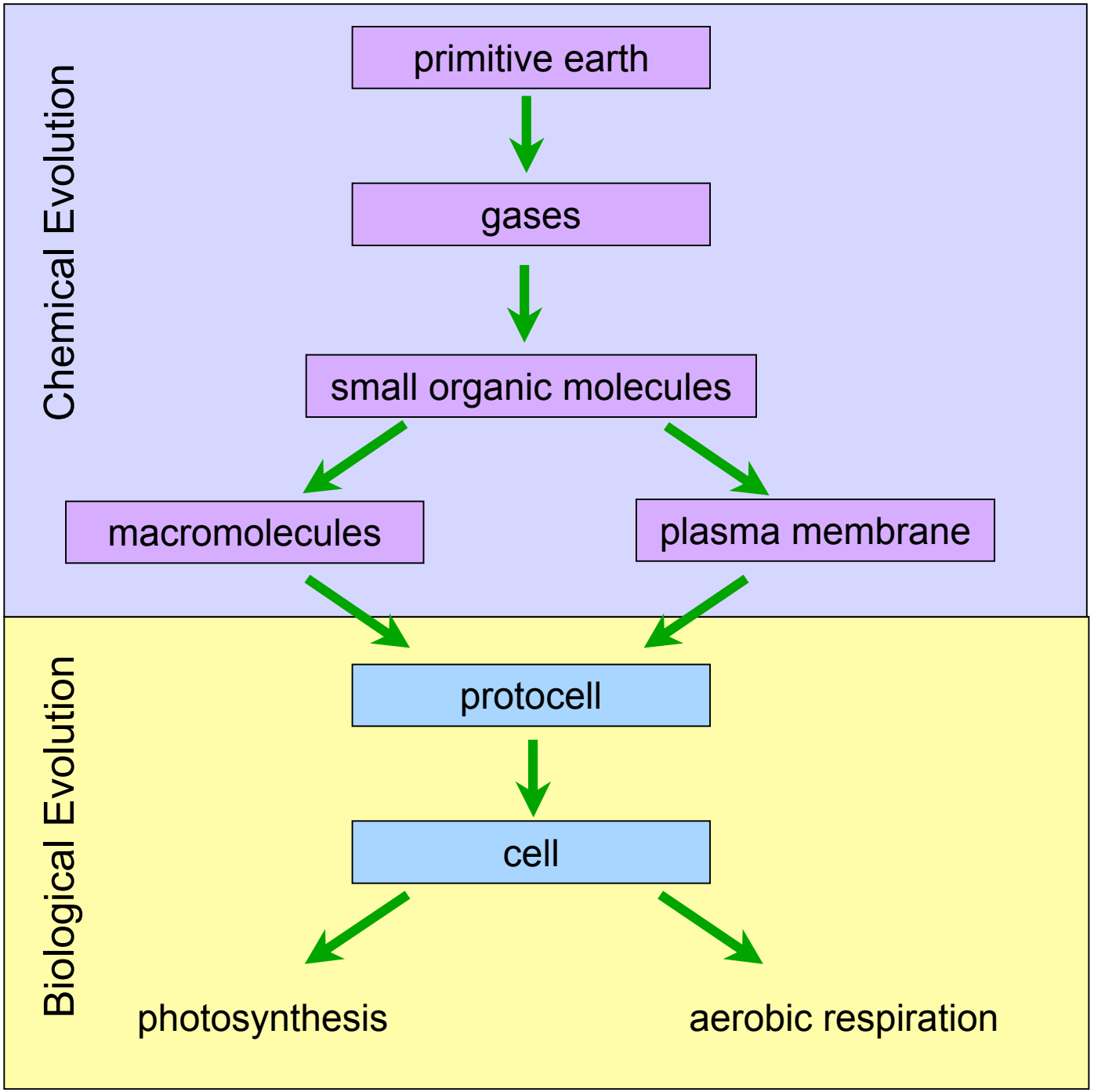


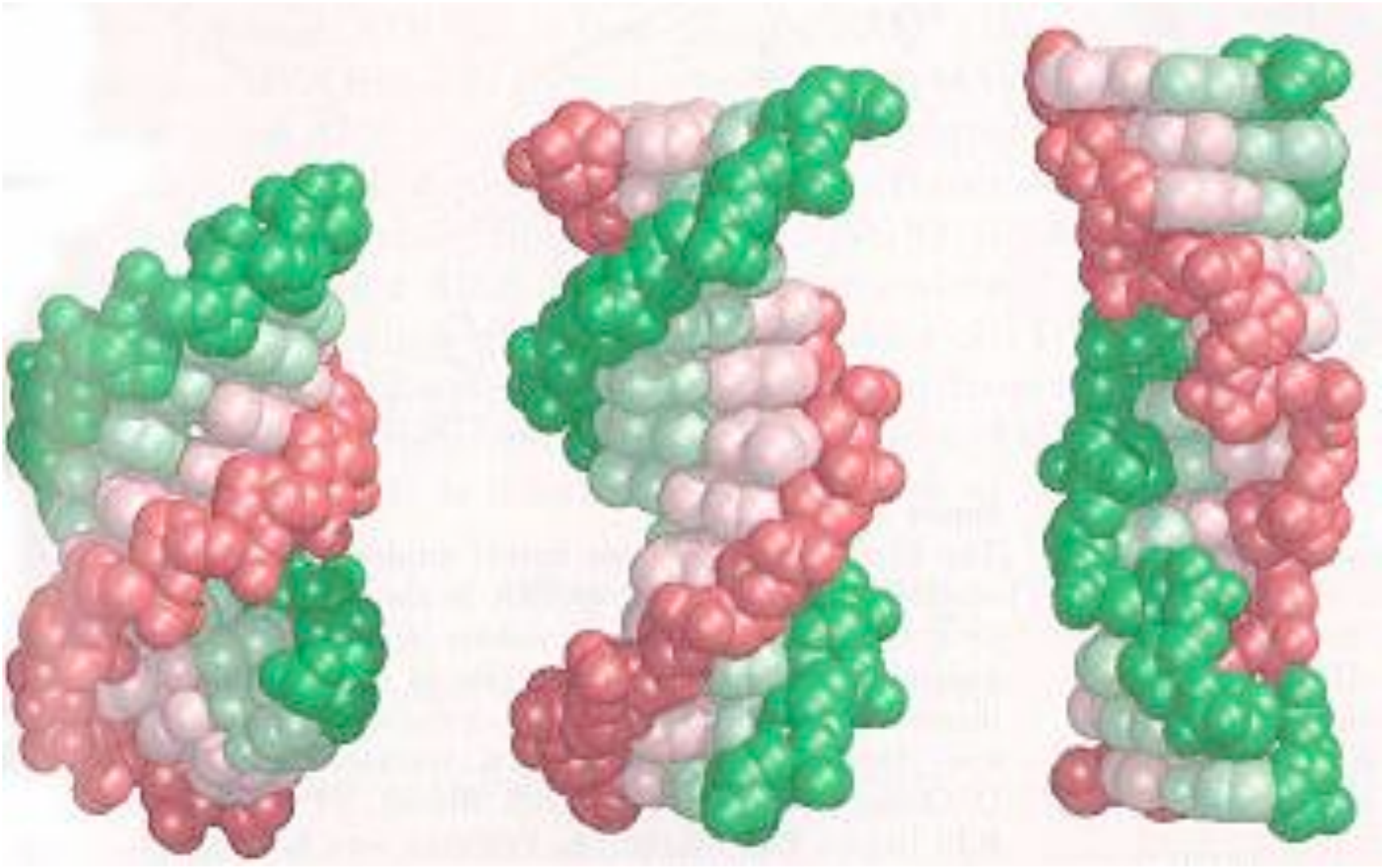
a. The primitive atmosphere contained gases, including water vapor,that escaped from volcanoes; as the water vapor cooled, some gases were washed into the ocean by rain.

