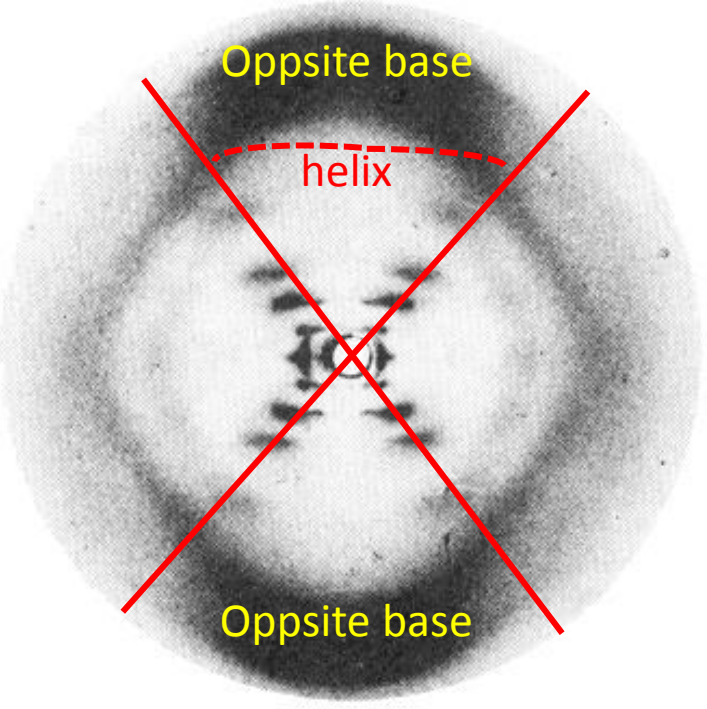
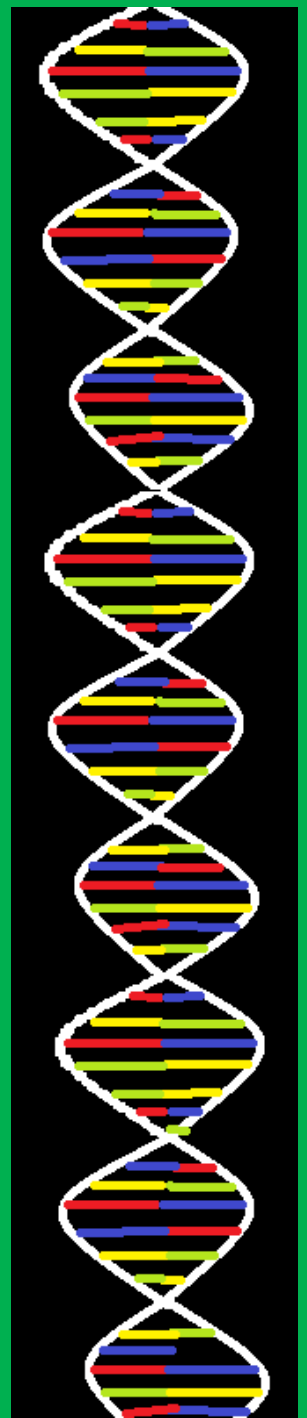
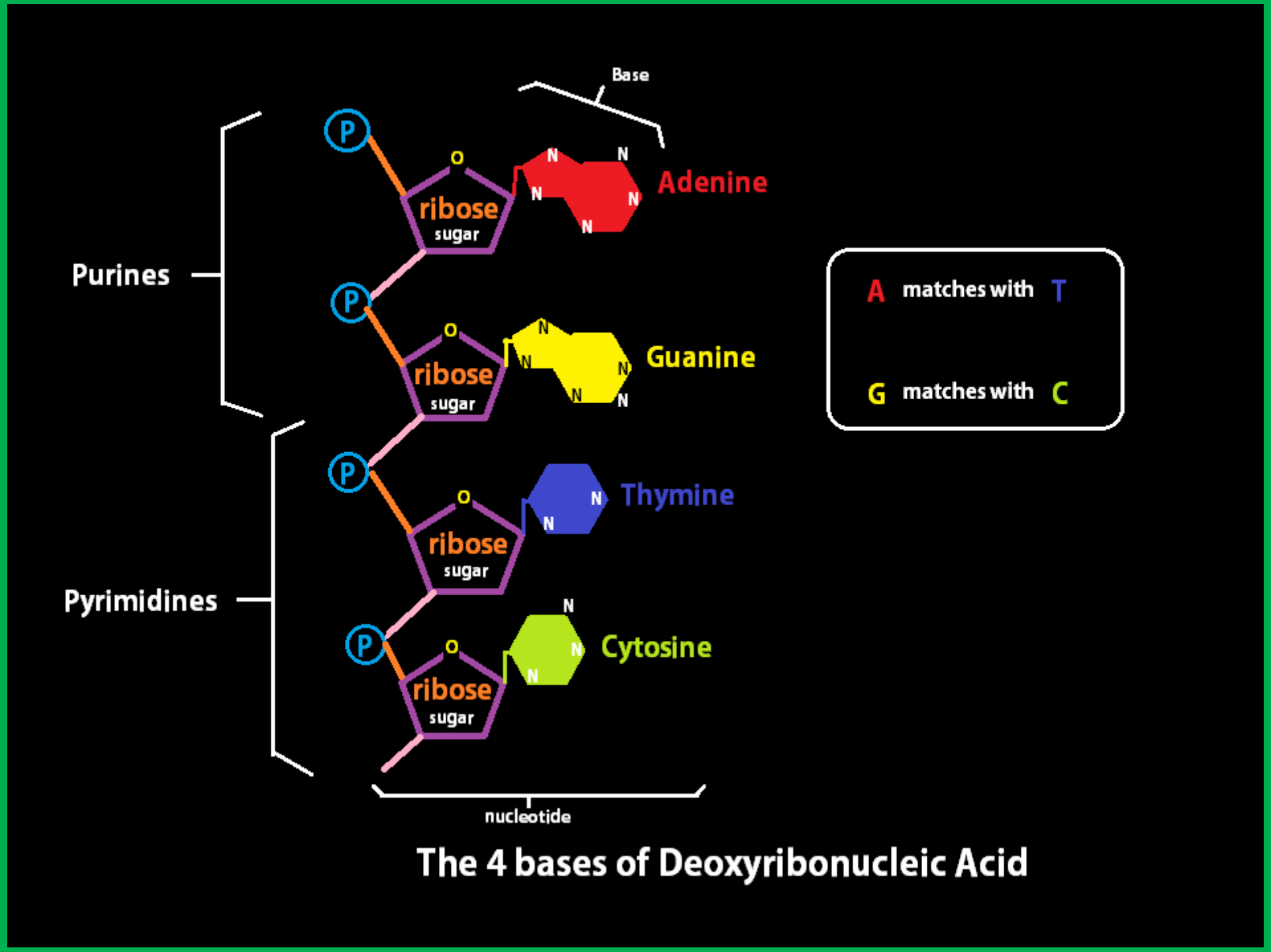


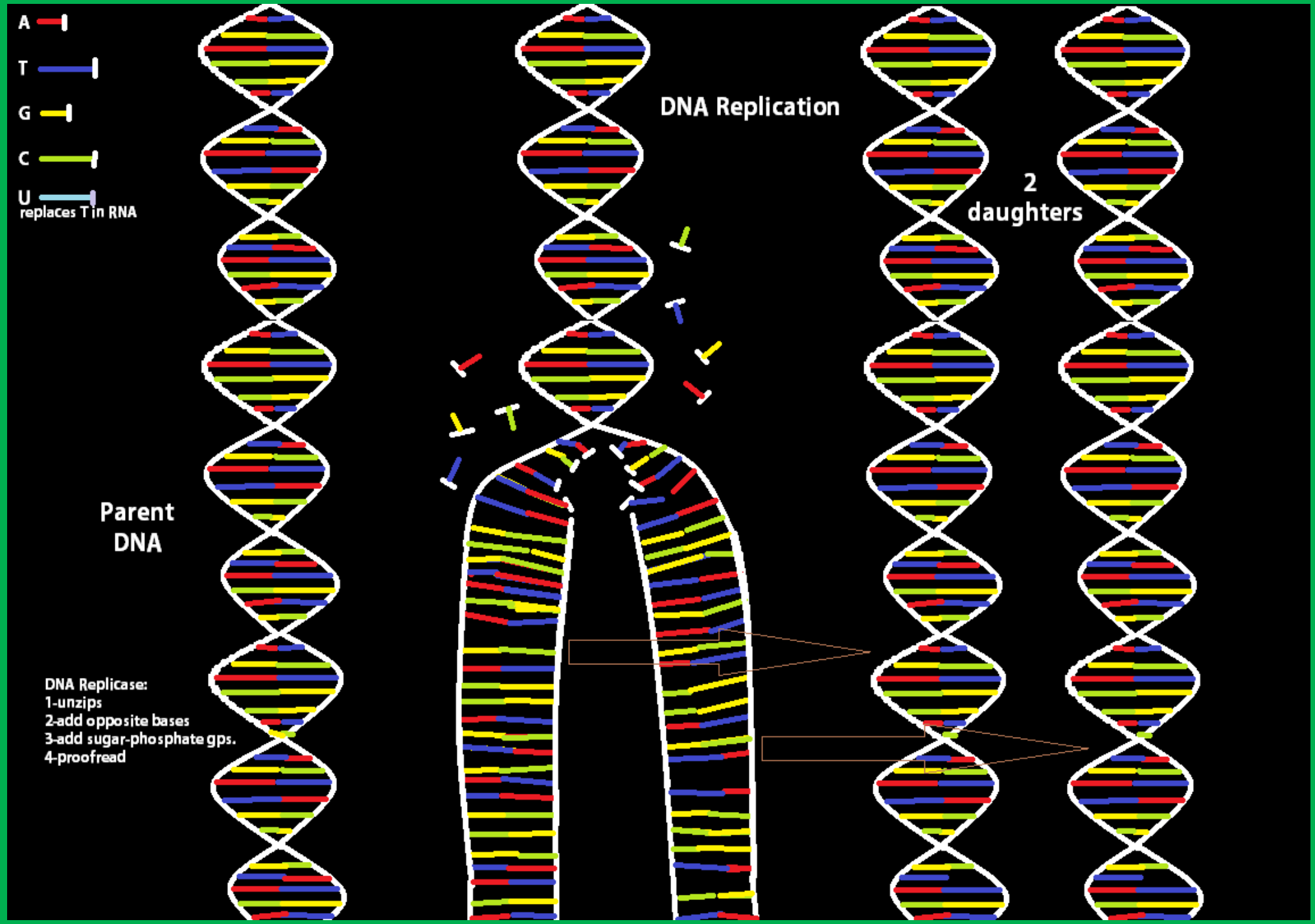
Franklin's X-ray diffraction pattern of DNA (crystal form) which Watson & Crick interpreted as a Double Helix. This led to the understanding of replication and protein synthesis and became part of the grand synthesis … uniting Mendel's laws, DNA (genes & chromosomes), protein synthesis, mutations & Darwinian evolution.

