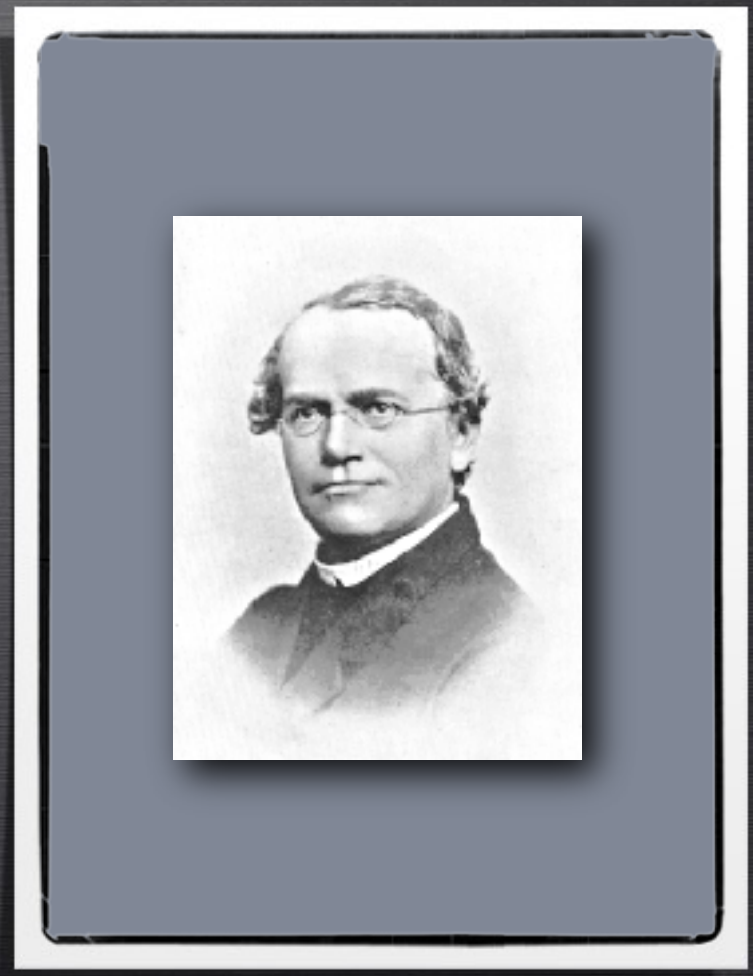
Watson and Crick

and the Structure of DNA

Early Genetics

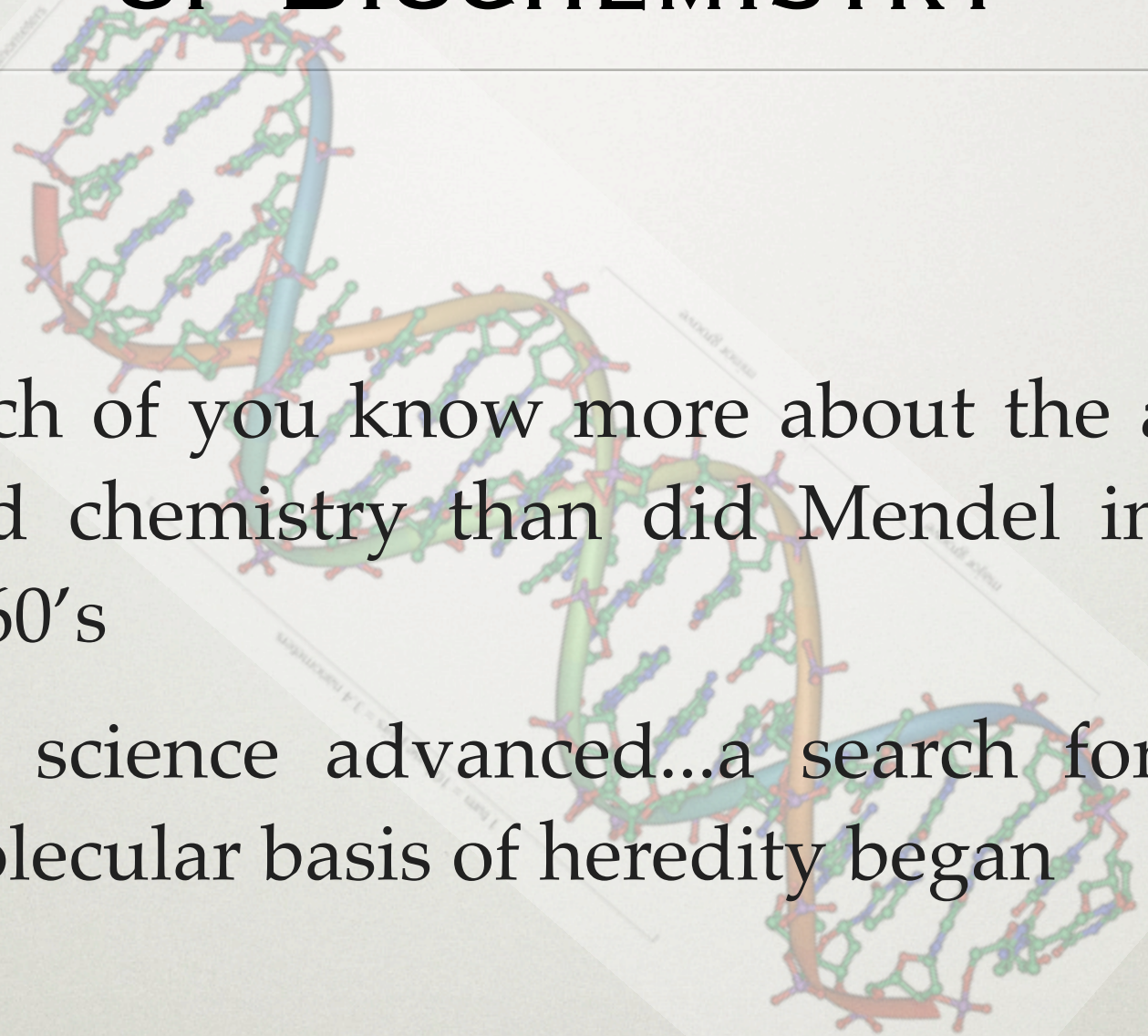
Gregor Mendel



Began the science of genetics in the 1860's

Mendel's observations were due to what he called "heritable factors"

Mendel Had NO Knowledge of Biochemistry



- Each of you know more about the atom and chemistry than did Mendel in the 1860's
- As science advanced...a search for the molecular basis of heredity began

What are chromosomes Made of?

DNA and Proteins

By the early 1900's scientists had established that genes were carried on chromosomes

The Great Debate

Which is the genetic material?

Protein

- Protein makes up more than 30% of the dry mass of a cell
- There are 20 amino acids found in proteins
- More mass + more variety was thought to equal a better ability to pass on traits

DNA

- Makes up only 1-3% of a dry cell's mass
- There are only 4 Nitrogen bases found in DNA
- DNA did not appear to have the potential to explain the wide variety of traits seen in higher plants and animals