b. The availability of energy from volanic eruption and lightning allowed gases to from simple organic molecules.

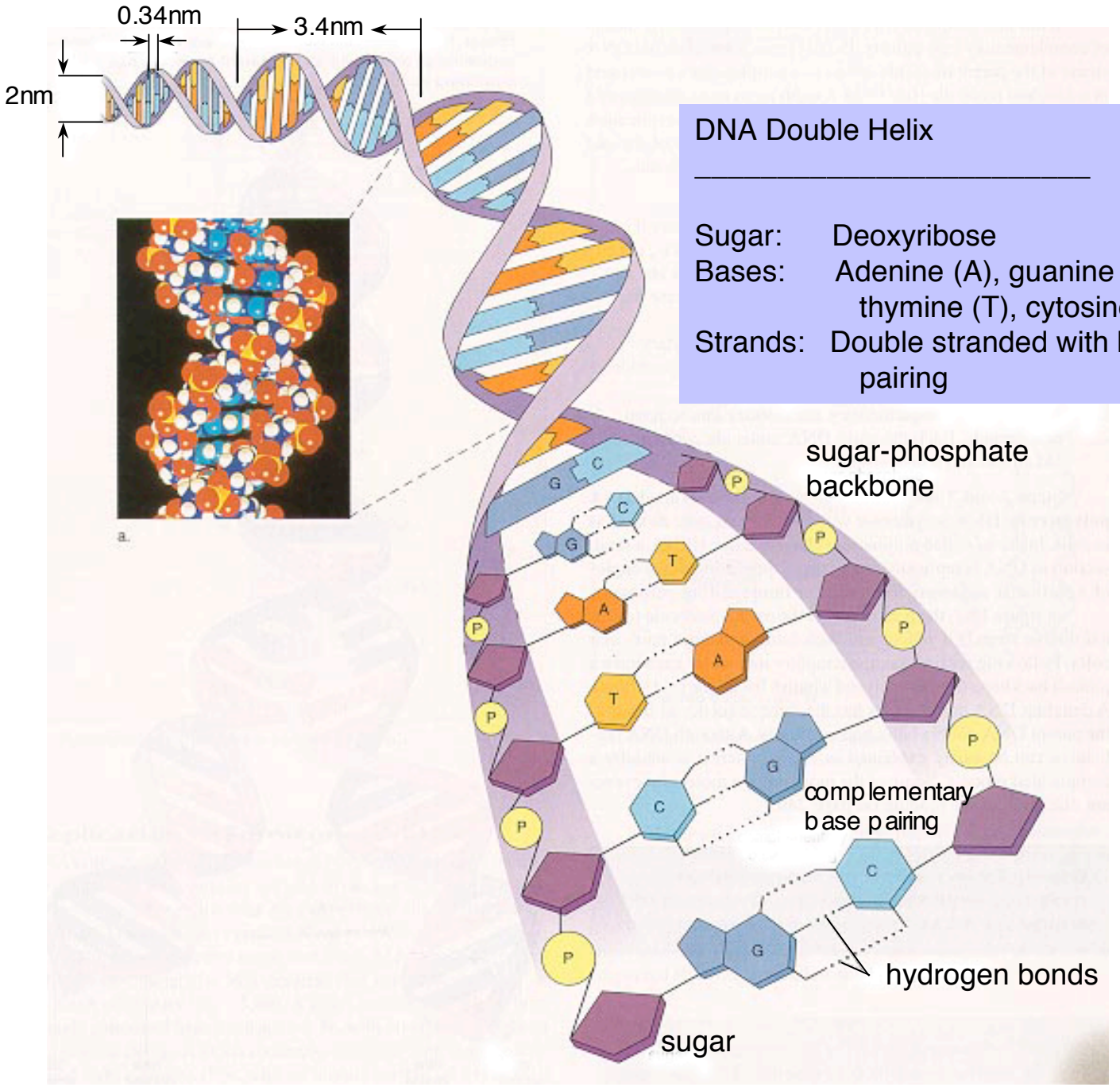
c. Amino acids that splashed up onto rocky coasts could have polymerized into polypeptides (proteinoids) that became microspheres when they reentered the water.

