A HISTORIC VIEW OF DNA

ONCE viruses are crystallized, it becomes possible to analyze them by X-rays. They are proteins, of course, but a particular variety, called nucleoproteins. The advance of staining methods makes it possible also work out the chemical nature of individual subcellular structures, and it turns out that the chromosomes, too, are composed of nucleoproteins.

A nucleoprotein molecule consists of a protein in association with a phosphorus-containing substance known as nucleic acid. The nucleic acids were studied in detail by the German biochemist, Albrecht Kossel (1853-1927), who broke nucleic acids down into smaller building blocks. These included phosphoric acid and a sugar he could not identify. In addition to this, there were 2 compounds of a class called purines with molecules made up of 2 rings of atoms, including 4 nitrogens. Kossel named these adenine and guanine (A & G). He found 3 pyrimidines which he named cytosine, thymine and uracil (C, T & U).

A Russian-American chemist, Thoebus Aaron Thiodor Levene showed that in the nucleic acid molecule, a phosphoric acid molecule, a sugar molecule and one of the purines or pyrimidines formed a 3-part unit which he called a nucleotide. The nucleic-acid molecule is built up of chains of these nucleotides, as proteins are built up by chains of amino acids. The nucleotide chain is built up by connecting the phosphoric acid of one nucleotide to the sugar group of the neighbouring nucleotide. In this way a sugar-phosphate backbone is constructed, a backbone from which individual groupings of purines and pyrimidines extend.

Levene further showed that the sugar molecules found in nucleic acids were of 2 types: ribose and deoxyribose. Each nucleic-acid molecule contained one type of sugar or the other, but not both. They were correspondingly named the ribonucleic acid RNA & deoxyribo nucleic acid DNA.

Kossel made some observations, which we can see to be most significant. Sperm cells consist almost entirely of tightly packed chromosomes and carry the chemical substances that include the complete instructions by which the share of inheritant characteristics are passed on to the young. Yet Kossel found very simple proteins in these sperm cells, much simpler than those found in common tissues. This might made it seem more likely that the inheritant instructions were included in the sperm's unchanged nucleic-acid molecules rather than in its gressly simplified proteins.

SINCE 1944, the new view of nucleic acid has been amply confirmed, most spectacularly perhaps through works on viruses. Viruses were shown to have an outer shell of proteins with a nucleic acid molecule in the inner hollow. The German-American biochemist, Heinz Fraenkel-Conrat was able, in 1955, to tease the 2 parts of the virus apart and put them together again. The protein portion byitself showed no infectivity; and it was alive, though it needed the protein portion to express itself most efficiently.

WORKS with radioactive isotopes showed clearly that when a bacteriophage , for instance, invaded a bacterial cell, only the nucleic acid portion entered the bacterial cell(host) and the protein portion remained outside. Inside the cell, the viral nucleic acid not only brought about the manufacture of more nucleic acids of its type, but also protein molecules to form its own shell. Certainly there could no longer be any doubt that the nucleic acid molecules and not the proteins carried the genetic information.

Virus contains either DNA or RNA or both. However within the cell, DNA was found exclusively in the genes only. Since the genes are the units of heredity, the importance of the nucleic acid resolves itself into the importance of DNA.

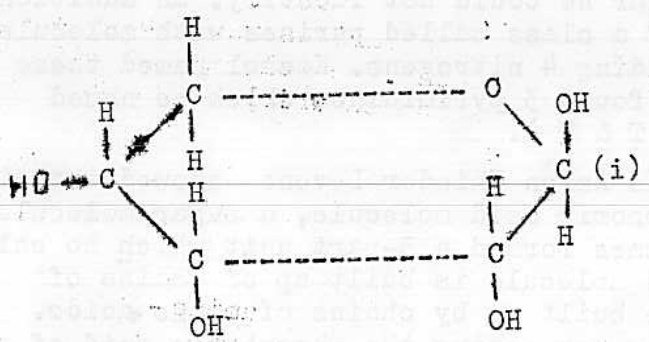
- END -

The above contents are extracted from the books :
A SHORT HISTORY OF BIOLOGY by ISAAC ASIMOV &
THE BIOLOGY OF THE CELL CYCLE by L.M. Mitchison