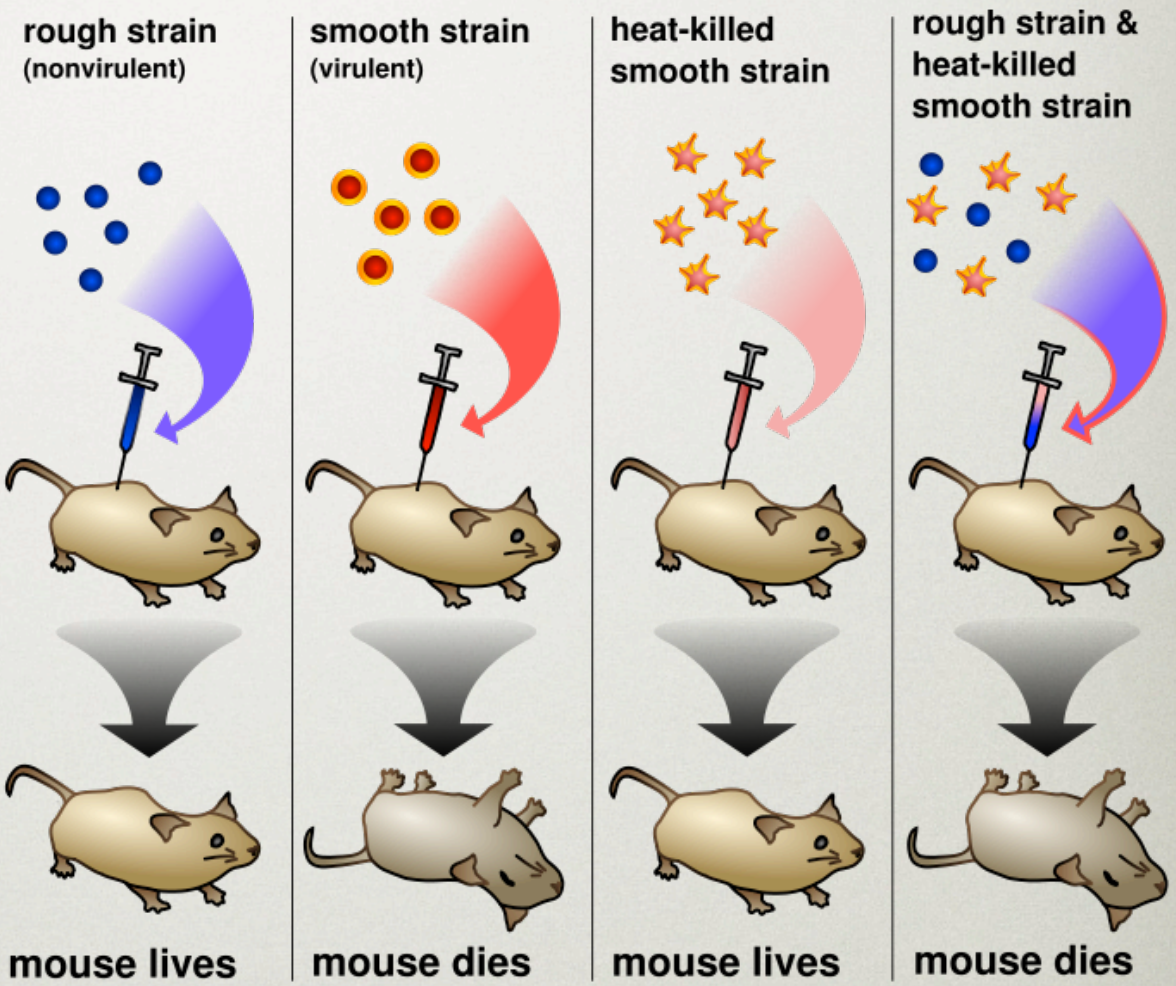
An Interesting Discovery

Frederick Griffith

"Bacterial Transformation"