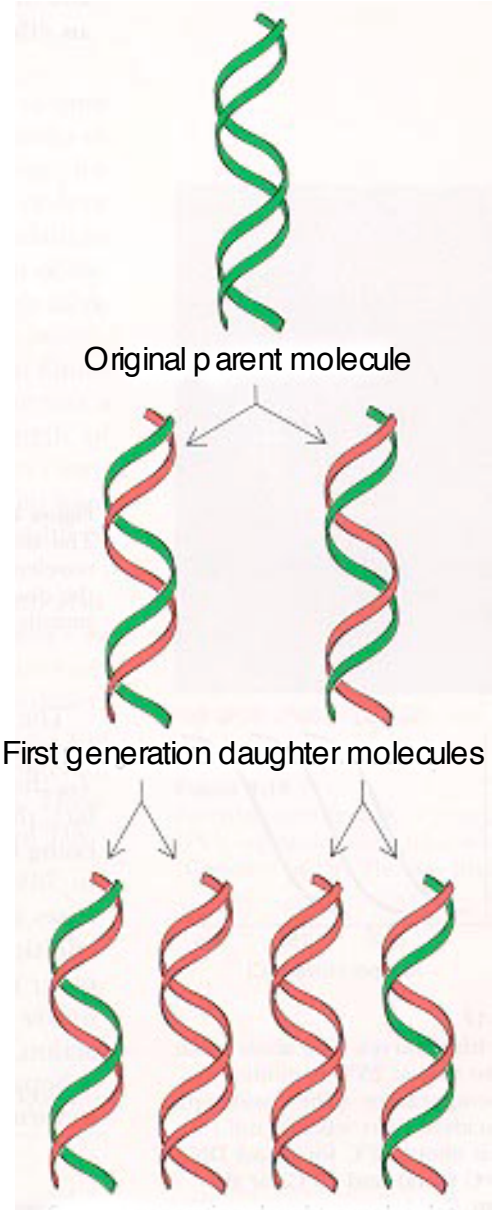
d. Eventually, various types of prokaryotes and then eukaryotes evolved. Some of the prokaryotes were oxygen-producing photosynthesizers.


Chemical Evolution
primitive earth
gases
small organic molecules
macromolecules
plasma membrane
Biological Evolution
protocell
cell
photosynthesis
aerobic respiration



A-DNA **B-DNA** **Z-DNA**


0.34nm
3.4nm
2nm
a.
DNA Double Helix
Sugar: Deoxyribose
Bases: Adenine (A), guanine (G) thymine (T), cytosine (C)
Strands: Double stranded with base pairing
sugar-phosphate backbone
complementary base pairing
hydrogen bonds
sugar



Schematic diagram of semiconservative replication. Parental DNA is shown in green and newly synthesized DNA in red. [After M. Meselson and F.W. Stahl. *Proc. Nat. Acad. Sci.* 44(1958):671.)

In particular research focusses on

SELF-REPLICATION SYSTEMS

Self means that the process is spontaneous, i.e., determined by the internal rule of the system

(generally self-replication corresponds to **autocatalysis, and generally the time process is exponential**)

A → 2A → 4A → 8A → 16A etc

Origin of life
from self-replicating molecules

(how it works on paper)