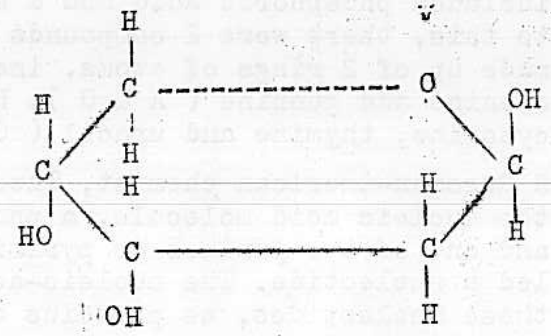
Figures extracted from A TEXT BOOK OF BIOCHEMISTRY AND PHYSIOLOGY by George H. Bell

. BOTANY - An introduction to Plant Biology by T.Elliott Weier

The passage is set and arranged by Miss Ho Dick Si



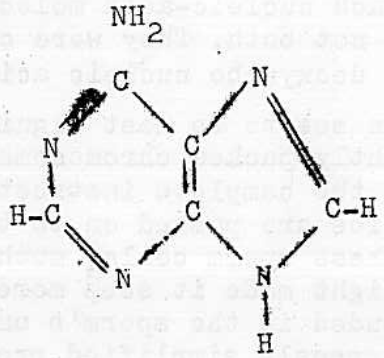
(i)



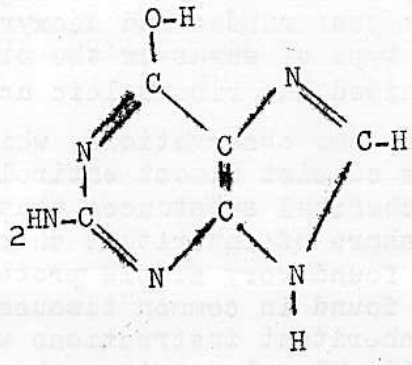
Ribose and Deoxyribose exist in free state as expressed above.

β-D-ribopyranose(free ribose)

β-D-2-deoxyribopyranose(free deoxyribose)

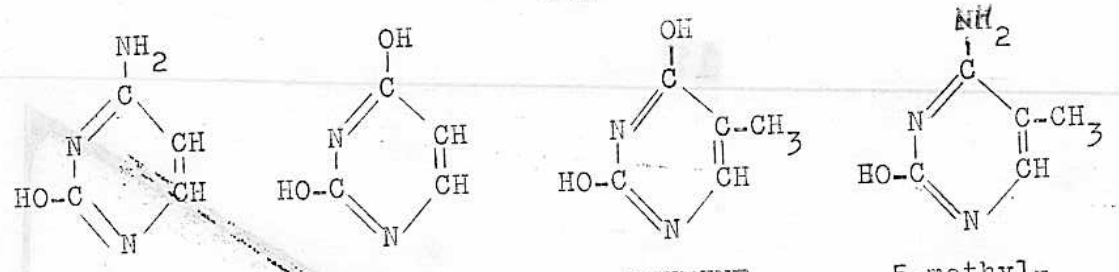


ADENINE (6-aminopurine)



QUANINE

(2-amino-6-hydroxypurine)