1928

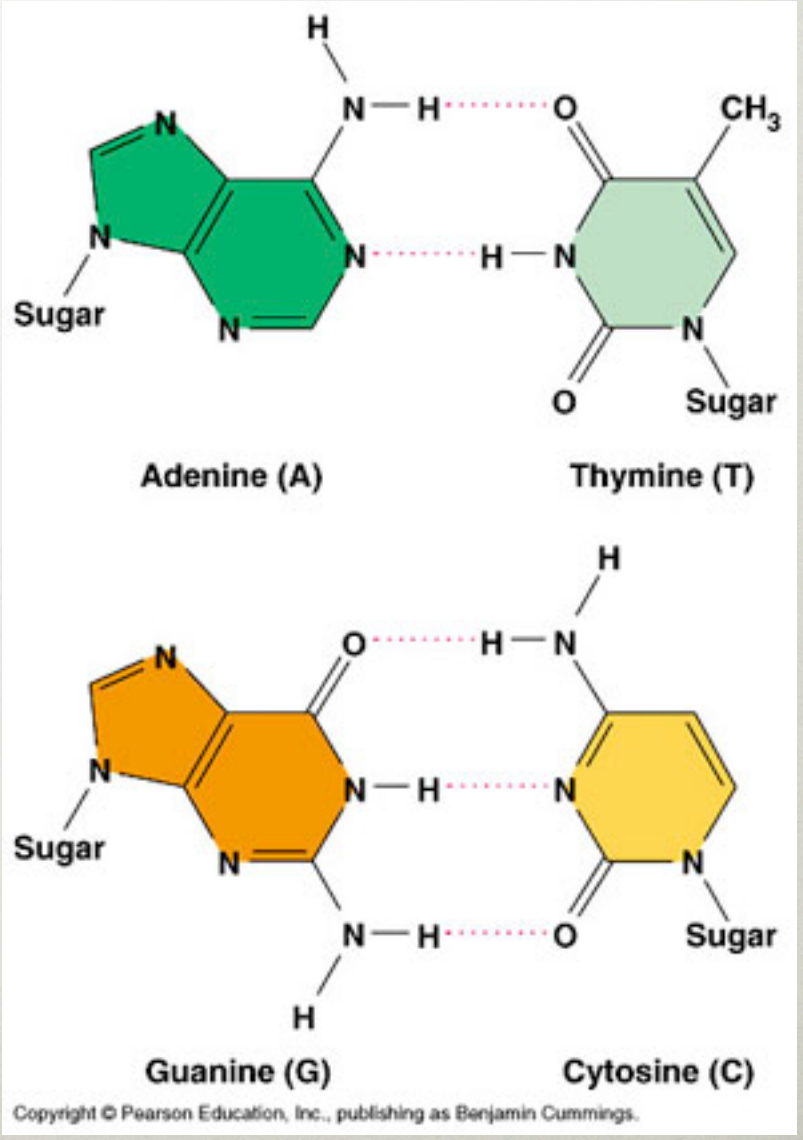
Something was being transfered between the bacteria...but what?