a) heterocatalysis

A ⋯⋯➤ B

One molecule per second, then 6.10^{23} sec. to make one mole of B

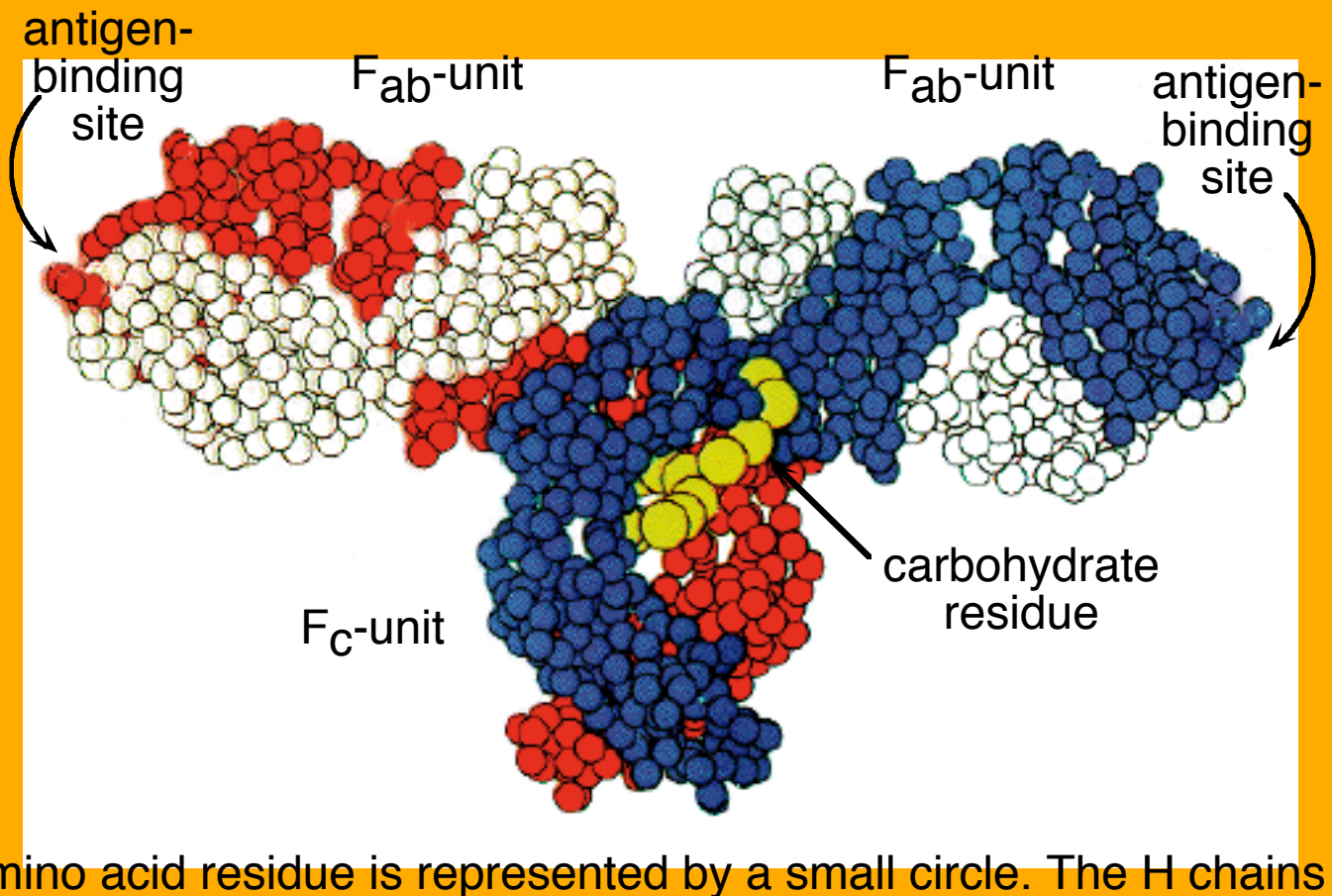
b) self-replication (autocatalysis)

A ⋯⋯➤ A

Only 79 sec. to make one mole of A

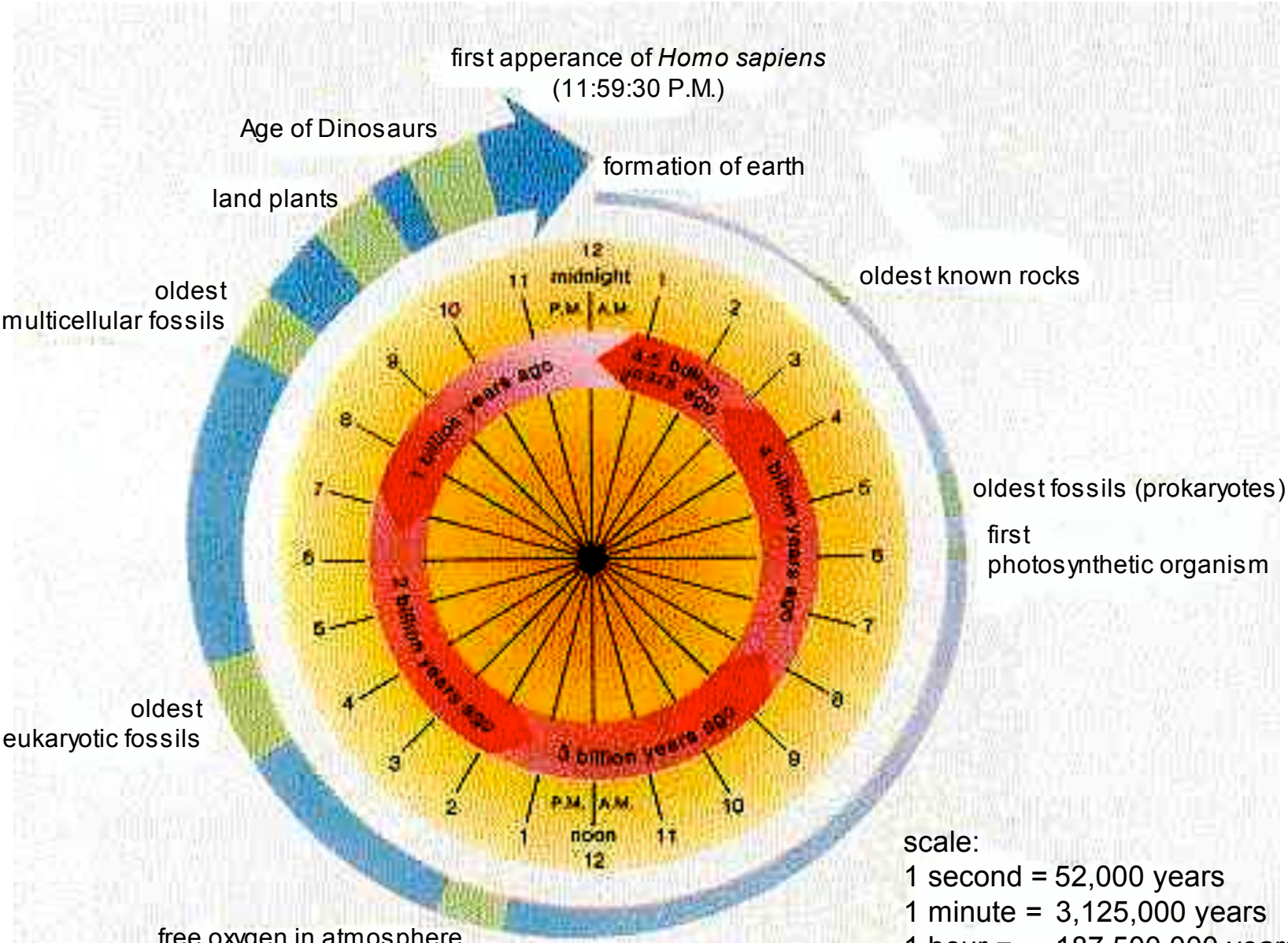
2.....4.....8.....16.....32.....64.....128.....etc.