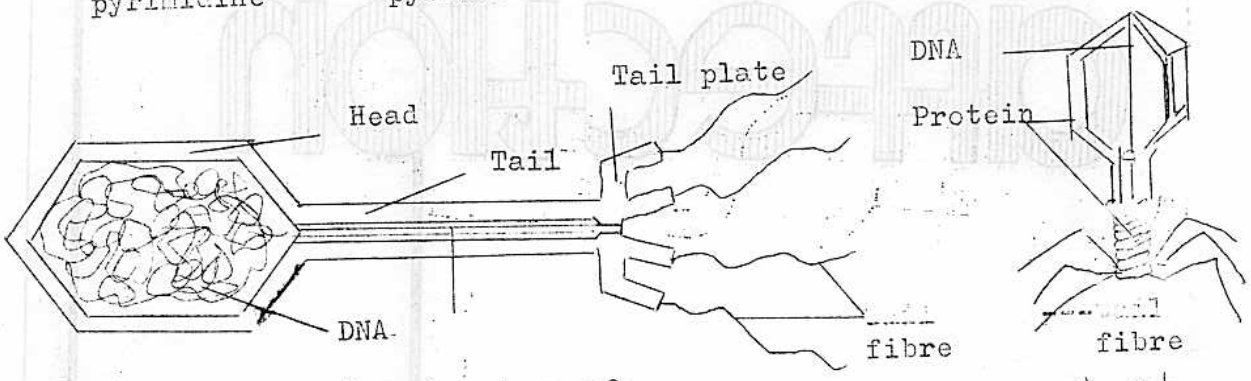


CYTOSINE — 2-hydroxy-4-amino/ pyrimidine

URACIL — 2,4, dihydroxy-/ pyrimidine

THYMINE — 5-methyl- / uracil

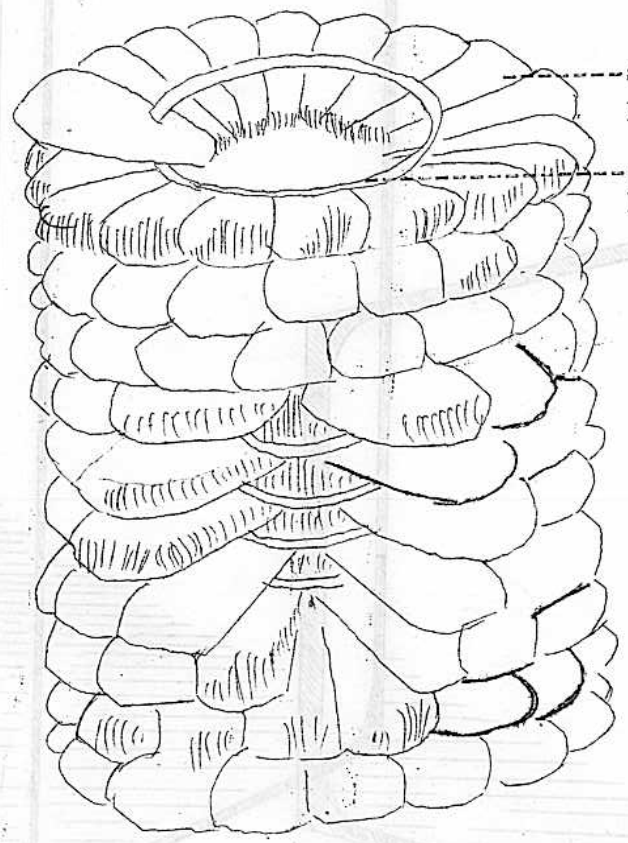
5-methyl-cytosine



Figures showing the structure of T_2 bacteriophage

T_2 噬菌體

Figure (below) showing the structure of TMV, Tobacco Mosaic Virus

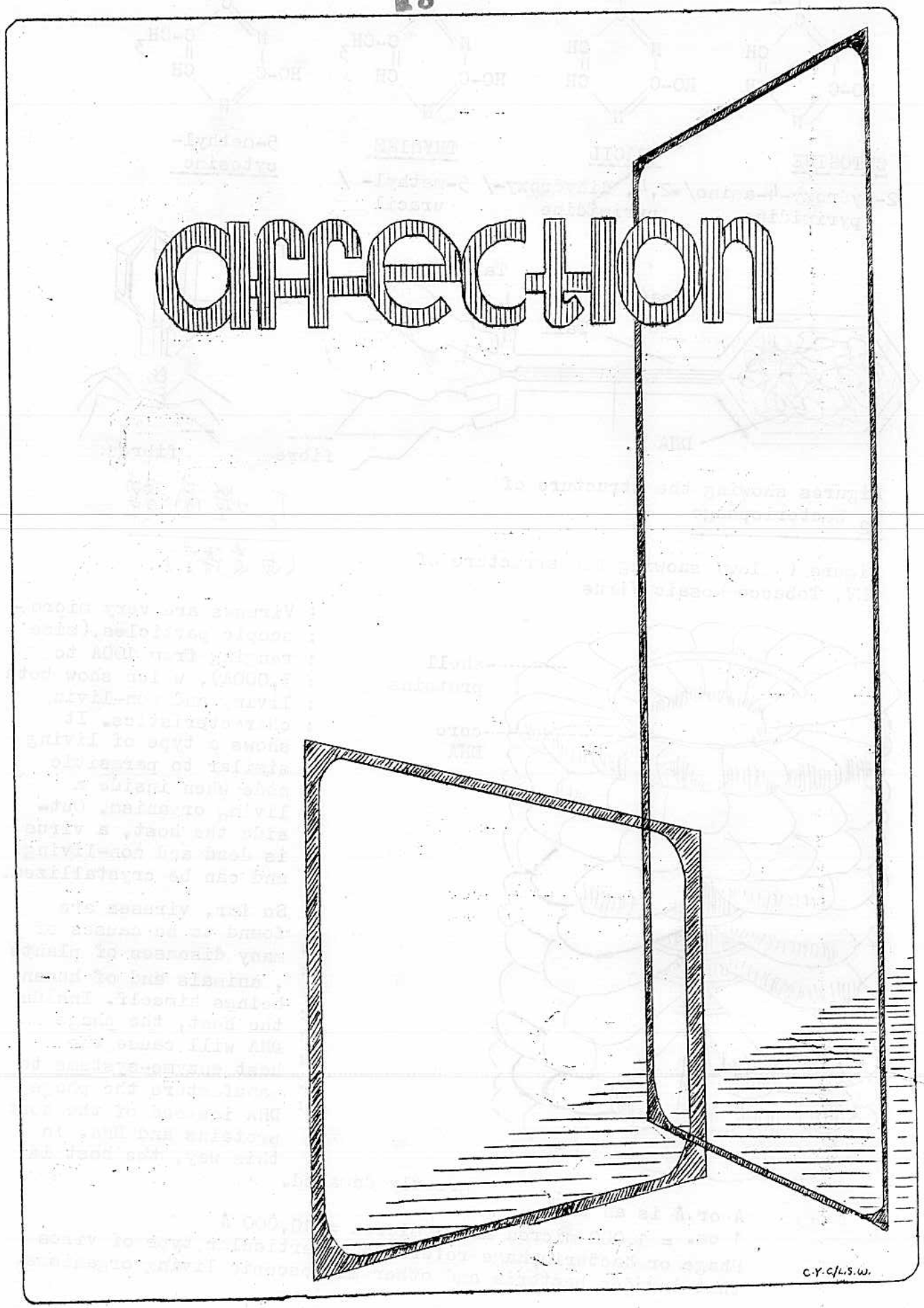


(由遺傳學)

: Viruses are very micro-
: scopic particles,(size
: ranging from 100A to
: 3,000A), which show both
: living and non-living
: characteristics. It
: shows a type of living
: similar to parasitic
: mode when inside a
: living organism. Out-
: side the host, a virus
: is dead and non-living,
: and can be crystallized.

: So far, viruses are
: found to be causes of
: many diseases of plants
: , animals and of human
: beings himself. Inside
: the host, the phage
: DNA will cause the
: host enzyme-systems to
: manufacture the phage
: DNA instead of the host
: proteins and DNA. In
: this way, the host is
greatly damaged.

A or Å is an unit
1 cm. = 1,000 micron and 1 micron = 10,000 Å
Phage or bacteriophage refers to a particular type of virus that invades bacteria and other microscopic living organisms.


DIRECTION
C.Y.C/L.S.W.