Nucleic Acids

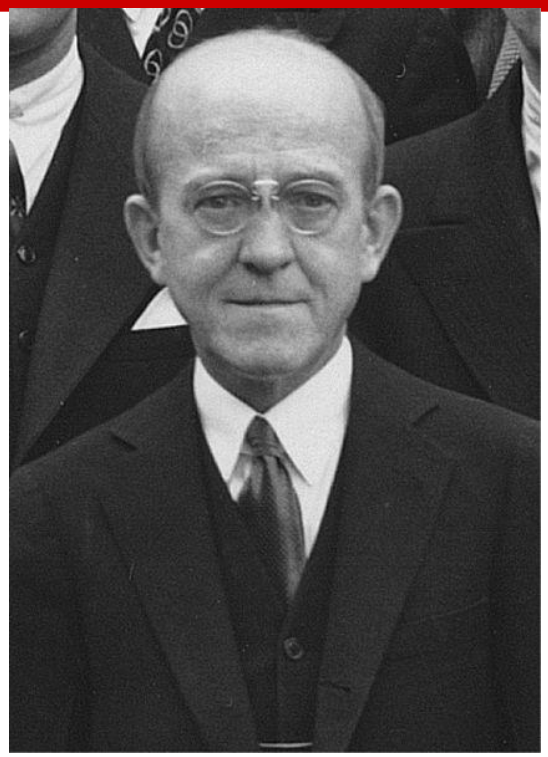
Frederick Griffith

- British physician, pathologist, bacteriologist
- Known for discovery of pneumococcal transformation

Griffith's experiment

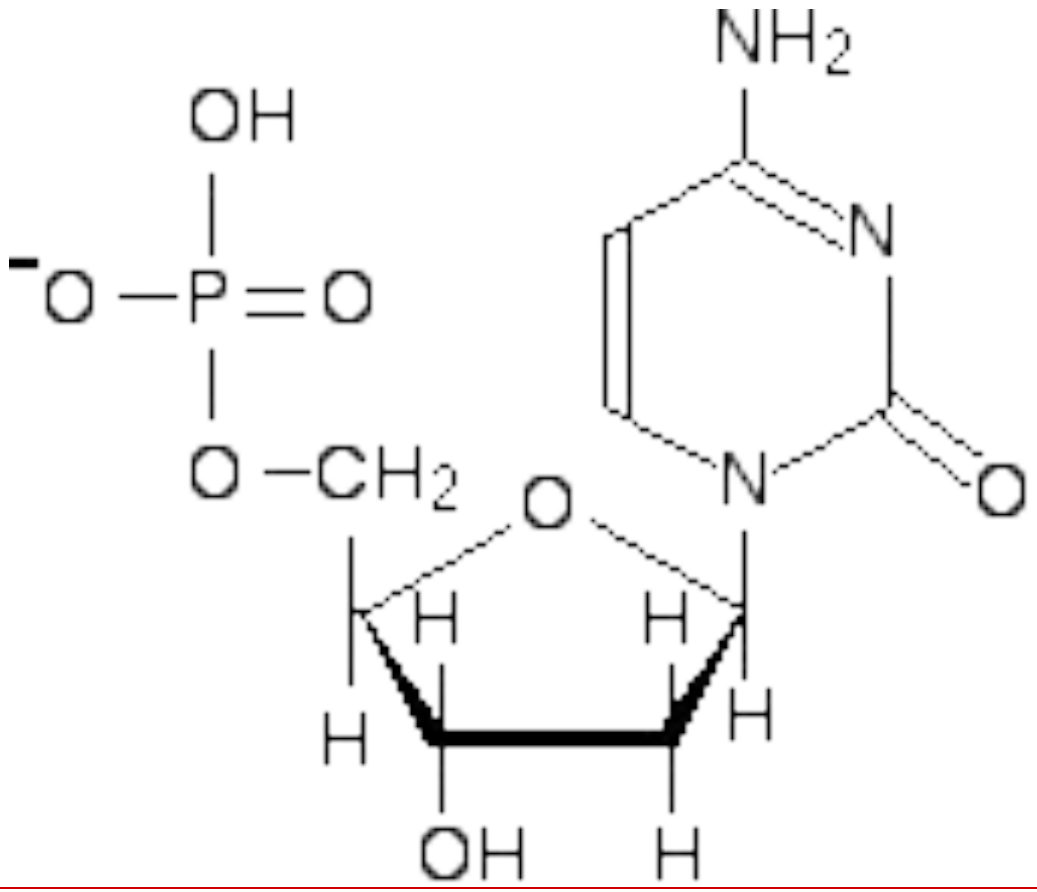
Died	Mouse with virulent pneumonia	Mouse with heated virulent pneumonia and non-virulent pneumonia mixed together
Lived	Mouse with non-virulent pneumonia	Mouse with heated, killed virulent pneumonia

Oswald Avery



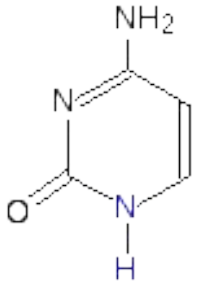
Canadian-born American physician and medical and medical researcher.
The major part of his career was spent at the Rockefeller University Hospital in New York City

dCMP

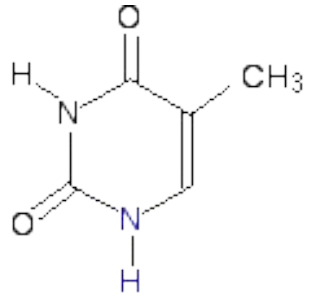


The principal bases in DNA

PYRIMIDINES

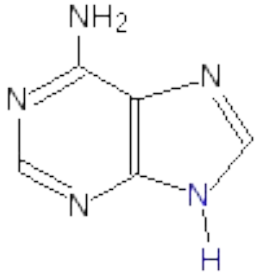


cytosine (C)