This experiment was repeated in 1944 (Avery, MacLeod, McCarty) with "extracted DNA" from the smooth strain...the results were identical

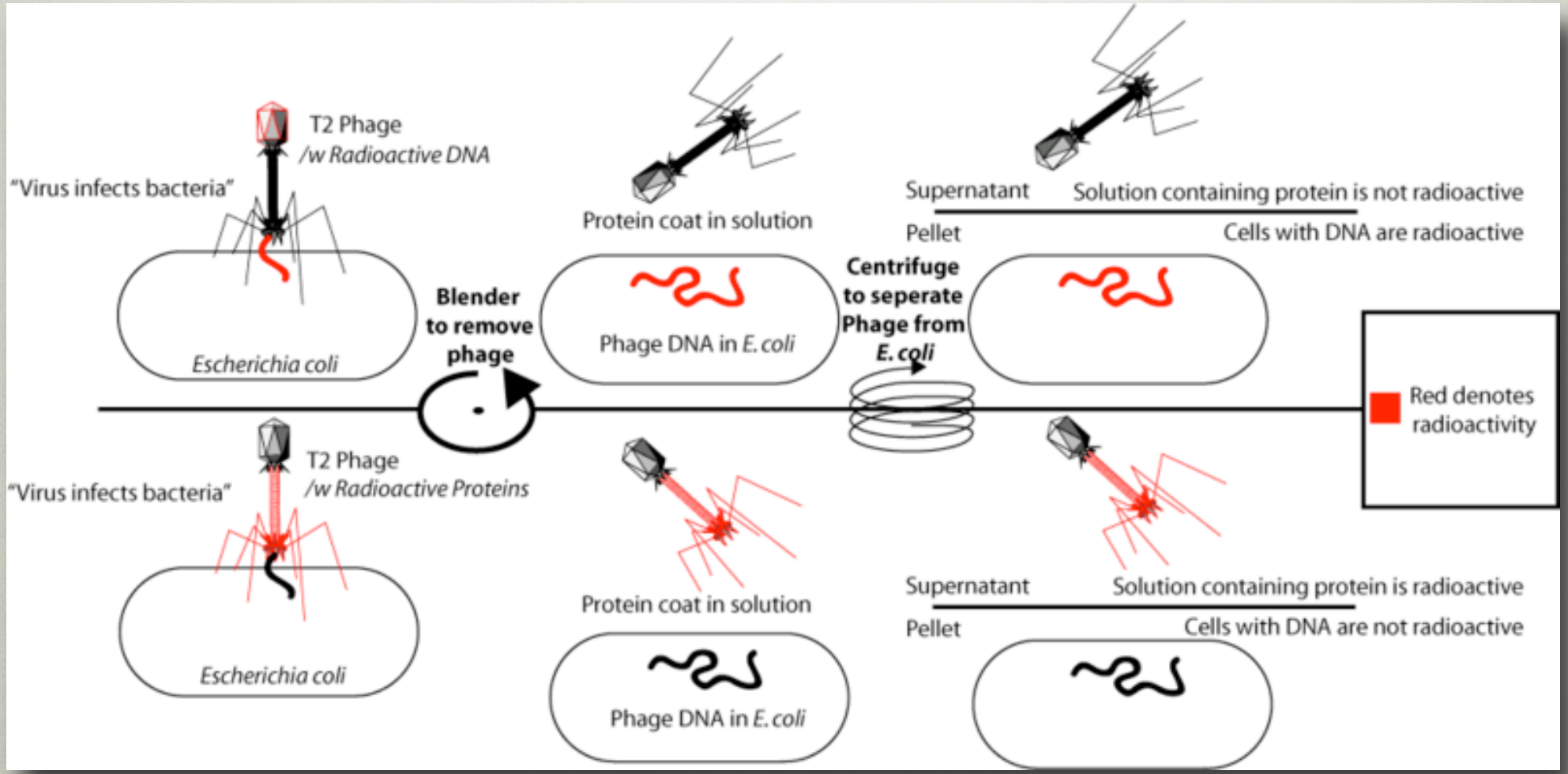
Chargaff and His Rules

- Showed that in DNA the amount of Thymine=Adenine, and Guanine=Cytosine
- Also showed that the relative amounts of A, C, T, and G differ in different species



The Debate Settled

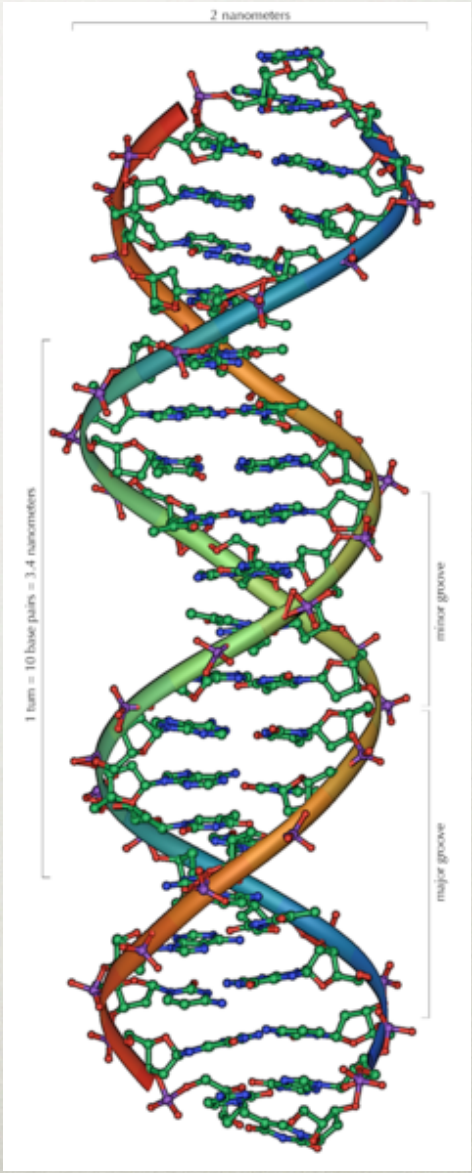
The Hershey-Chase "Blender" Experiment - 1952