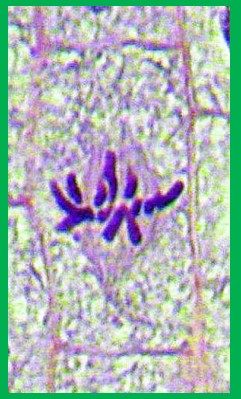
DNA: Replication & Protein Synthesis

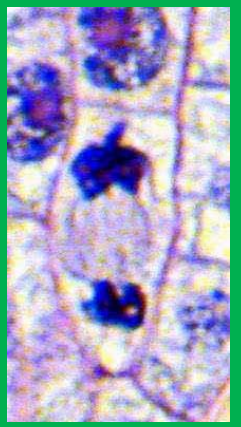




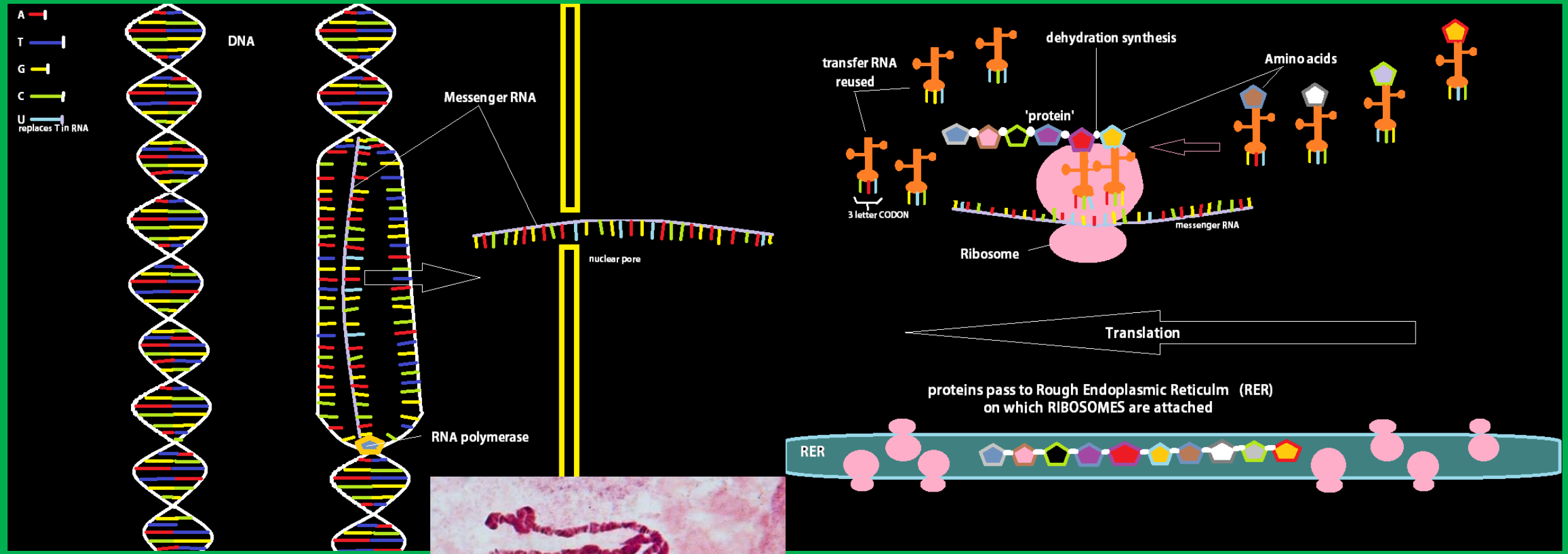
The 4 bases of Deoxyribonucleic Acid

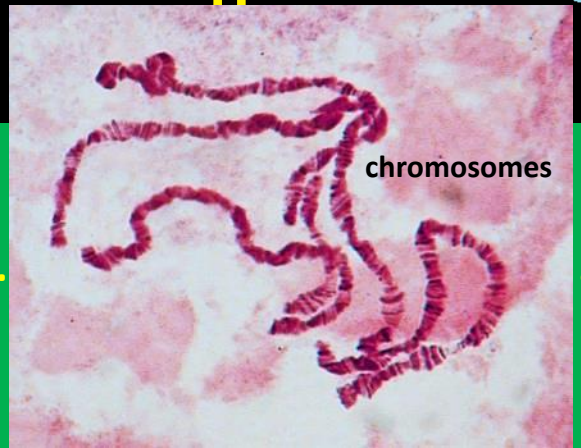






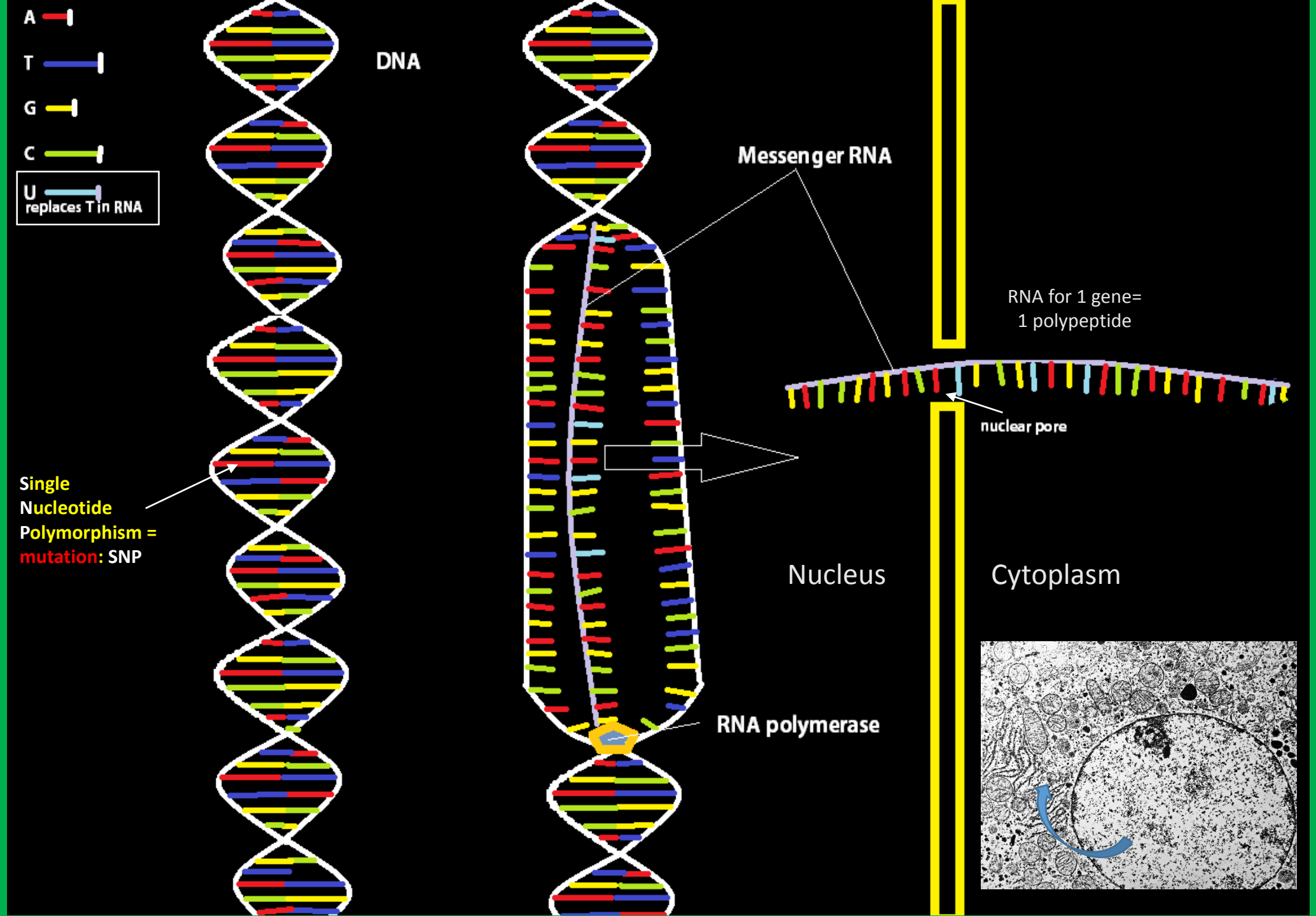
Replication happens during Interphase

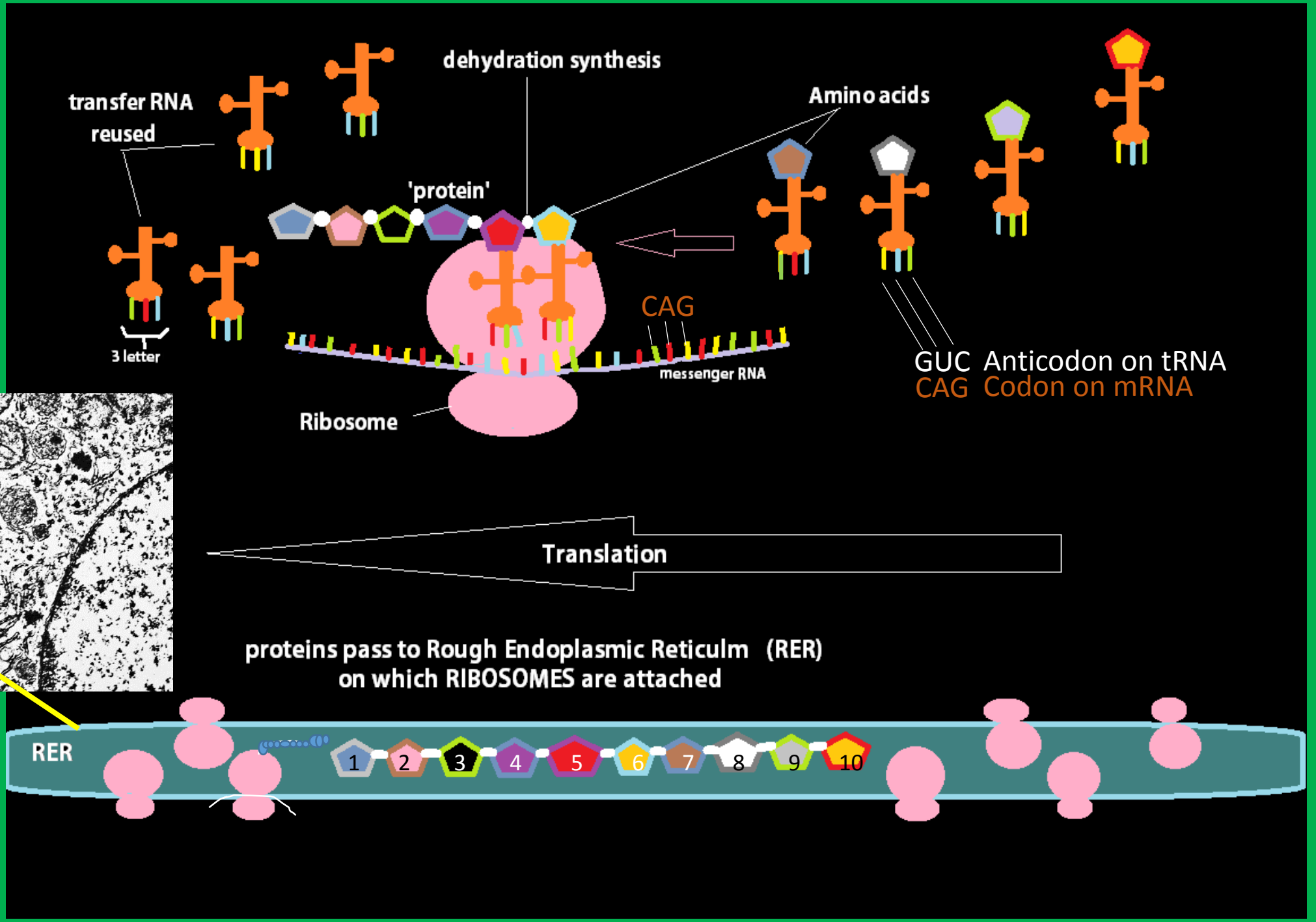




One gene…

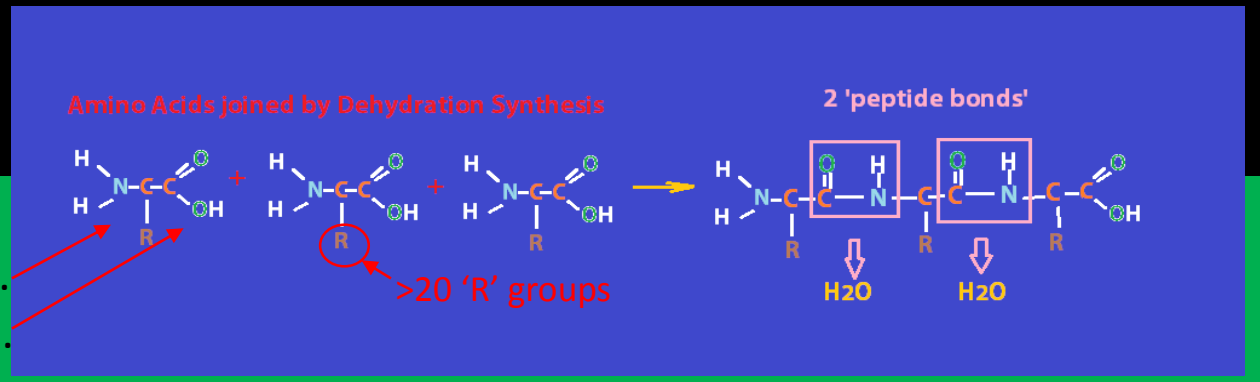
…One Polypeptide


A
T
G
C
U replaces T in RNA
DNA
Messenger RNA
RNA for 1 gene=
1 polypeptide
nuclear pore
Single
Nucleotide
Polymorphism =
mutation: SNP
Nucleus
Cytoplasm
RNA polymerase


dehydration synthesis
transfer RNA
reused
Amino acids
'protein'
CAG
3 letter
messenger RNA
Ribosome
GUC Anticodon on tRNA