SCHEMATIC REPRESENTATION OF THE THREE-DIMENSIONAL STRUCTURE OF I_gG

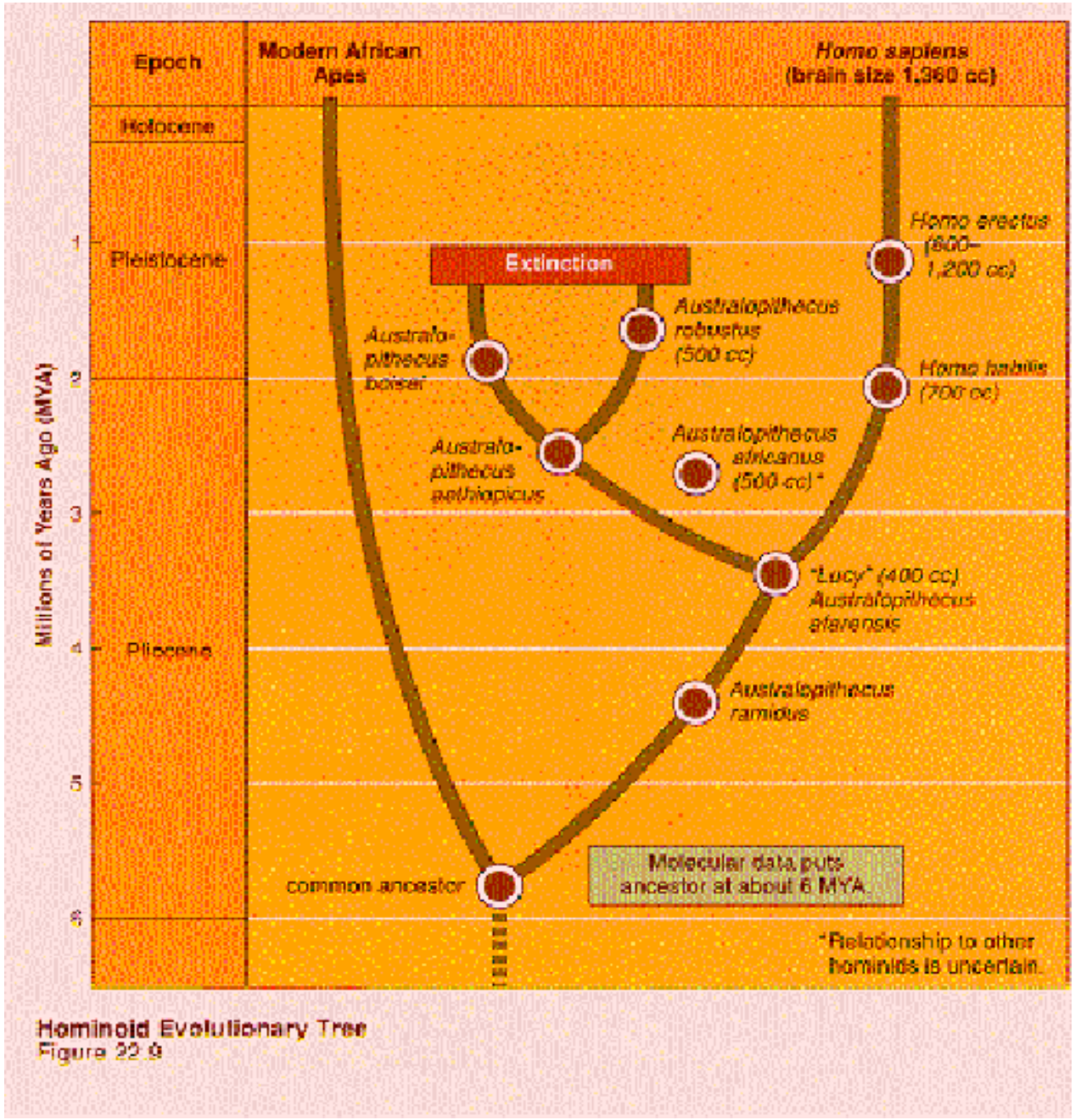


Each amino acid residue is represented by a small circle. The H chains are red and the L chains blue. A carbohydrate residue is yellow.

