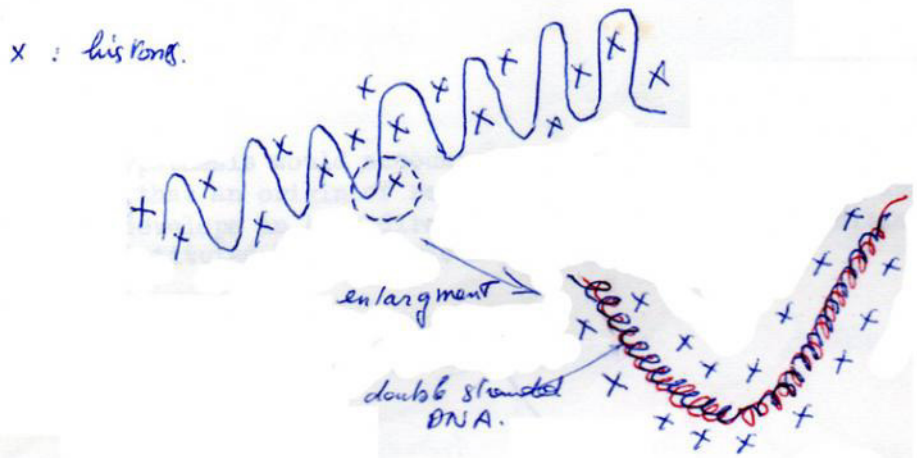
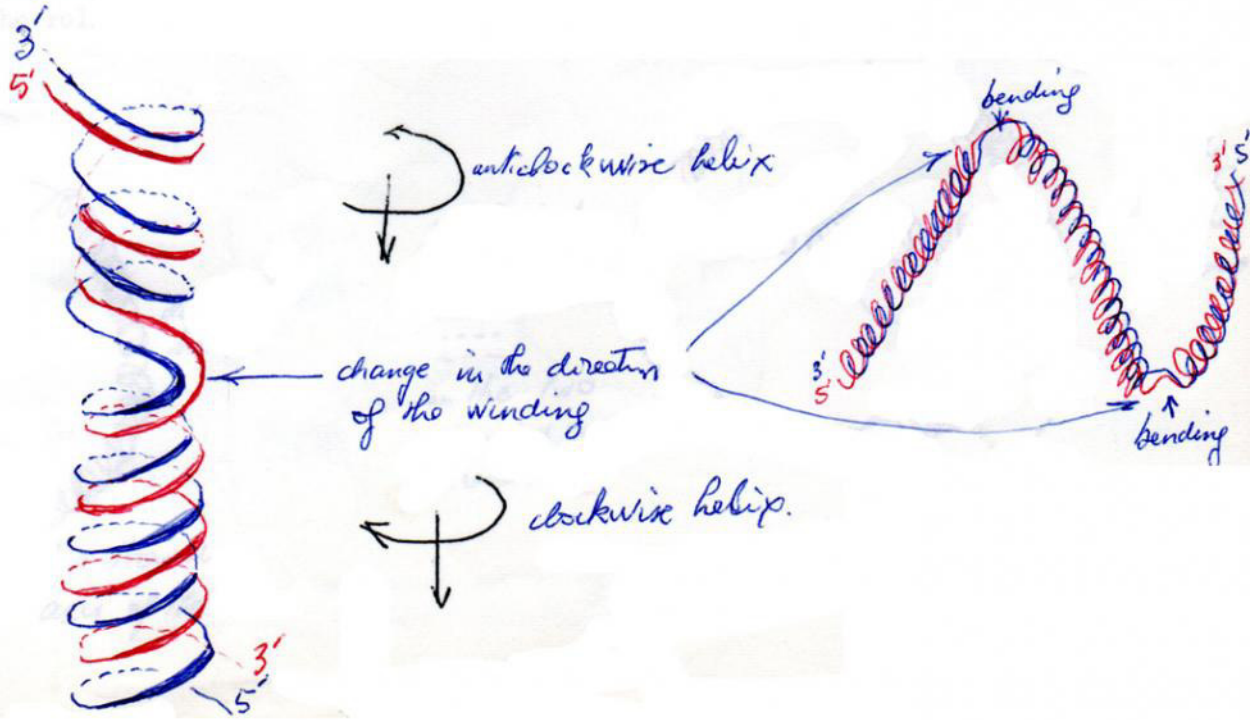
HYPOTHESES ON THE STRUCTURE OF CHROMOSOMES. CONSEQUENCES ON THE REPLICATION OF THE DNA.