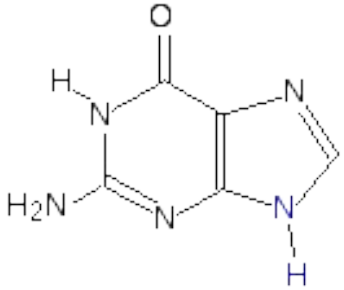


thymine (T)

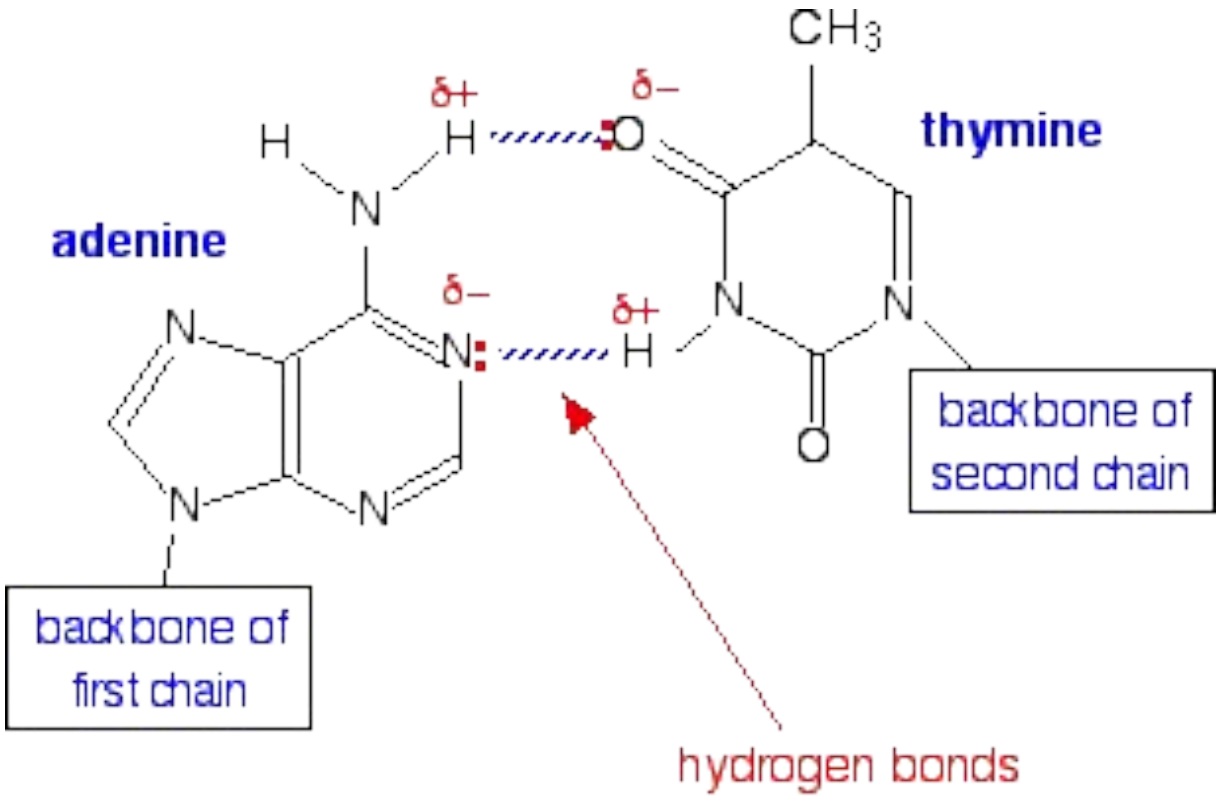
PURINES

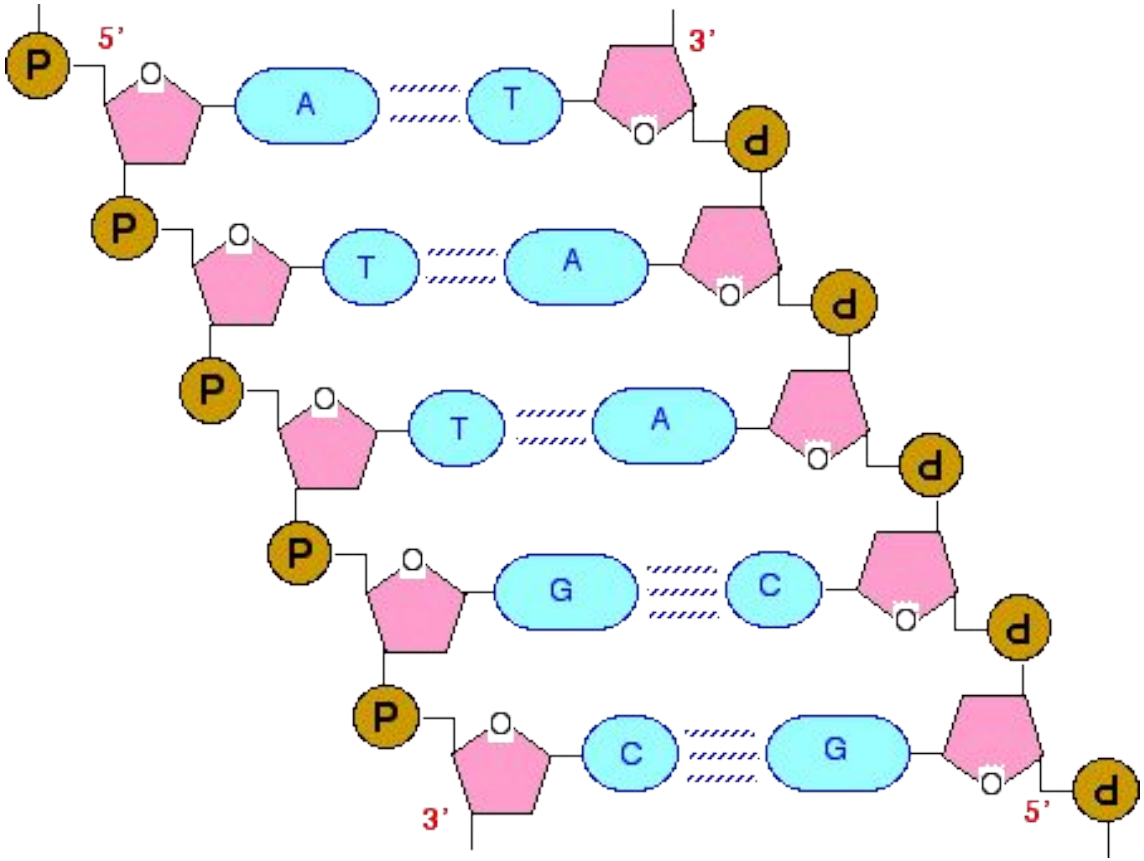


adenine (A)

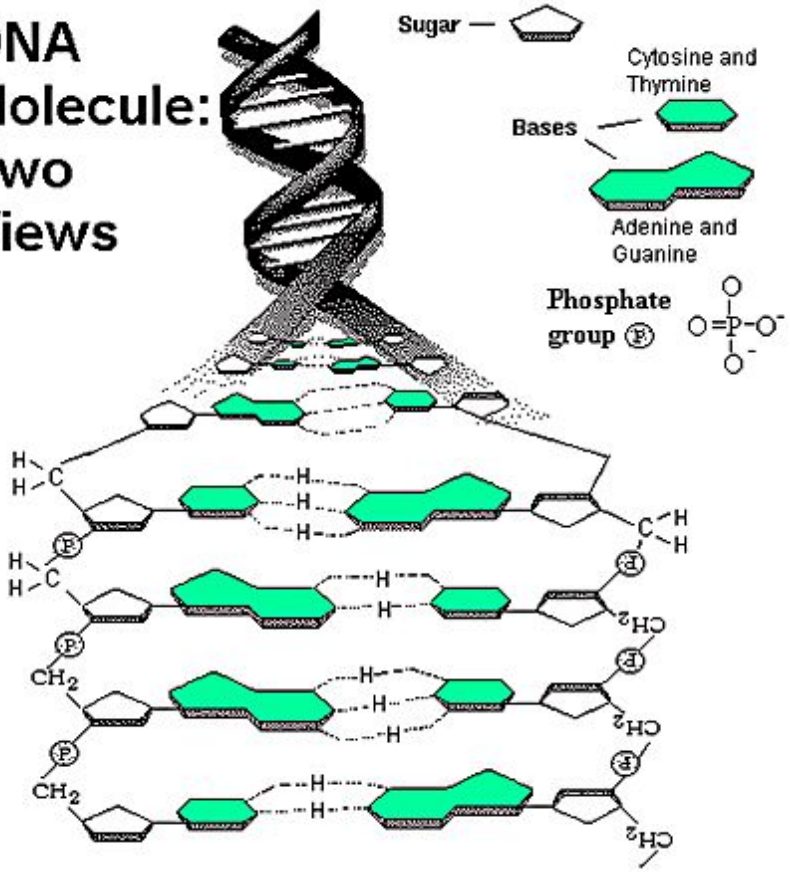


guanine (G)

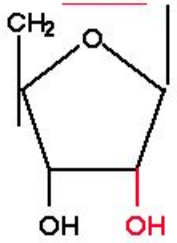
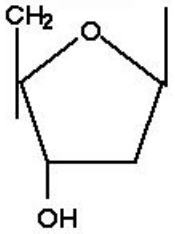
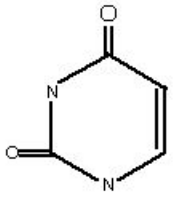
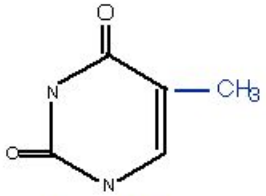

CH3
δ+
δ−
H
H
O
thymine
N
adenine
δ−
δ+
N
N
H
N
N
N
N
O
backbone of
second chain
backbone of
first chain
hydrogen bonds


5'
3'
P
O
A
T
d
T
A
G
C
3'
5'