CAG Codon on mRNA
Translation
proteins pass to Rough Endoplasmic Reticulm (RER)
on which RIBOSOMES are attached
RER
1
2
3
4
5
6
7
8
9
10

Functional Groups

1- Hydroxyl ('Alcohol')	-OH	sugars
2- Carboxyl	-COOH / –C(=O)OH	sugars, fats, amono acids
3- Ketone	-R-C(=O)-R	sugars
4- Aldehyde	-R-C(=O)H	sugars
5- Amine (Amino)	–R–NH$_2$	amino acids
6- Sulfhydryl	R–SH	amino acids
7- Phosphate	–R–P(=O)(O$^-$)–O$^-$ (ionized) / –R–O–P(=O)(OH)–OH (nonionized)	phospholipids, nucleotides, nucleic acids
8- Methyl	–R–C(H)(H)–H	fats, oils, waxes

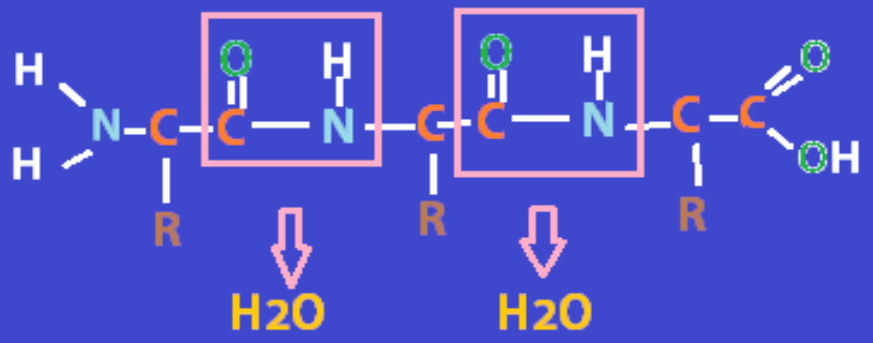


Carboxyl Gp.

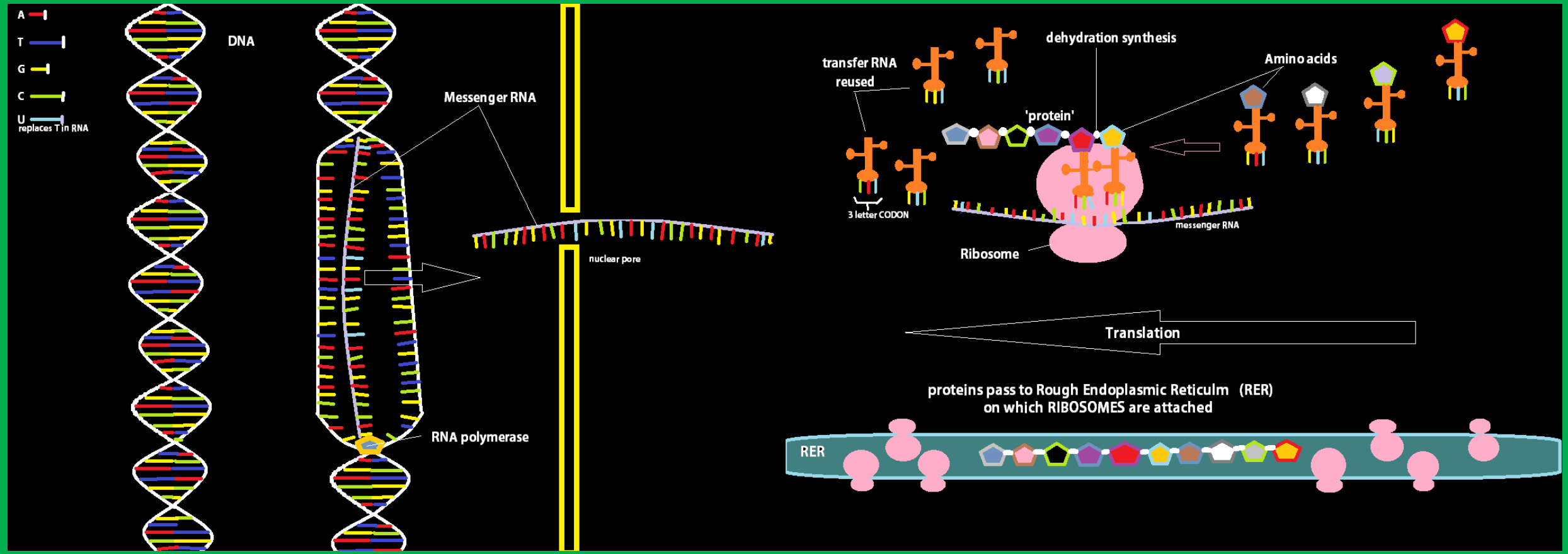
Amino Gp.

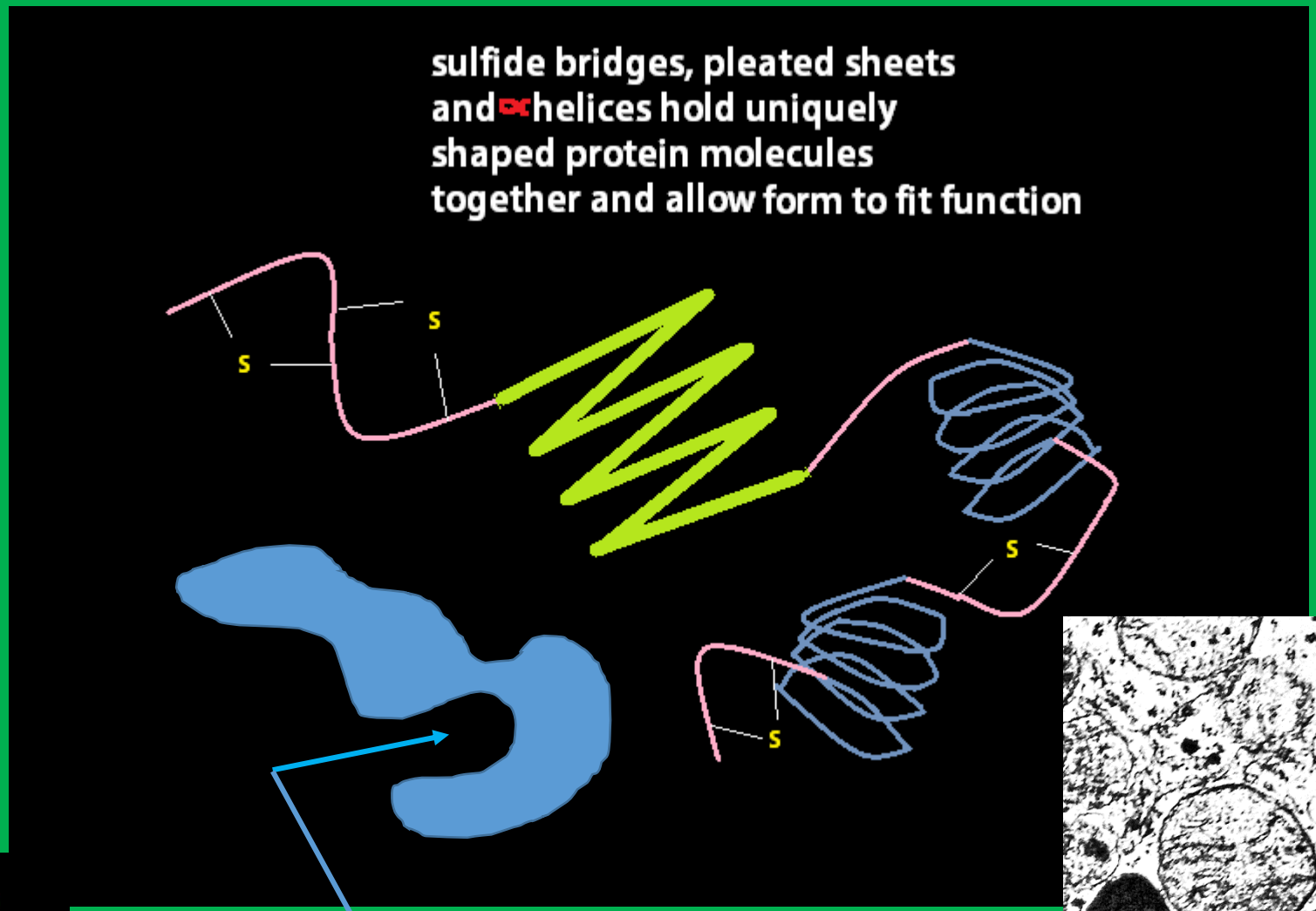
Amino Acids joined by Dehydration Synthesis