The Double Helix

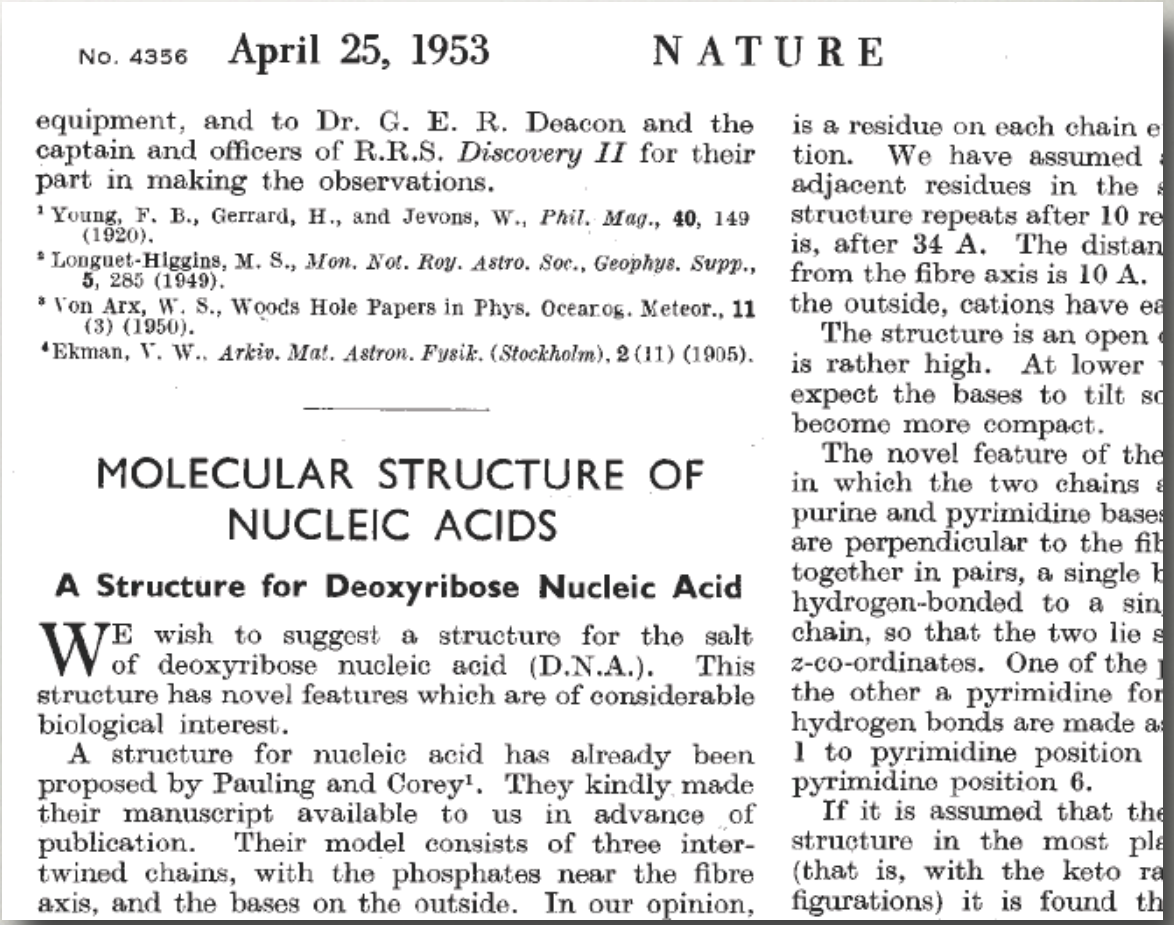
Now that DNA was known to be the genetic material...

the race was on to determine its structure and how it worked



The moment of Truth

James Watson and Francis Crick published their landmark paper in the British journal *Nature* in 1953



No. 4356 April 25, 1953 NATURE

equipment, and to Dr. G. E. R. Deacon and the captain and officers of R.R.S. *Discovery II* for their part in making the observations.

[1] Young, F. B., Gerrard, H., and Jevons, W., *Phil. Mag.*, **40**, 149 (1920).
[2] Longuet-Higgins, M. S., *Mon. Not. Roy. Astro. Soc., Geophys. Supp.*, **5**, 285 (1949).
[3] Von Arx, W. S., Woods Hole Papers in Phys. Oceanog. Meteor., **11** (3) (1950).
[4] Ekman, V. W., *Arkiv. Mat. Astron. Fysik. (Stockholm)*, **2** (11) (1905).

MOLECULAR STRUCTURE OF NUCLEIC ACIDS

A Structure for Deoxyribose Nucleic Acid

WE wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A.). This structure has novel features which are of considerable biological interest.

A structure for nucleic acid has already been proposed by Pauling and Corey[1]. They kindly made their manuscript available to us in advance of publication. Their model consists of three inter-twined chains, with the phosphates near the fibre axis, and the bases on the outside. In our opinion,