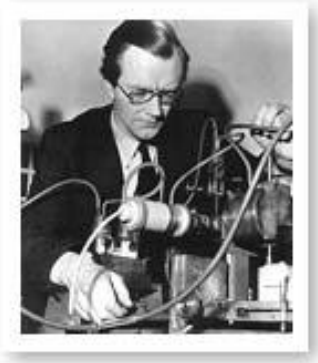
DNA Molecule: Two Views

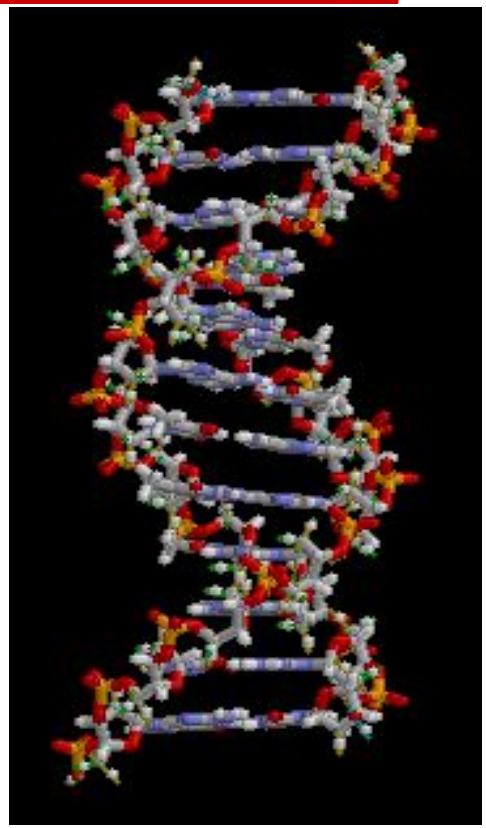


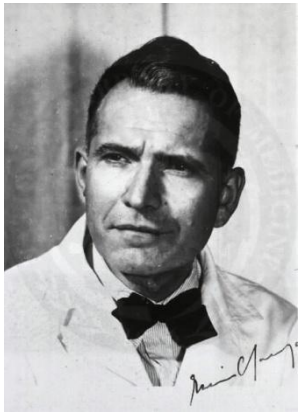
Differences between RNA and DNA

	RNA	DNA
1) ribose sugar	 (ribonucleic acid)	 (deoxy ribonucleic acid)
2)T and U	 uracyl	 thymidine
3) strand	single	double

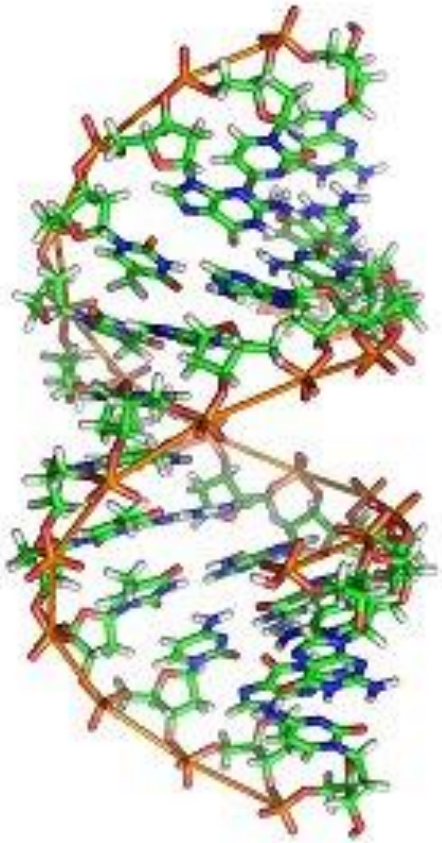
The greatest discovery!