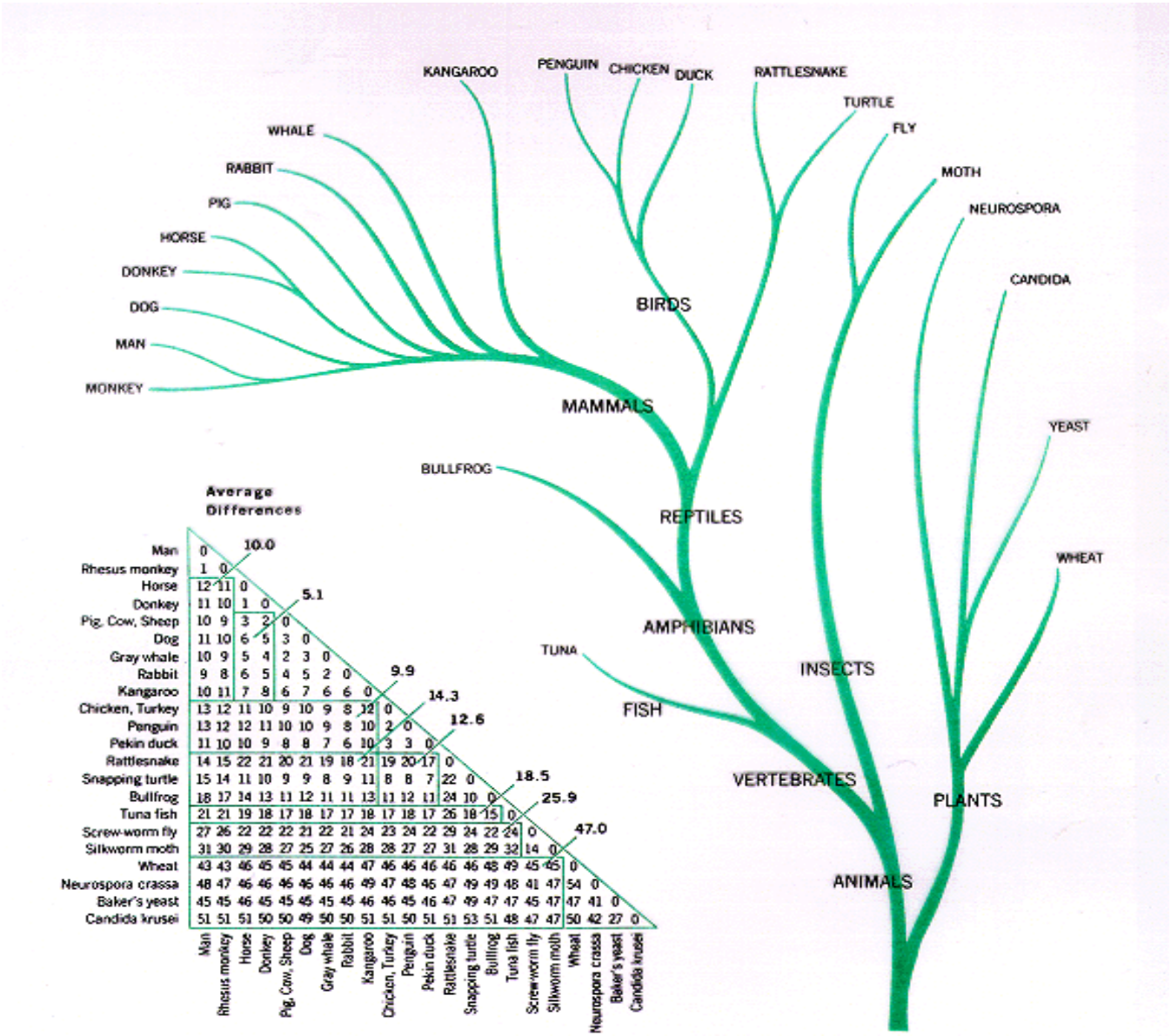
E. W. Silverton, et al. *Proc. Nat. Acad. Sci. 74 (1977); p. 142.*