2 'peptide bonds'



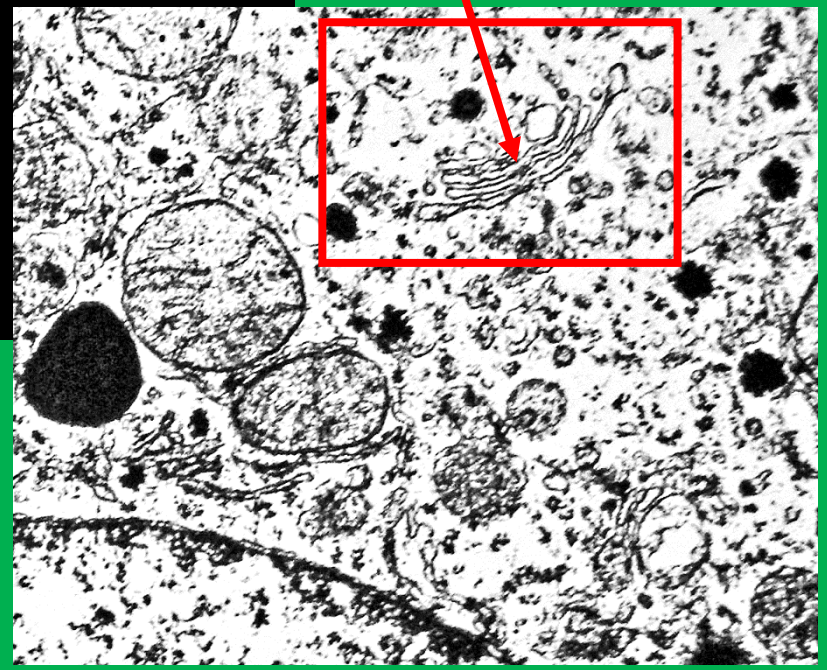
Summary

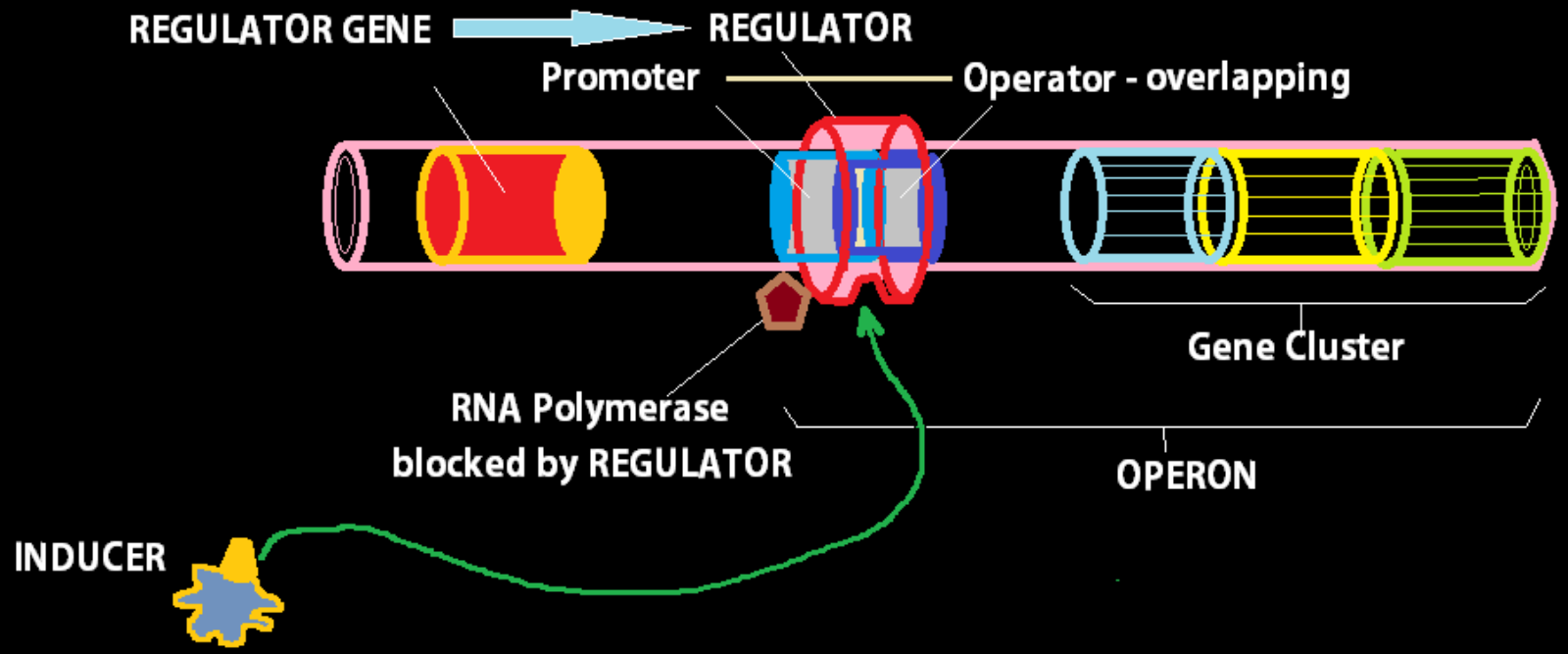

A
T
G
C
U
replaces T in RNA
DNA
Messenger RNA
nuclear pore
RNA polymerase
transfer RNA
reused
dehydration synthesis
Amino acids
'protein'
3 letter CODON
messenger RNA
Ribosome
Translation
proteins pass to Rough Endoplasmic Reticulm (RER)
on which RIBOSOMES are attached
RER



Example – “lock-and-key” shapes of enzymes

The final shaping, and addition of lipid and sugar molecules to proteins (lipoproteins & glycoproteins) is done in the **Smooth E.R. & GOLGI Apparatus** – they are then packaged for exocytosis