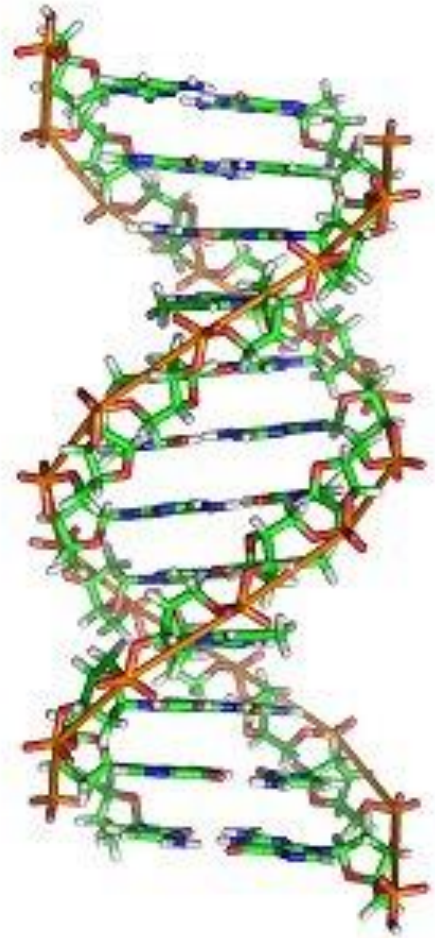




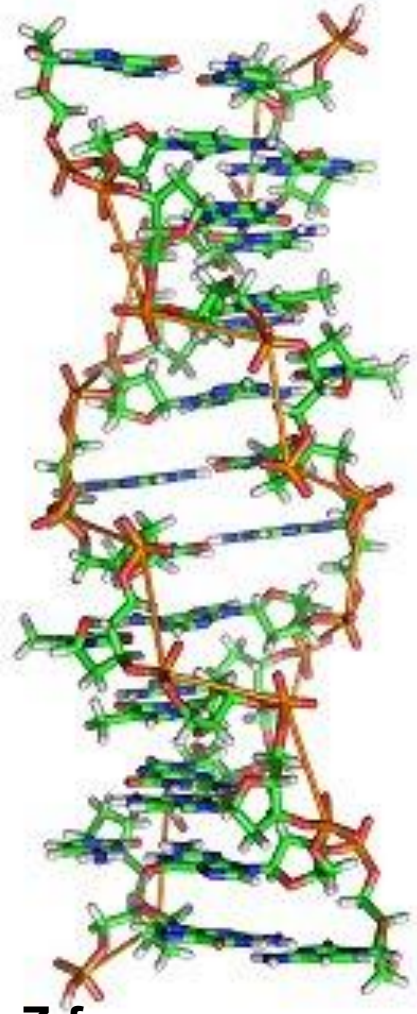
Form of DNA



A-form



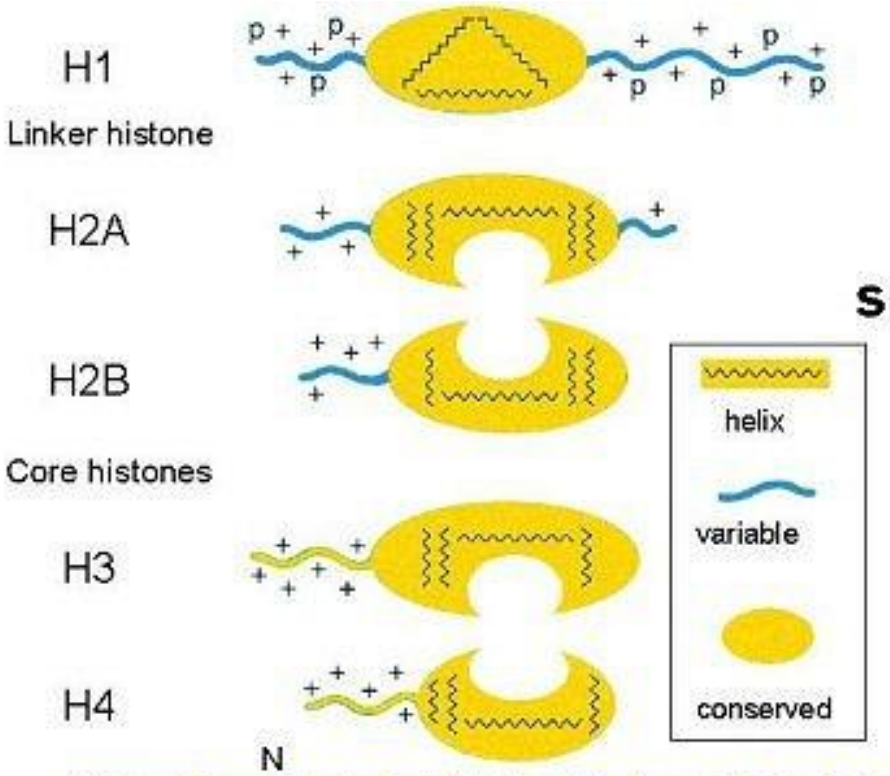
B-form



Z-form

Histones

- H2A, H2B, H3 и H4 – similar between distant species:
  - H3 of calf differs from H3 sea-urchin only in one amino acid and from green peas H3 in tree amino acids
- H1 – more variable
  - birds posses H5 histone in erythrocytes instead H1