History of Earth Using a 24-hour Time Scale

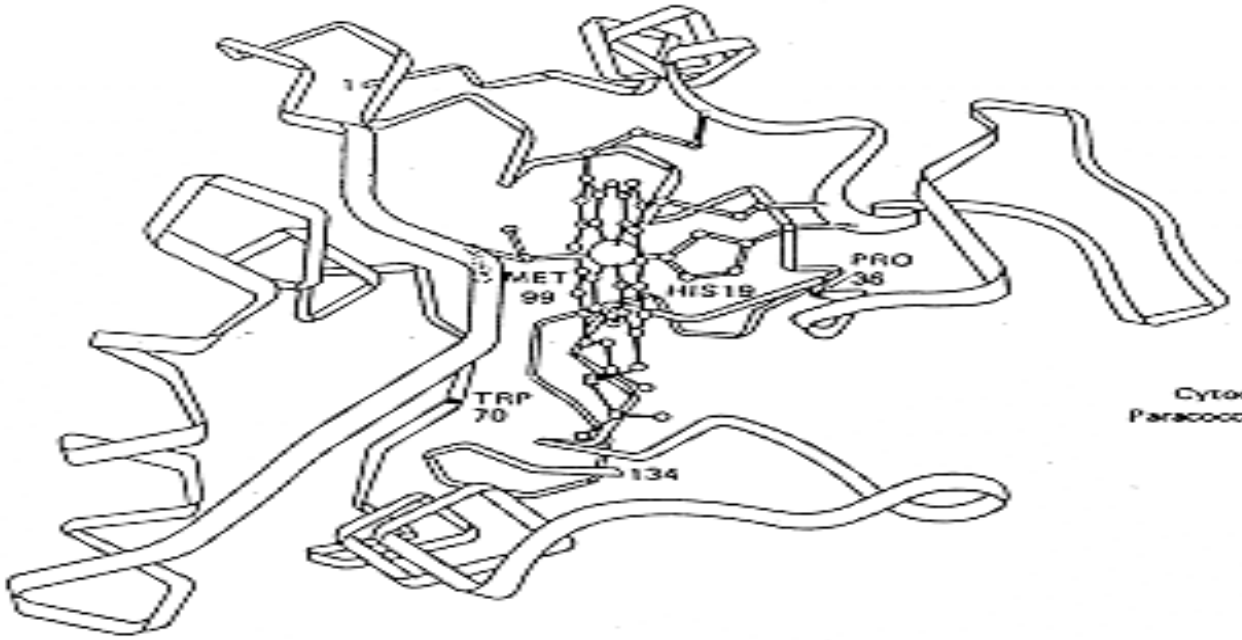


Hominoid Evolutionary Tree
Figure 22.9

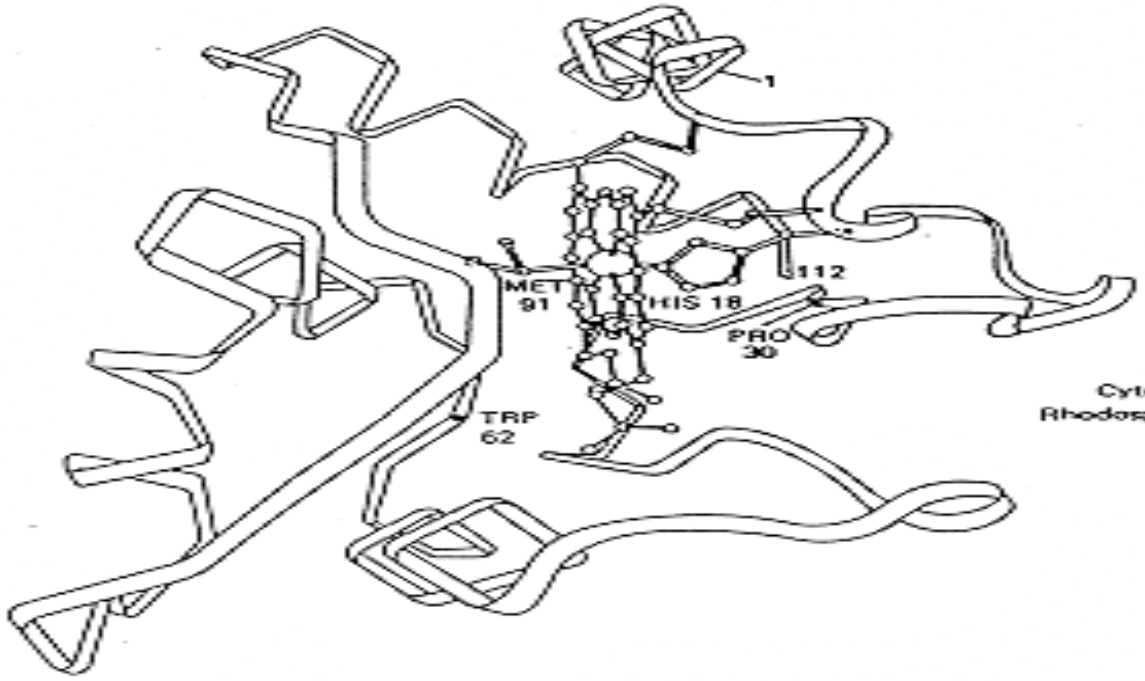


THE FAMILY TREE OF THE CYTOCHROMES C

The species differences shown in the table above left lead to a tree of family relatedness. Note that these is no ascending hierarchy. From the viewpoint of a yeast (if it had one, and therein lies a real if anthropocentric distinction), a moth, a man, and a bullfrog are equally far away. Note also how provincial is the view that we usually take of the living kingdom. The differences between fungi are greater than those between insects and vertebrates.



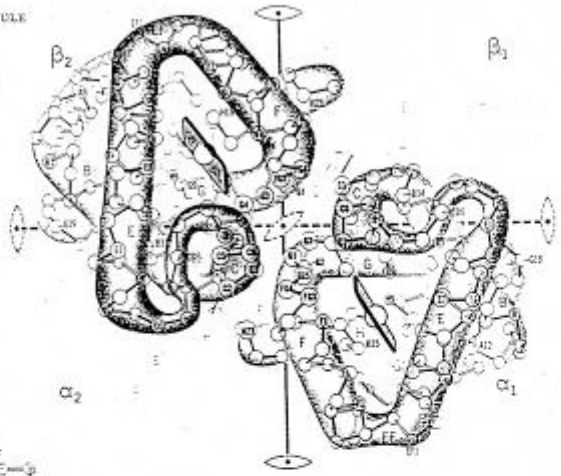
Cytochrome c_{550}
Paracoccus denitrificans



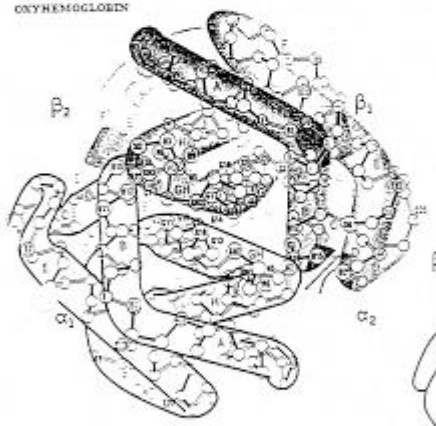
Cytochrome c_2
Rhodospirillum rubrum

THE FOUR CHAINS OF OXYHEMOGLOBIN

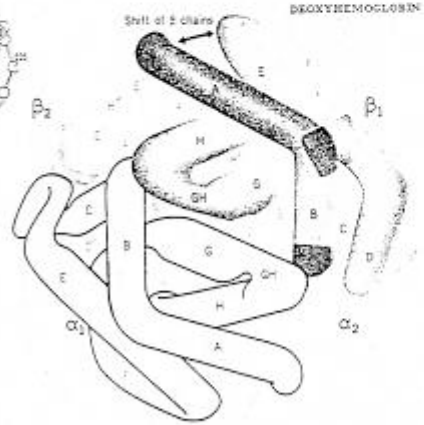
The folding and packing of chains in hemoglobin. The true symmetry axis (solid line) is vertical. One pseudo-axis (dashed line) is horizontal; the other rises directly out of the page. Those residues which participate in the $\alpha_1\beta_2$ interchain contacts are labeled in bold type in large circles (21). Numbering in the H helix is that of hemoglobin, not myoglobin (see page 32). A view of the molecule down the true twofold axis is given in the stereo supplement.