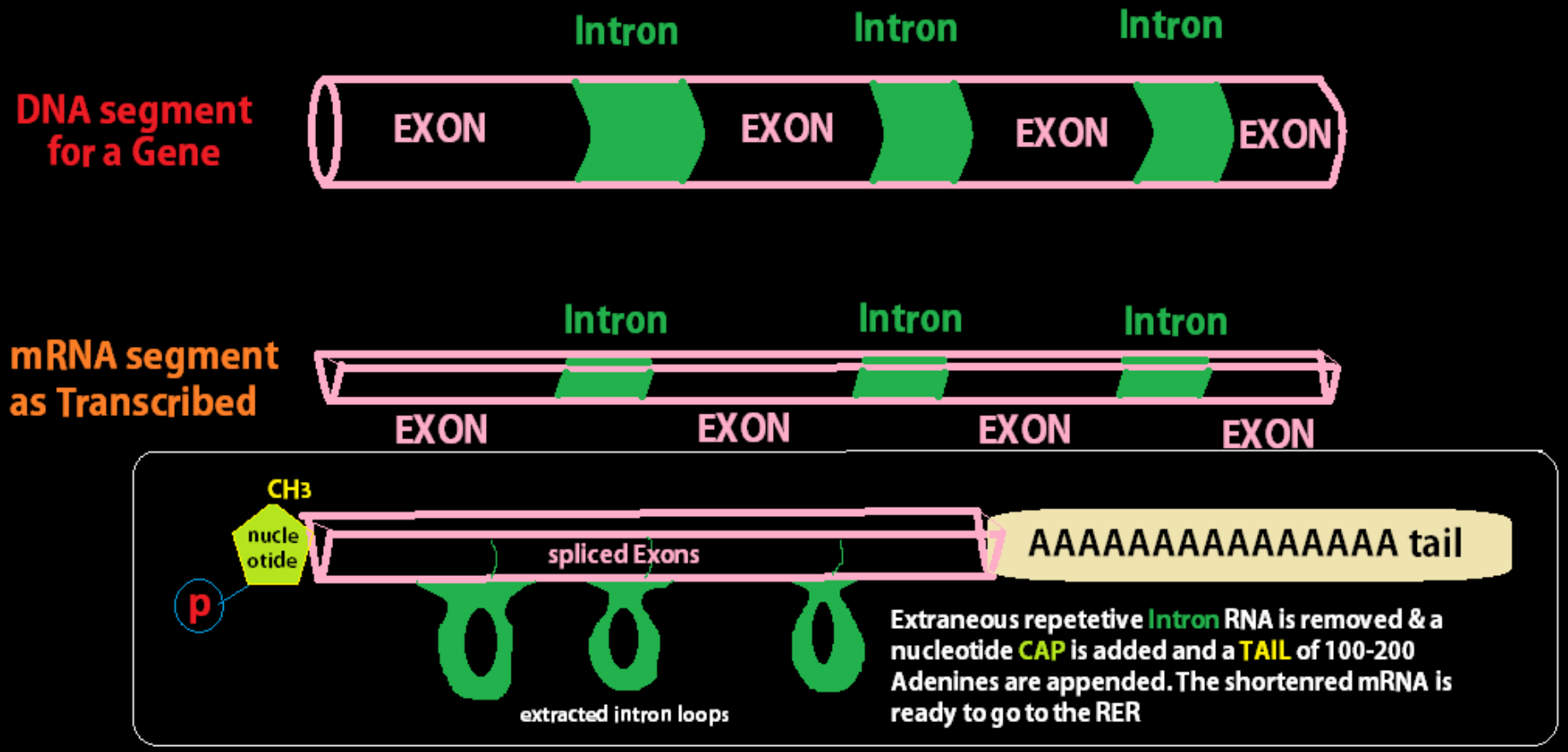




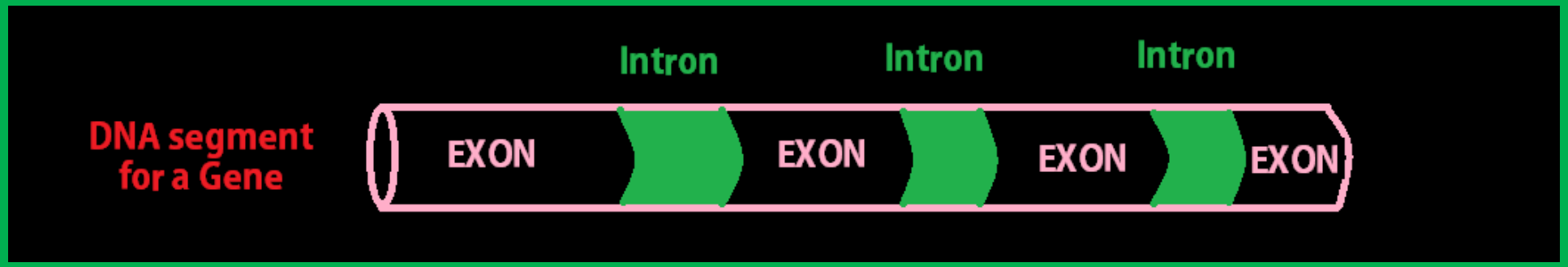
GENES are regulated; turned on & off: Regulator genes are responsible for producing the Regulator molecule which surrounds the overlapping Promoter & Operator areas of the OPERON. This prevents the RNA Polymerase from moving down the line of the gene or gene cluster and prevents TRANSCRIPTION.

Then the INDUCER with its "lock & key" shape arrives, binds with the REGULATOR and removes it. The RNA Polymerse is free to unzip and transcribe the genes for the proteins to act on the Inducer. Example: lactose from milk arrives (the 'Inducer') and binds with the Lactase REGULATOR molecule which is removed. This in turn allows the RNA Polymerase to transcribe the gene (genes) to make lactase enzymes.

Prokaryote Gene Regulation



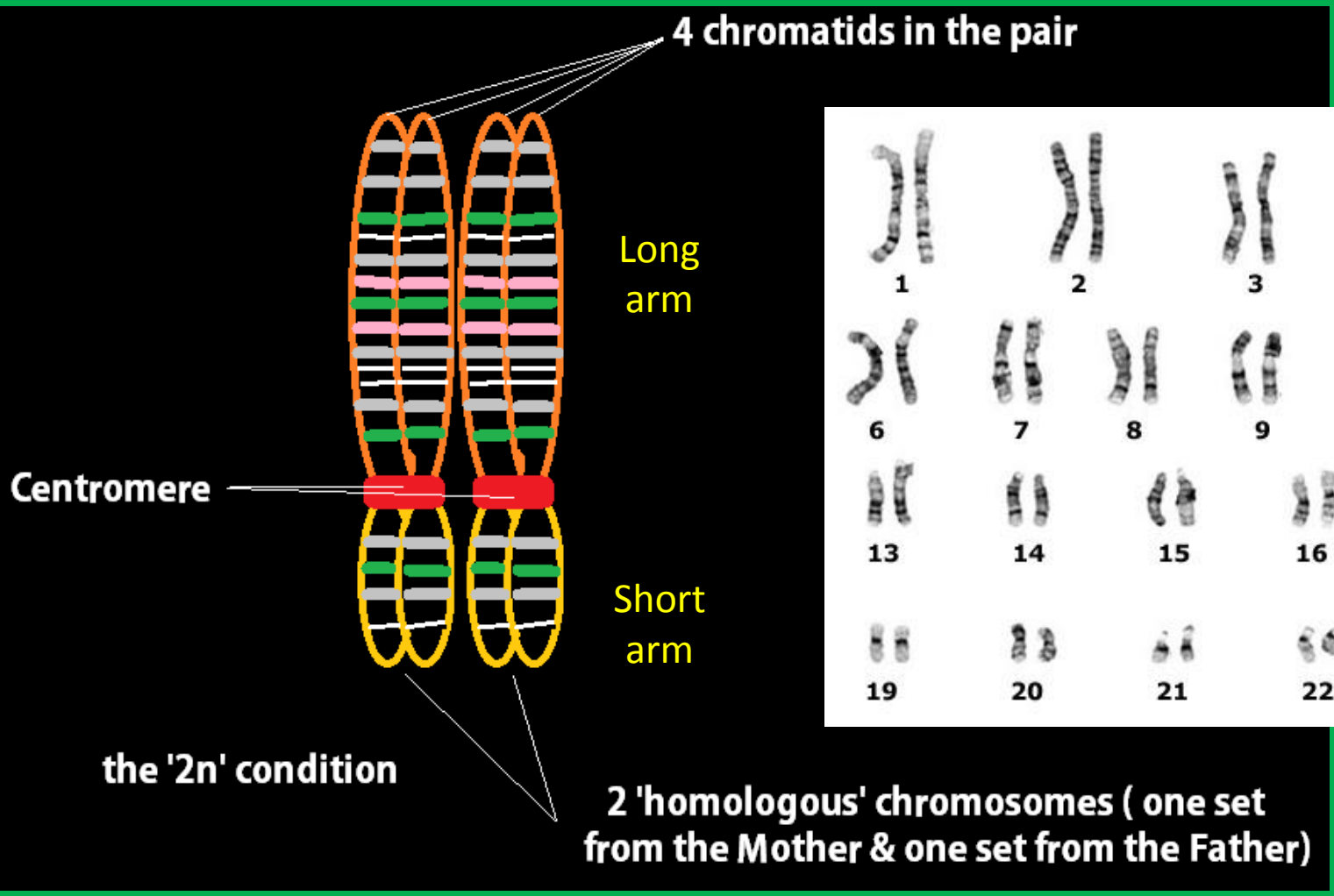
Eukaryotic Gene Expression



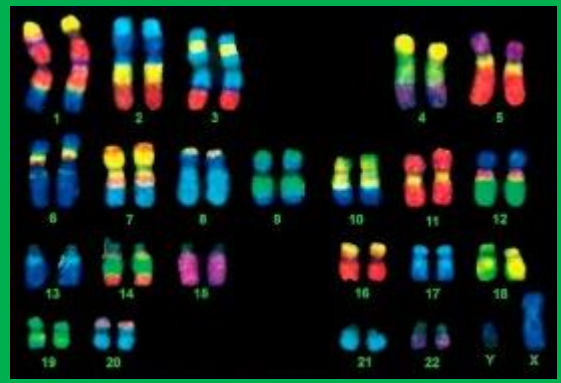
Y - Chromosome

	Locus	1	2	3	4	5	6	7	8	9	10	11	12
	DYS#	393	390	19/394	391	385a	385b	426	388	439	389-1	392	389-2
	Alleles	13	23	17	11	11	15	12	12	12	14	13	30