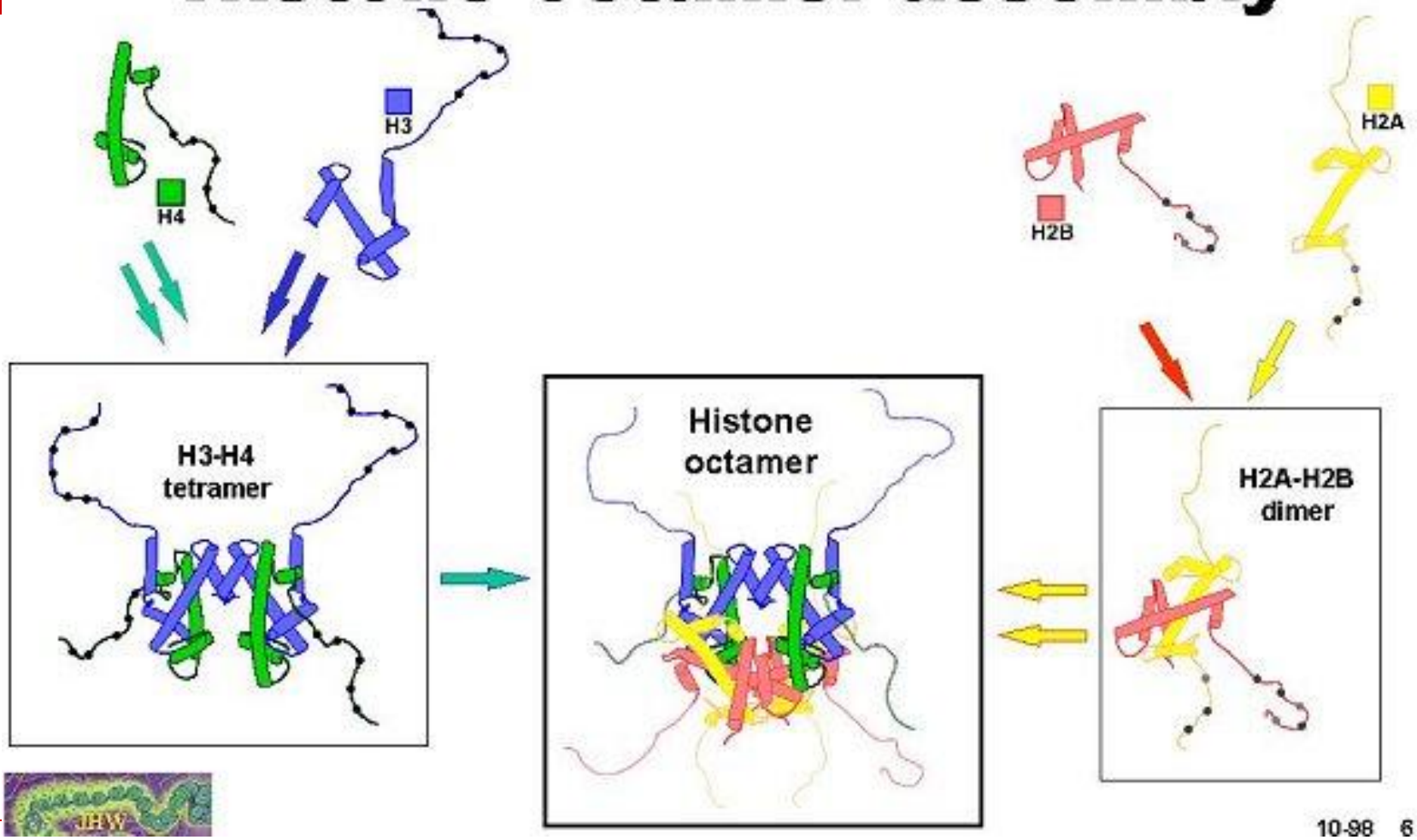
HISTONES

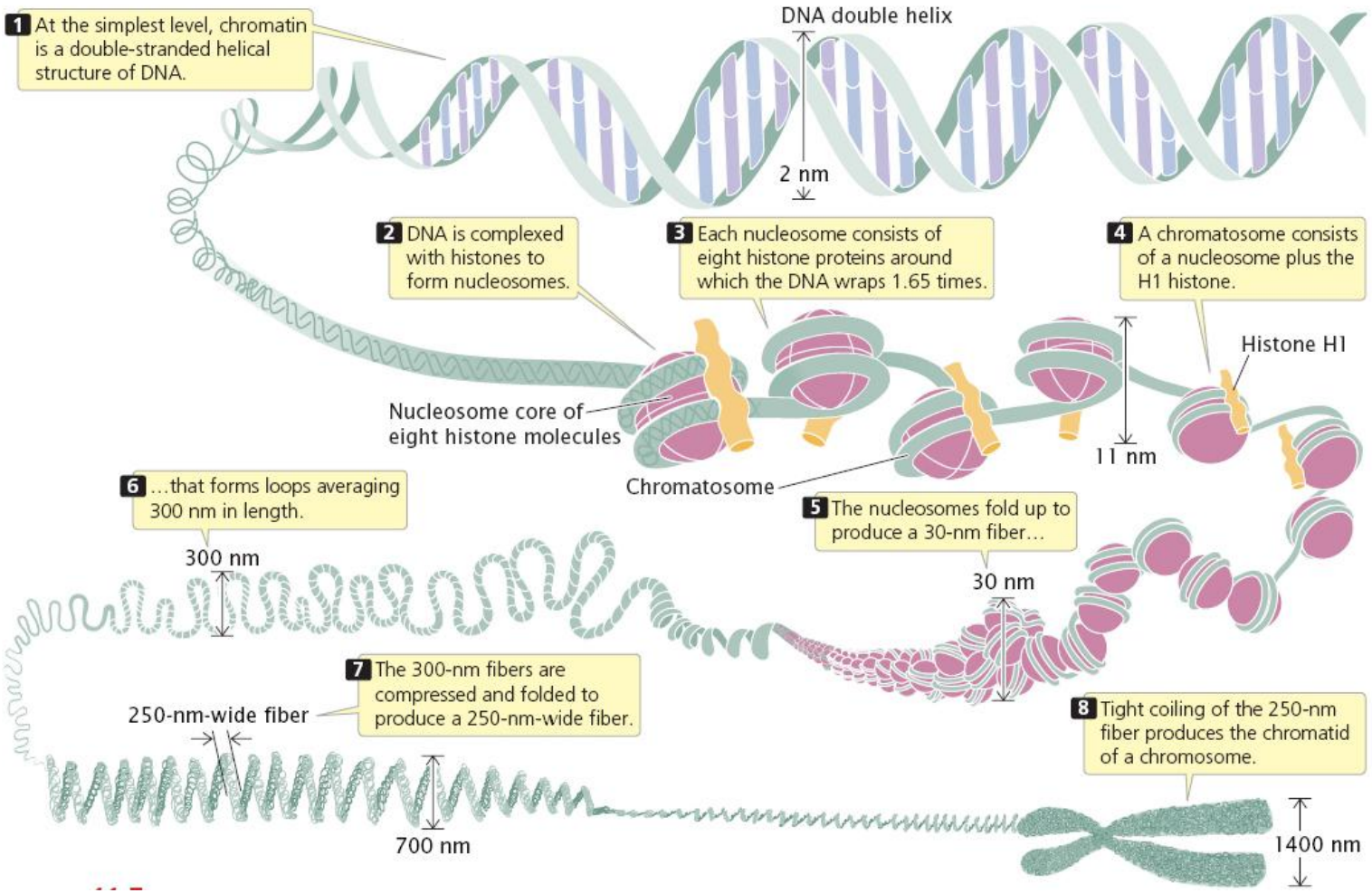
are

highly conserved, small, basic proteins

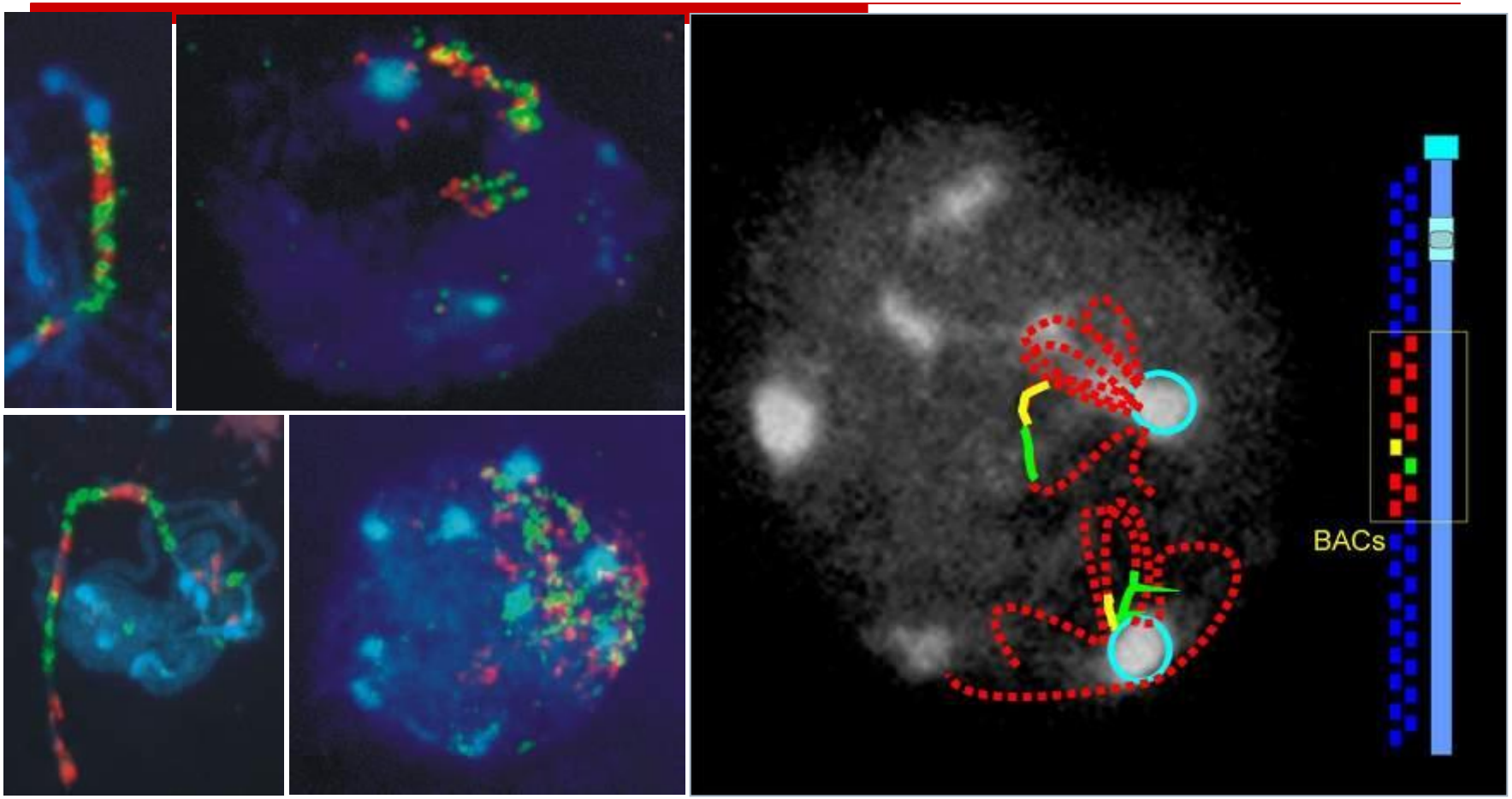
Histone Type	Molecular Weight	Number of Amino Acids	Approx. Content of Basic Amino Acids
H1	17,000–28,000	200–265	27% lysine, 2% arginine
H2A	13,900	129–155	11% lysine, 9% arginine
H2B	13,800	121–148	16% lysine, 6% arginine
H3	15,300	135	10% lysine, 15% arginine
H4	11,300	102	11% lysine, 4% arginine