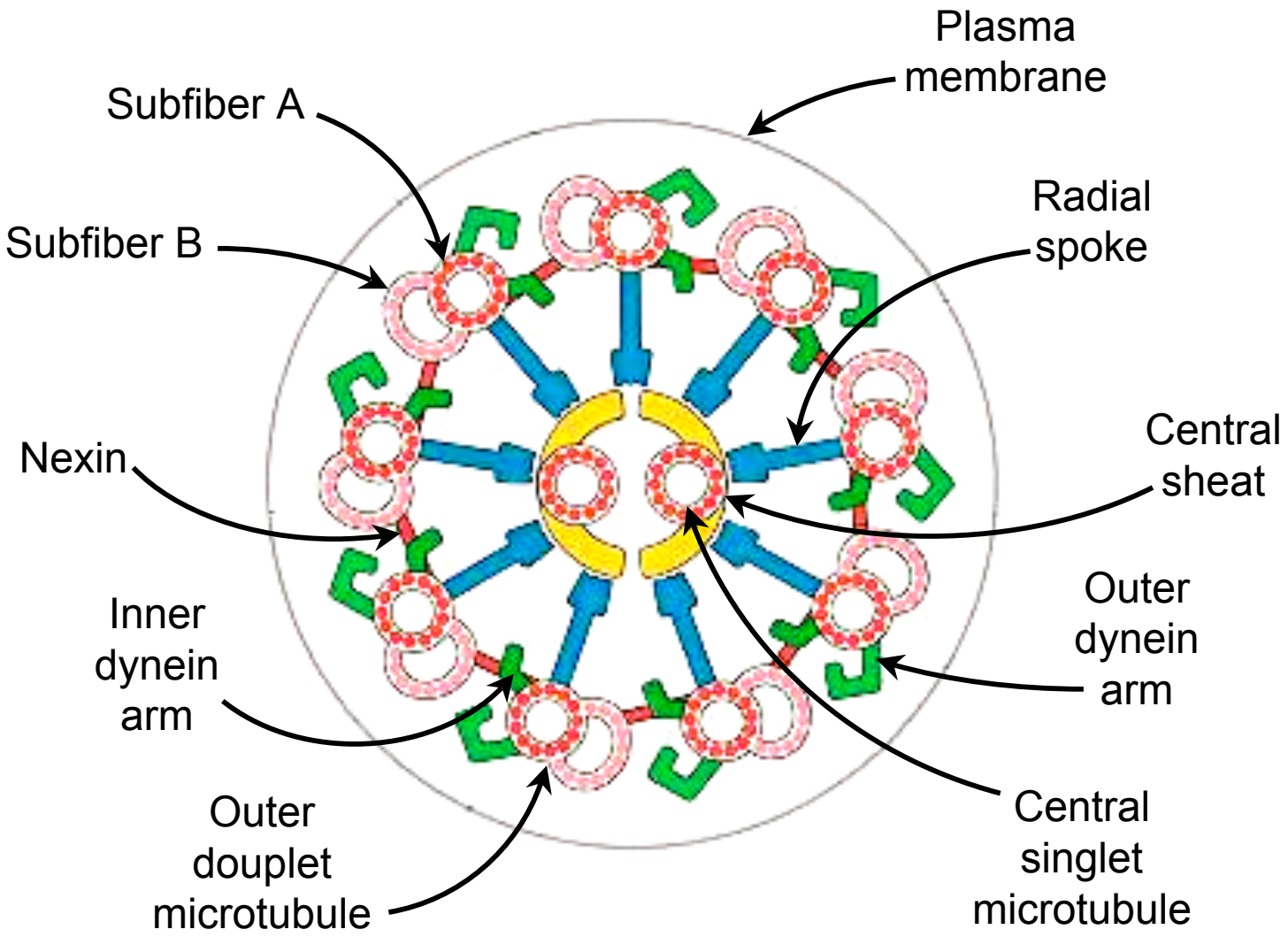
OXYHEMOGLOBIN



DEOXYHEMOGLOBIN



Two views from the right in the top drawing. $\alpha_1\beta_1$ interchain contacts in bold type in large circles. Arrow marks the shift of β chains in deoxyhemoglobin. Atomic coordinates of oxyhemoglobin by courtesy of Dr. M. F. Perutz, Cambridge, England.



Schematic diagram of the structure of an axoneme

(from Biochemistry / L.Stryer, 4th ed.)

From the watchmaker (Paley 1802):

. . . when we come to inspect the watch, we perceive. . . that its several parts are framed and put together for a purpose, e.g. that they are so formed and adjusted as to produce motion, and that motion so regulated as to point out the hour of the day; that if the different parts had been differently shaped from what they are, or placed after any other manner or in any other order than that in which they are placed, either no motion at all would have been carried on in the machine, or none which would have answered the use that is now served by it. . . . the inference we think is inevitable, that the watch must have had a maker -- that there must have existed, at some time and at some place or other, an artificer or artificers who formed it for the purpose which we find it actually to answer, who comprehended its construction and designed its use.

Living organisms, Paley argued, are even more complicated than watches, thus only an intelligent Designer could have created them, just as only an intelligent watchmaker can make a watch.

According to Paley :

That designer must have been a person. That person is GOD.

darwinism and molecular evolution

.....The various structures built by Nature are the result of chance. There is no aim, no pre-determination- only chance determined assembly processes, and random structures.

If one of these structures happens to perform an useful function for the organism, it may be codified and preserved. Then Chance becomes encoded in DNA, it becomes Necessity, i.e. the hard law of genetic invariance.

from Monod' Chance and Necessity

..die Natur ist wie ein Bastler, der in seinem Garage ziellos Dinge zusammensetzt.
Viele von diesen Konstruktionen sind instabil oder unnötig-
Werden weggeworfen.
Manchmal irgend eine Konstruktion ist nützlich
(für die Reproduktionseffizienz des Organismus)-
Und dann wird beibehalten (genetisch gespeichert).
Chance wird Notwendigkeit.

Monod, Chance and Necessity
F. Jacob, The actual and the Possible
R. Dawkins, The blind watchmaker