Number of REPEATS: **INTRONS**

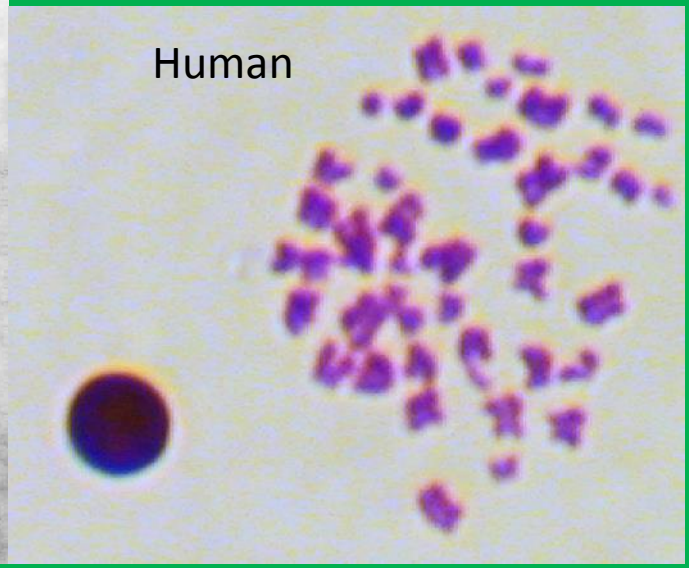


Human Karyotypes

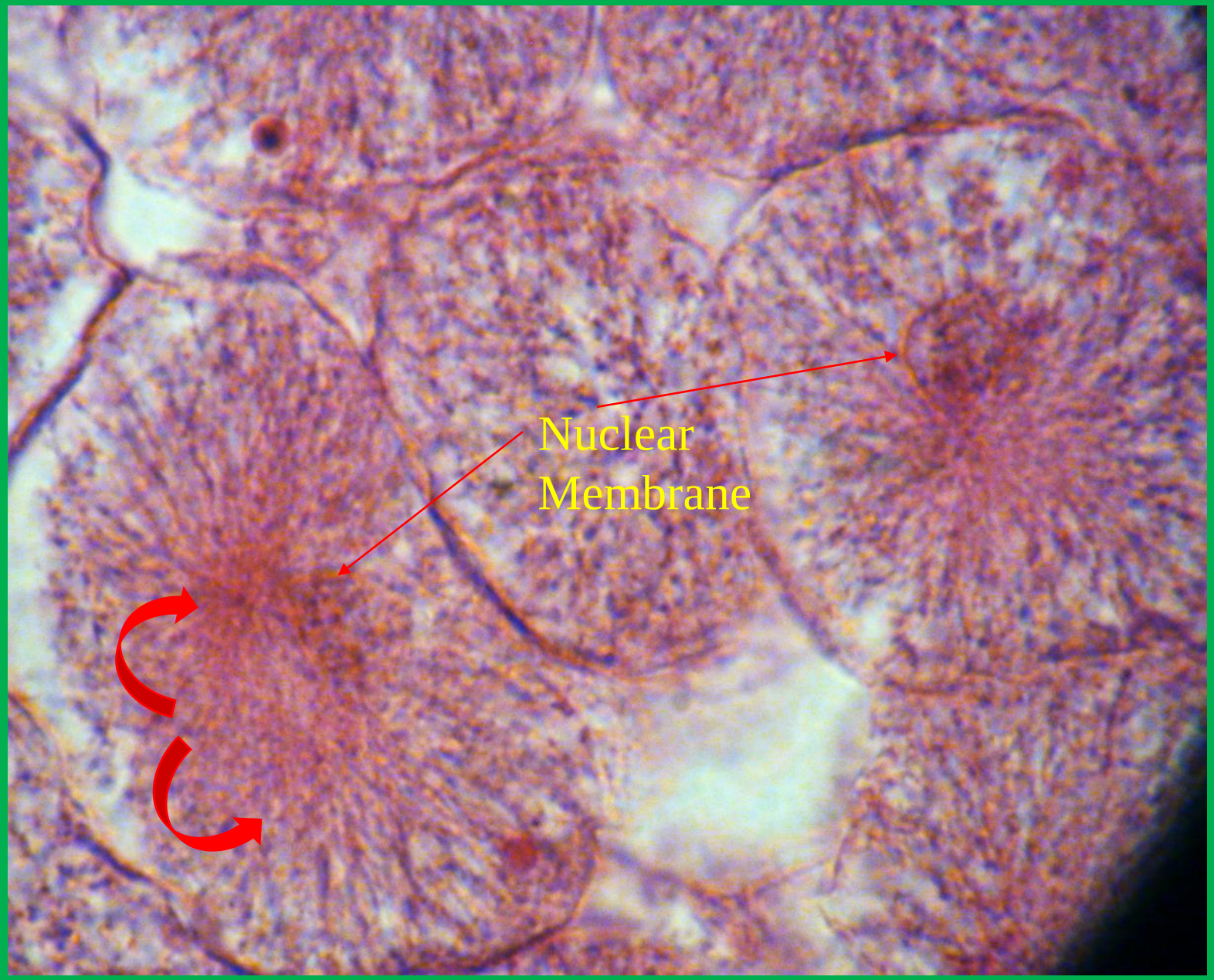


Fly

Chromosomes

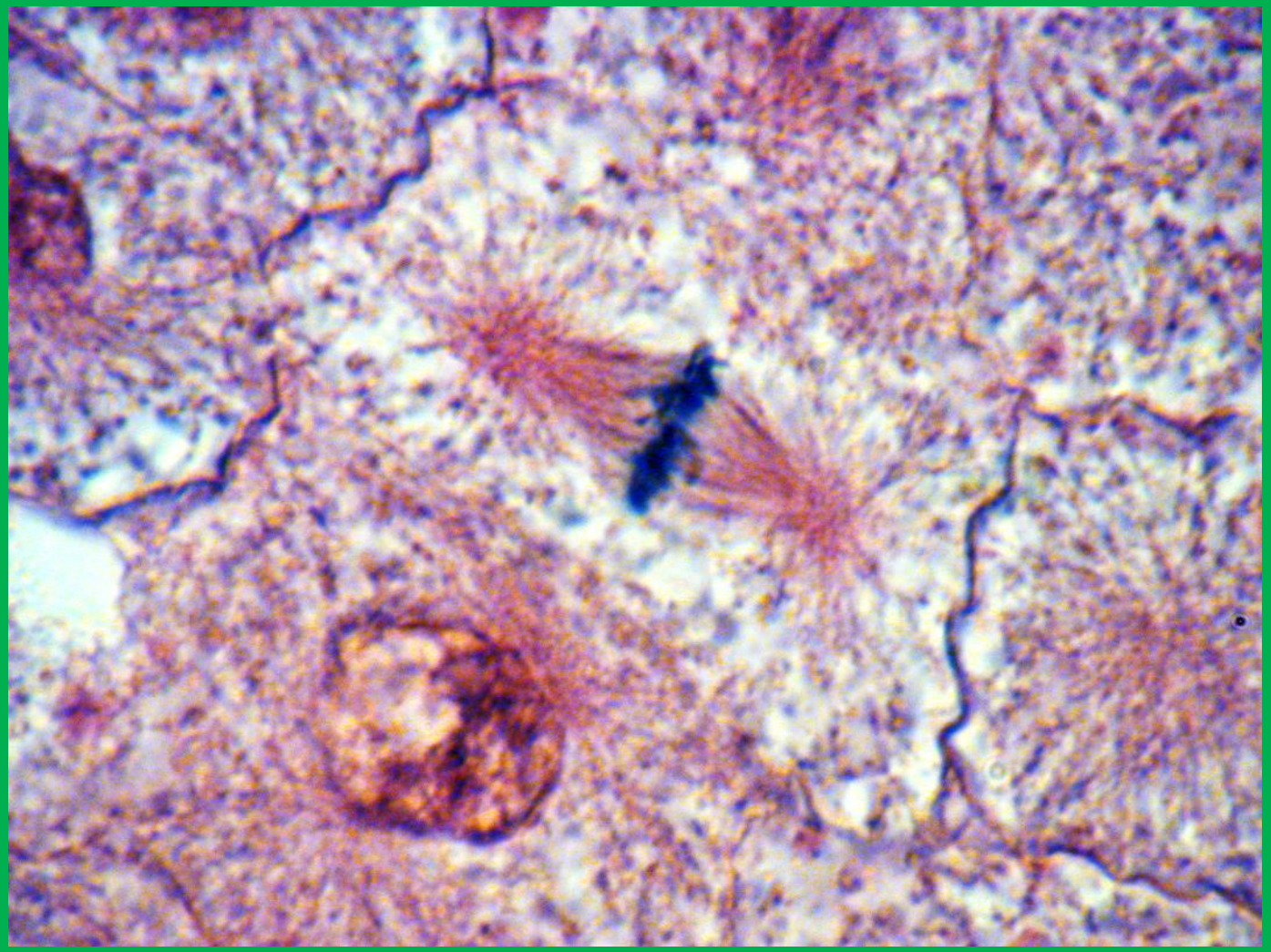


Prophase

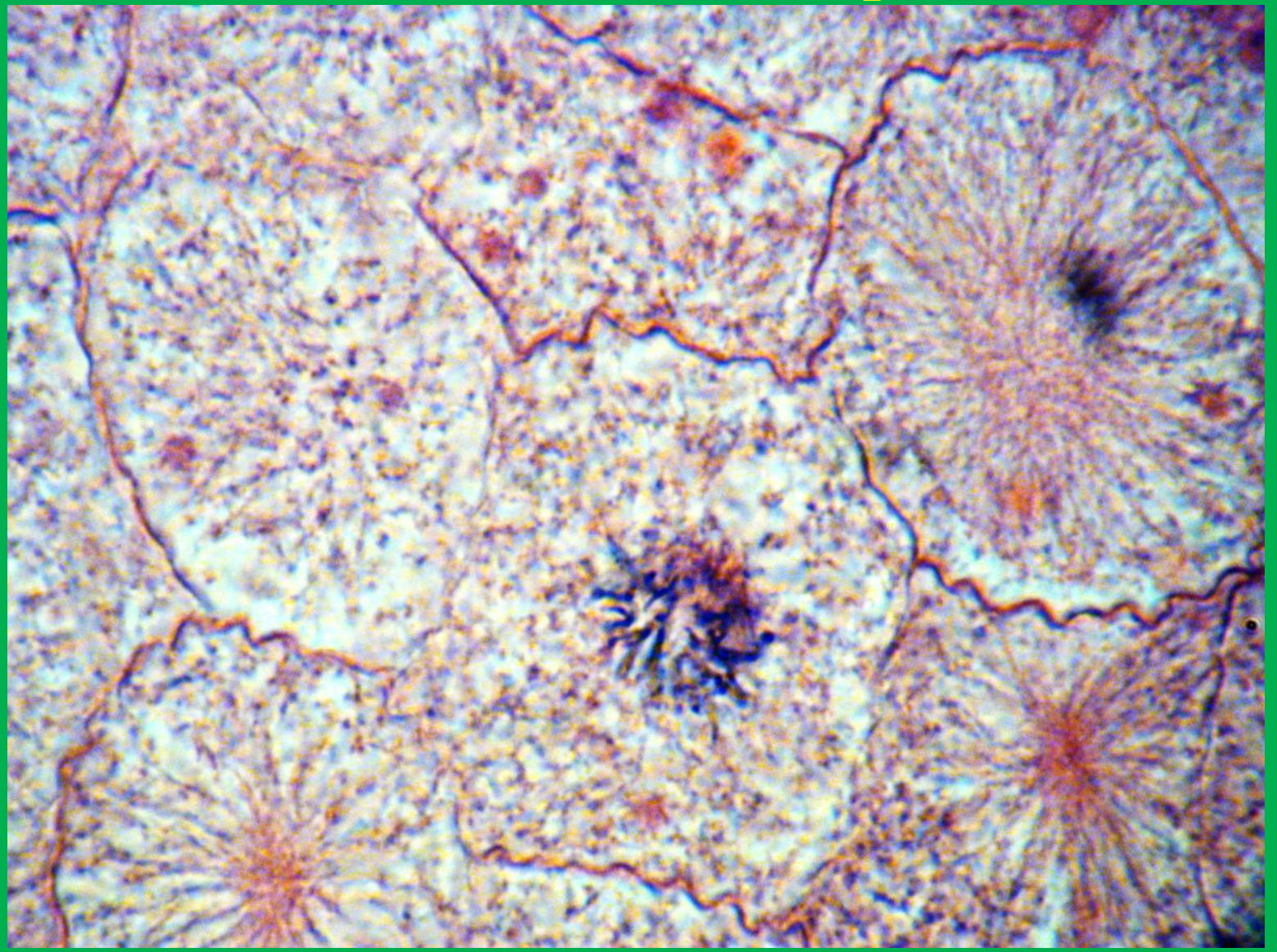


Centrioles separate as nuclear membrane disintegrates

METAPHASE

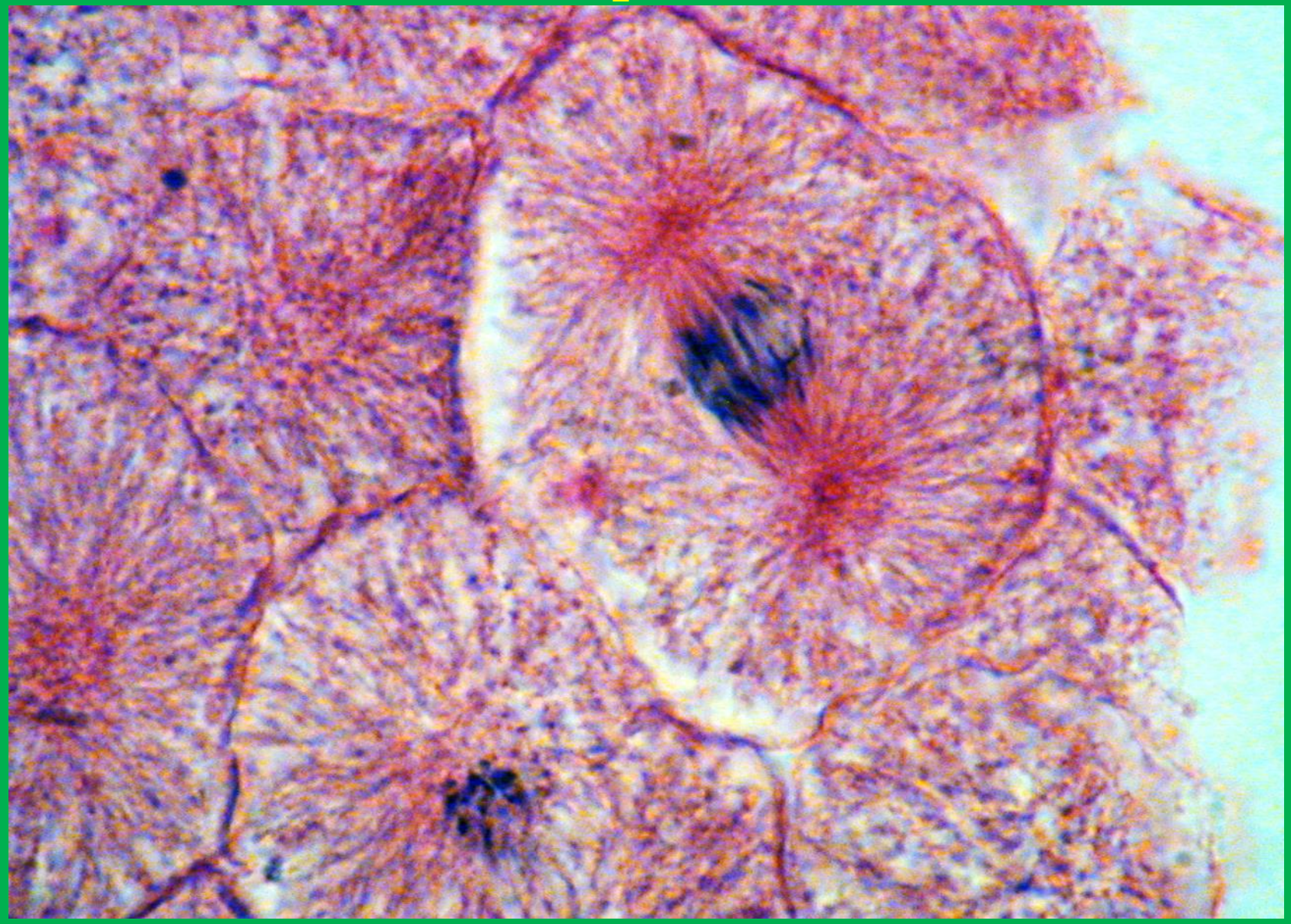


Polar view of Metaphase



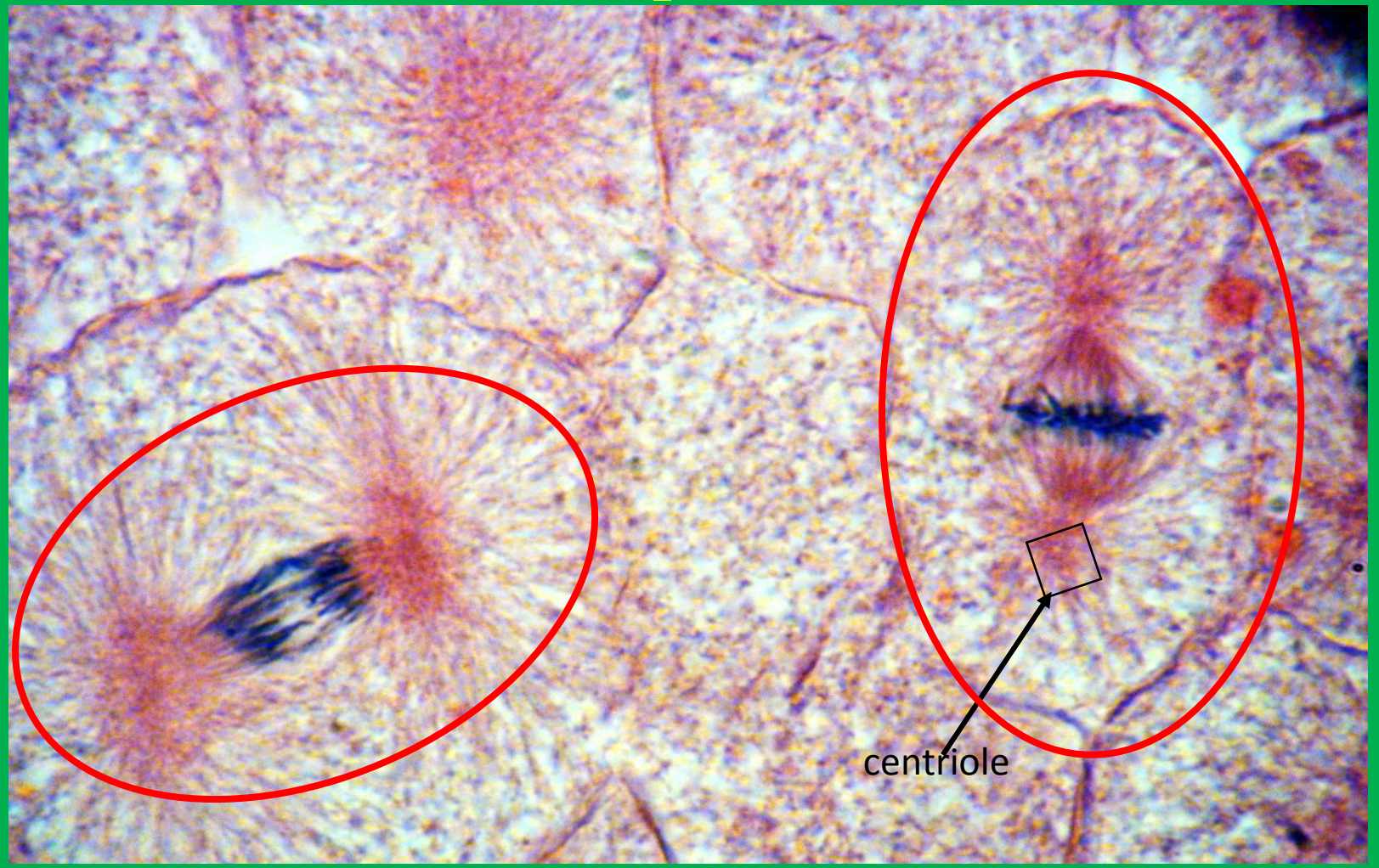
Metaphase and Anaphase

Anaphase