Histone octamer assembly



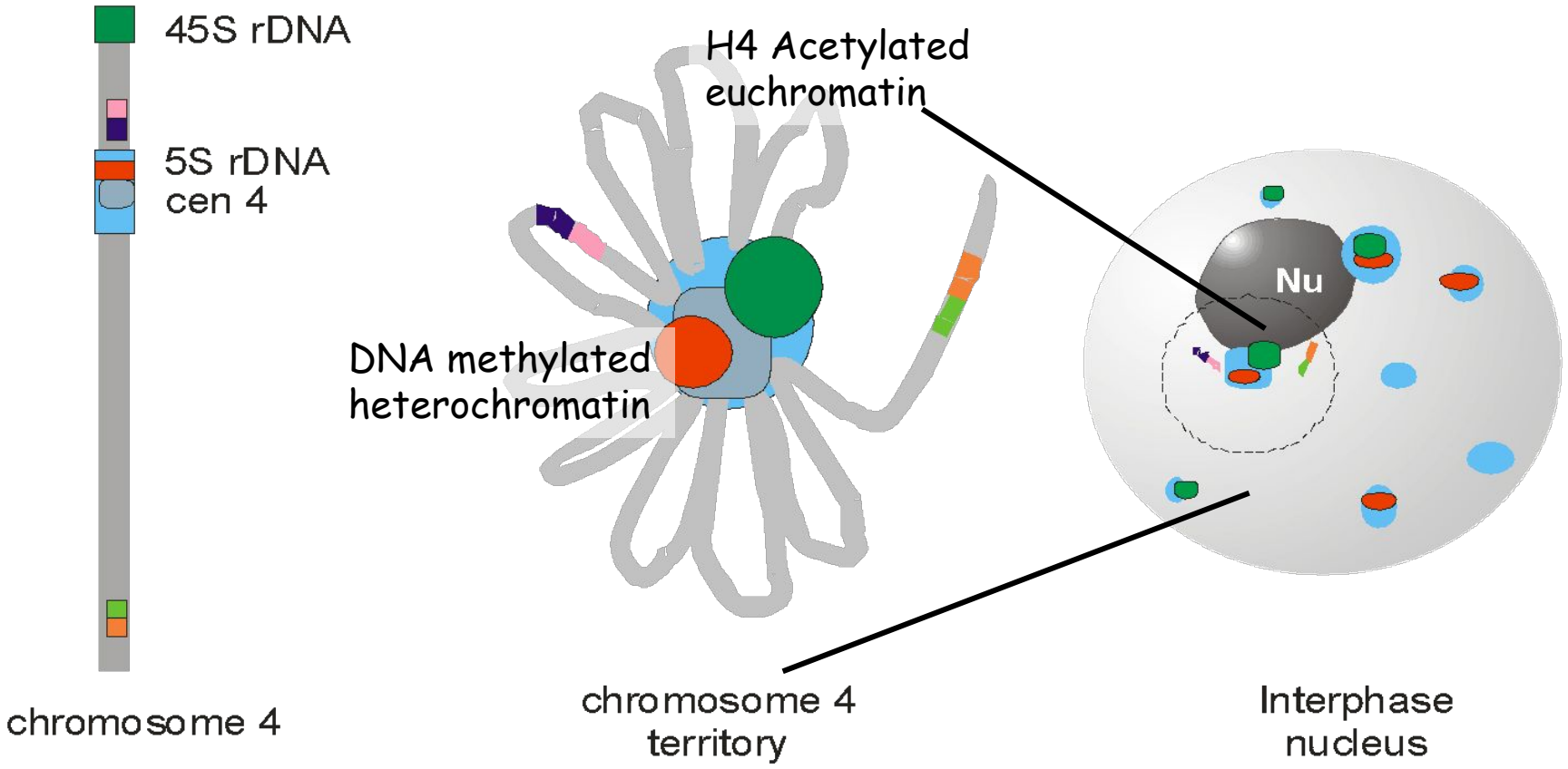

1 At the simplest level, chromatin is a double-stranded helical structure of DNA.
DNA double helix
2 nm
2 DNA is complexed with histones to form nucleosomes.
3 Each nucleosome consists of eight histone proteins around which the DNA wraps 1.65 times.
4 A chromatosome consists of a nucleosome plus the H1 histone.
Histone H1
Nucleosome core of eight histone molecules
11 nm
Chromatosome
5 The nucleosomes fold up to produce a 30-nm fiber…
30 nm
6 …that forms loops averaging 300 nm in length.
300 nm
7 The 300-nm fibers are compressed and folded to produce a 250-nm-wide fiber.
250-nm-wide fiber
8 Tight coiling of the 250-nm fiber produces the chromatid of a chromosome.
700 nm
1400 nm

A simple interphase organization



From Prof. de Jong lecture, 2006

Interphase loop model

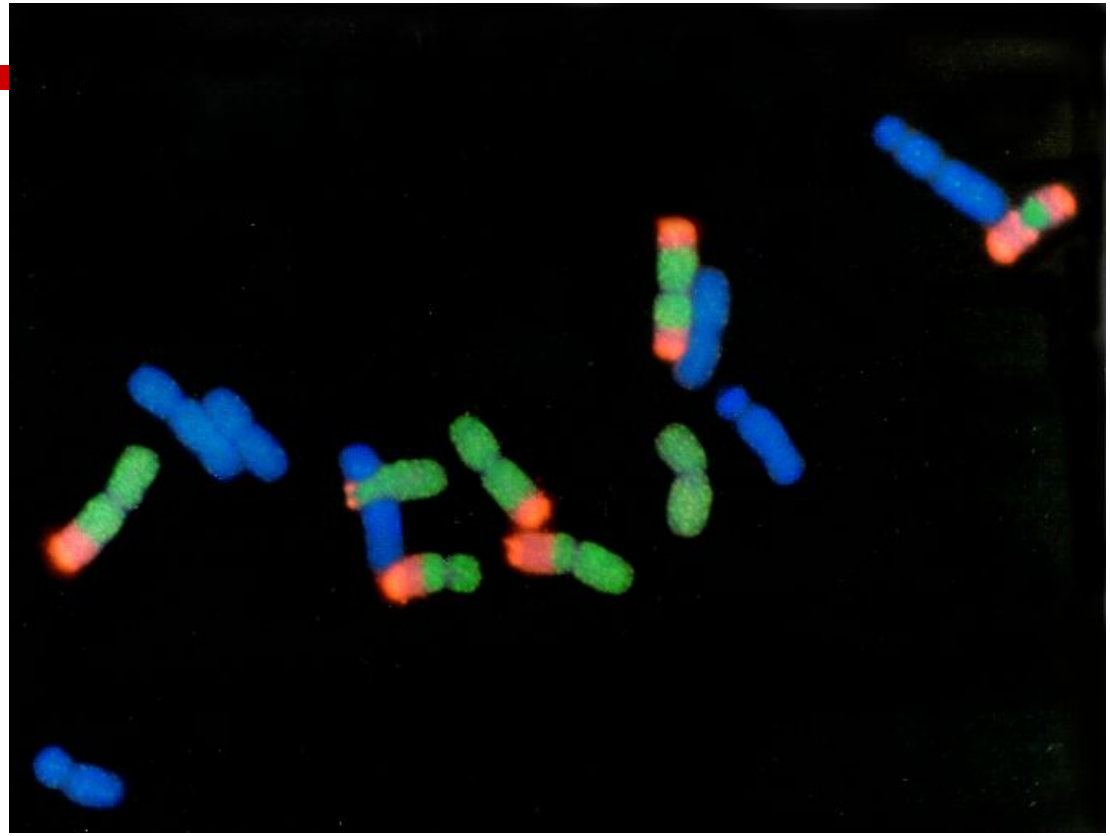


From Prof. de Jong lecture, 2006

Trihybrid 1: CC x (FF x RR)

Mitosis: metaphase

- *A. fistulosum* - Biotin, CY3
- *A. roylei* - FITC
- *A. cepa* - block DNA, DAPI



Khrustaleva & Kik (1998) Theor Appl Genet 96: 8-14

FISH: Human chromosomes

Расположение 23 хромосом человека в прометафазе фибробластов