— If the results obtained with the ovocytes of the Batrachia can be extrapolated to the somatic cells of the higher animals, a single molecule of double stranded DNA folded several times on itself would constitute each of the homologous chromosomes of any pair, the whole being coated by molecules of histones and forming a structure thick enough to be visible under the optical microscope.

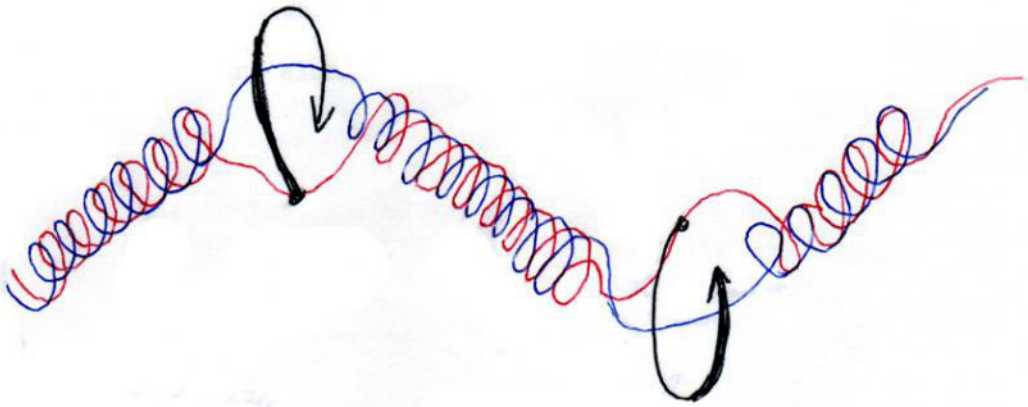


— The replication of each chain requires the separation of the two strands and therefore their rotation round the axis of the helix. This cannot be easily conceived without numerous tanglings if the chain is long and folded several times on itself

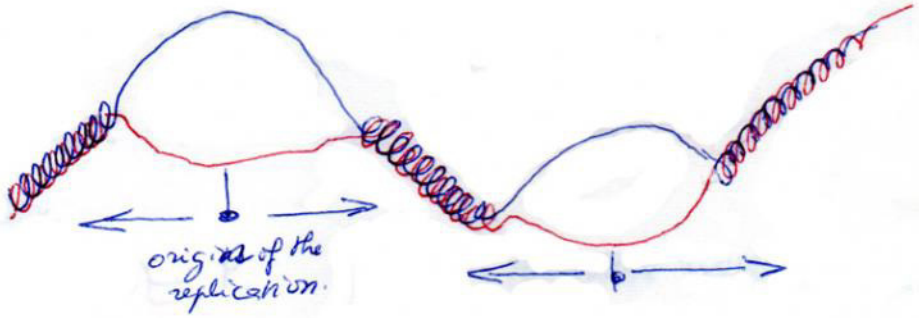
Consequently, the hypothesis proposed here is that the direction of the winding of the helix would change several times along the chain: the helix would be, by turns, clockwise or anticlockwise (without there being a change in the direction of the phosphodiester links). Each change in the direction of the winding would provoke the bending of the chain.



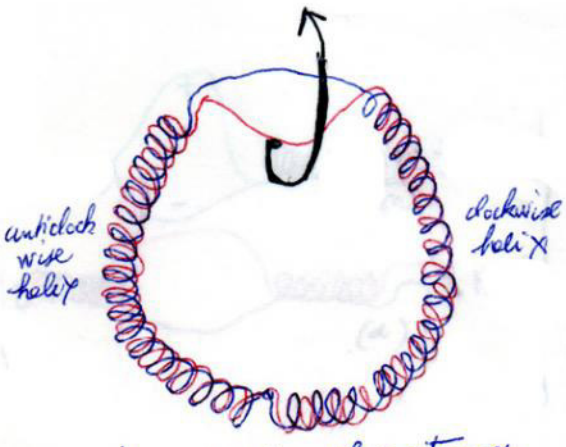
— The replication can be more easily conceived with this model: the separation of the strands would be achieved by the rotation of a strand round the axis, from each bending. The direction of the winding being reversed, the resultant torsion would be null, on a long enough molecule, and the risks of tangling would be avoided. A model can be made to verify it, with a staple of wool or a strand of wire.