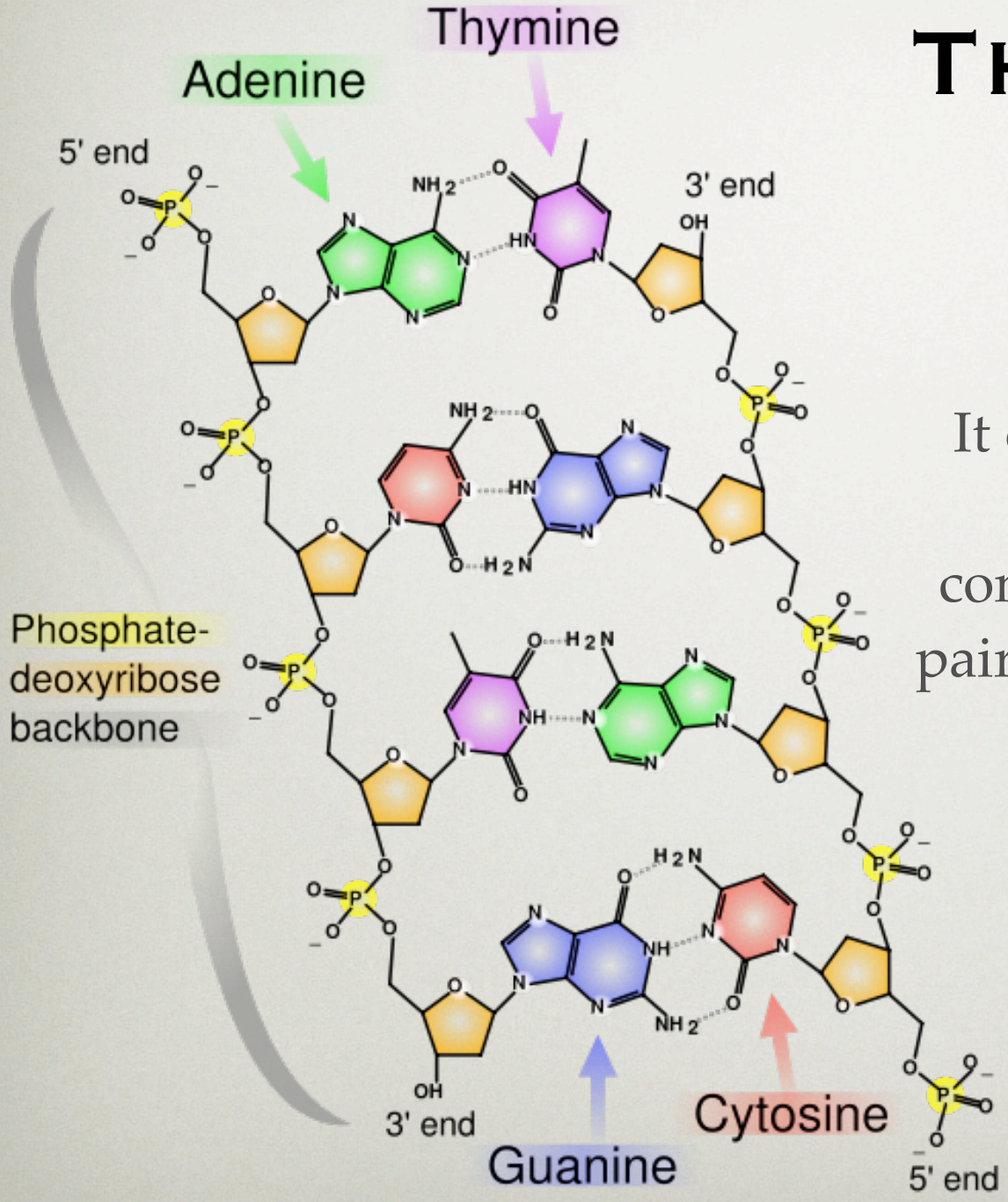
is a residue on each chain e
tion. We have assumed
adjacent residues in the
structure repeats after 10 re
is, after 34 A. The distan
from the fibre axis is 10 A.
the outside, cations have ea

The structure is an open
is rather high. At lower
expect the bases to tilt s
become more compact.

The novel feature of the
in which the two chains
purine and pyrimidine base
are perpendicular to the fi
together in pairs, a single b
hydrogen-bonded to a sin
chain, so that the two lie s
z-co-ordinates. One of the
the other a pyrimidine for
hydrogen bonds are made a
1 to pyrimidine position
pyrimidine position 6.

If it is assumed that the
structure in the most pl
(that is, with the keto ra
figurations) it is found th

Combining data and findings of other scientists with a knowledge of chemical modeling...they successfully predicted the exact 3-dimensional structure of DNA



Their Model Worked!

It quickly became obvious that the Watson-Crick model, combined with Chargaff's base-pairing rules explained the ability of DNA to replicate itself