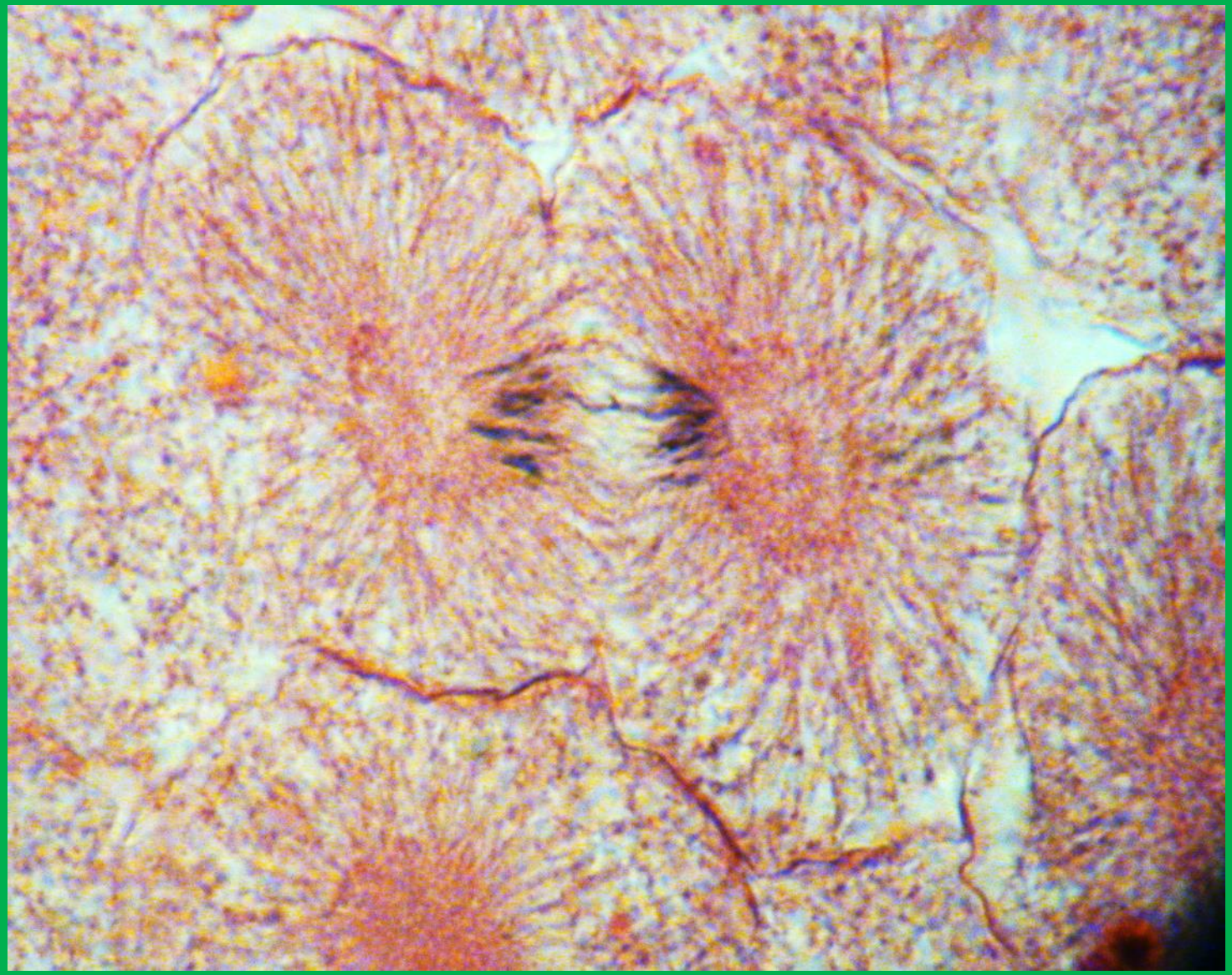


Note microtubules of spindle fibers

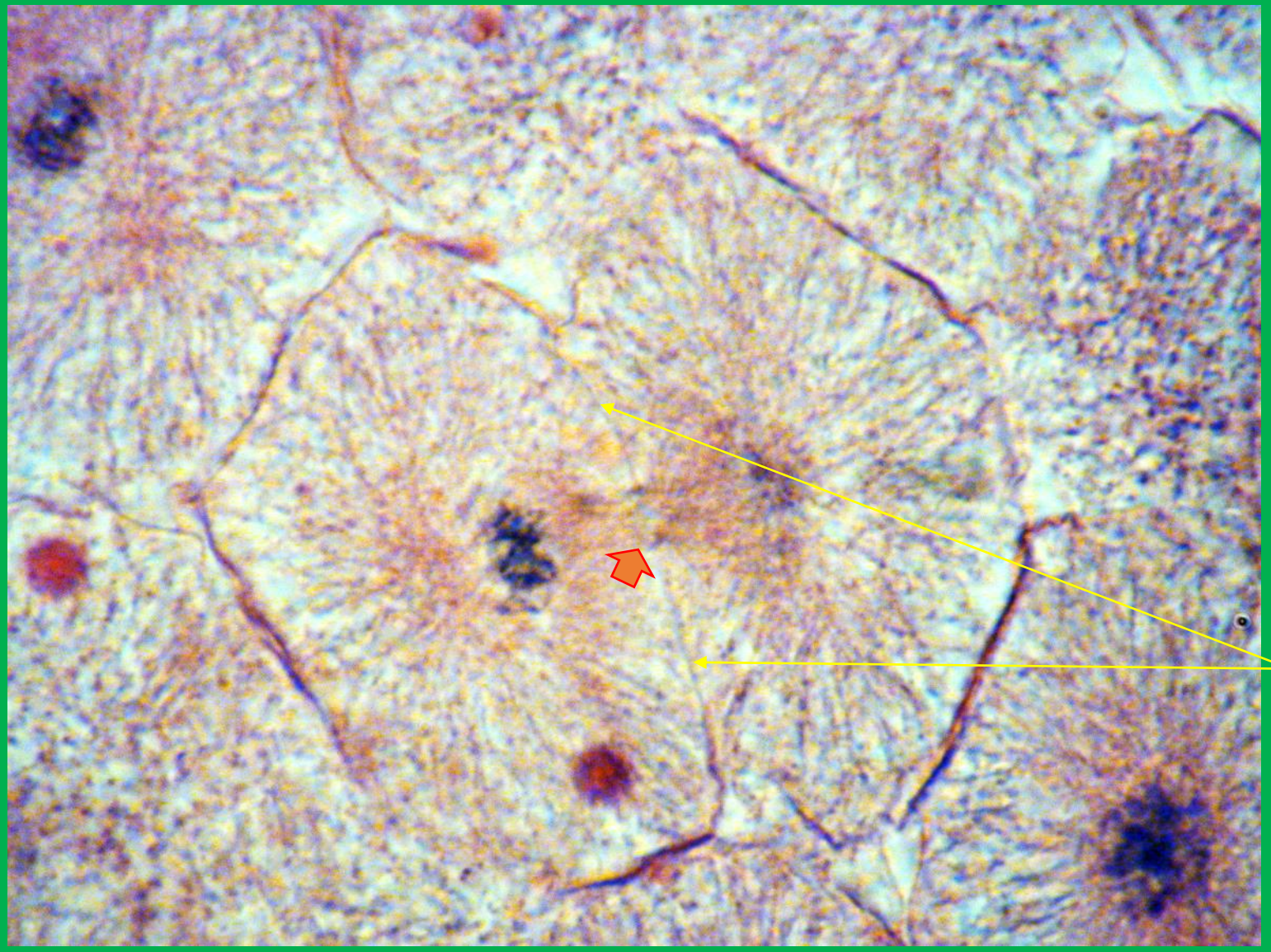
Late Anaphase to Early Telophase & Metaphase



Late Anaphase toTelophase



Late Telophase



Pinching Off, leaving microtubules of Spindle Fibers caught in center

Late Telophase

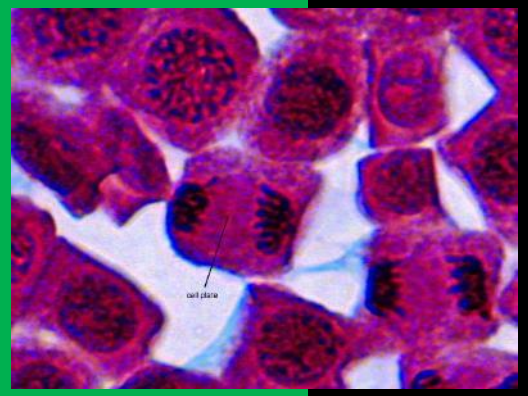
Pinching Off, leaving microtubules of Spindle Fibers caught in center

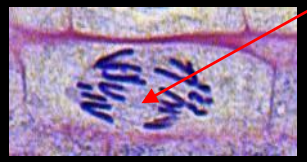
2n

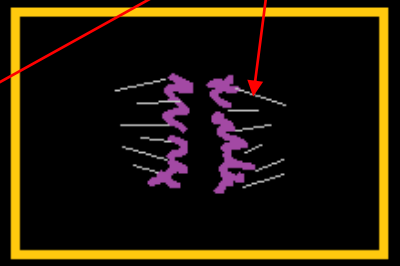