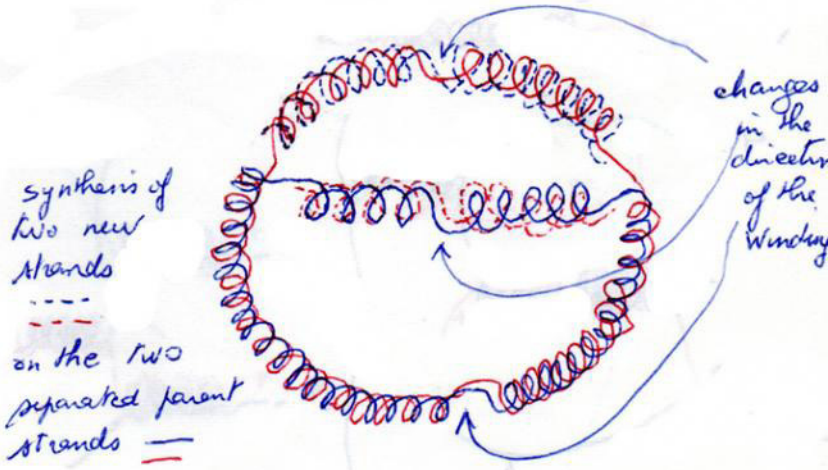
— This hypothesis would account for the fact, observed for the mammalian chromosomes, that an origin of replication exists every 100 μ and that the elongation develops in both directions from the sites of initiation: they would be constituted by the various bendings.



— The θ-shaped images observed under the electronic microscope in the case of the DNA replication of Coli could result from the unwinding of one of the strands round the other at the bending level, no need for the inter-vention of any "molecular joint" or a complicated system of endonucleases (theory of the rolling circle)



1) unwinding of a strand round the axis of the helix



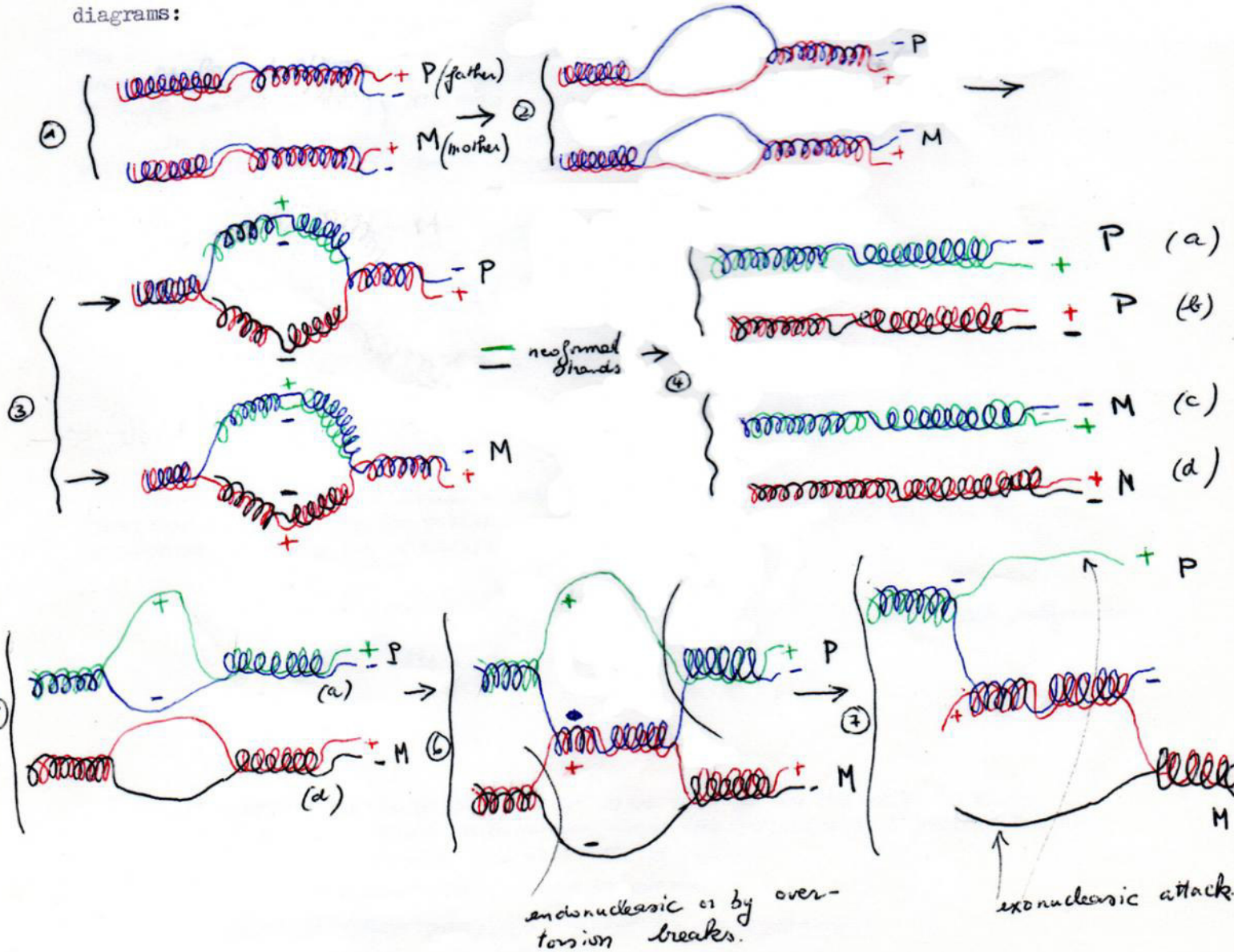
2) θ shaped image.

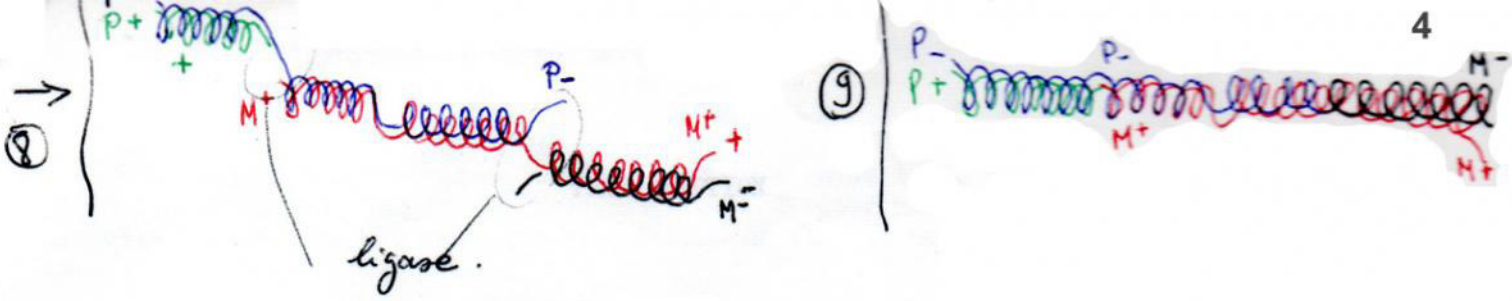
— It is understanble that the initiation of the replication should begin at a precise point(a bending)Yet two origins at least should be observed in a circular molecule.As it isn't the case,it must be admitted that the two strands can be separated at only one point of change in the winding of the helix,with a circular chromosome.

— Note: The replicative double-stranded form of ØX I74 DNA cannot be used,it is known,as a template,without the intervention of nucleases.Nethertheless it is formed by the replication of a circular strand + and there is no reason that there be a change of the winding along the chain.

This cannot operate in the same way for the, by nature, double-stranded genomes of Coli or of the phage λ

— The crossing-over can be explained too,as it is shown on the following diagrams:





The favouring roles of the nucleases and of the protein that holds the double strands separated can obviously be explained.

— The presence of polynucleotides bound in a covalent way to the parent strands of Coli can result from crossing-over, without having need of using the complicated theory of the "rolling circle."