Prophase: nuclear membrane disintegrates, chromosomes visible

Metaphase
Chromosomes line up in middle of cell

Microtubular spindle fibers



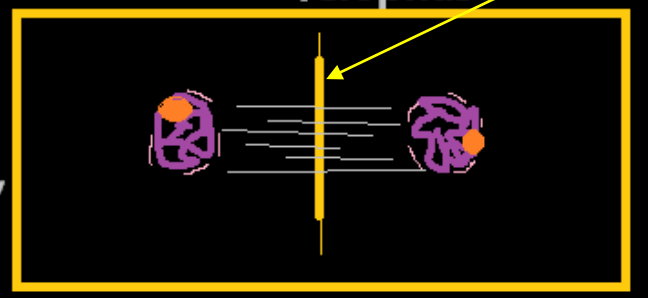




Anaphase
Chromosomes separate

Cell plate

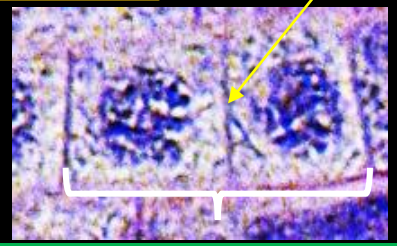
Telophase

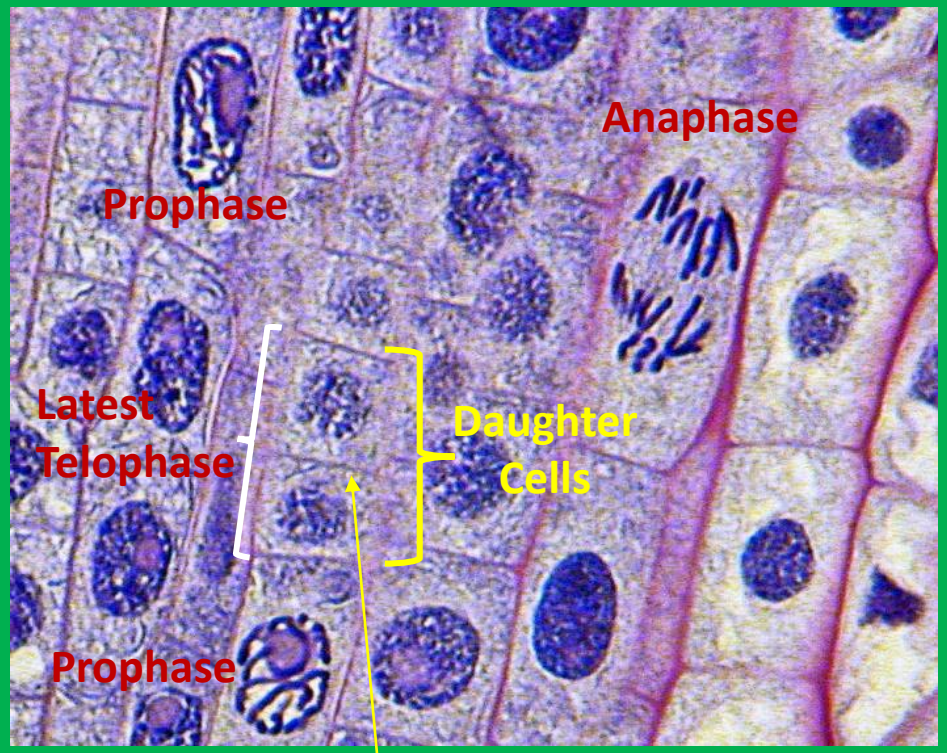


1n each, 'til DNA replication

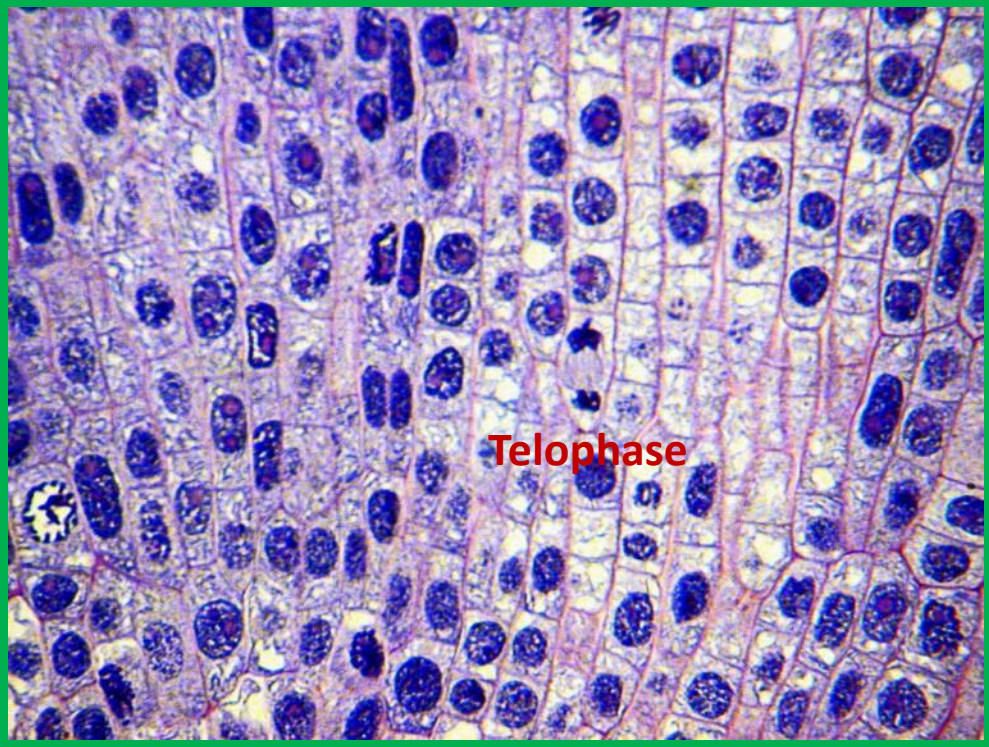
Cell plate forms as cell walls extend, nuclei of daughter cells reform

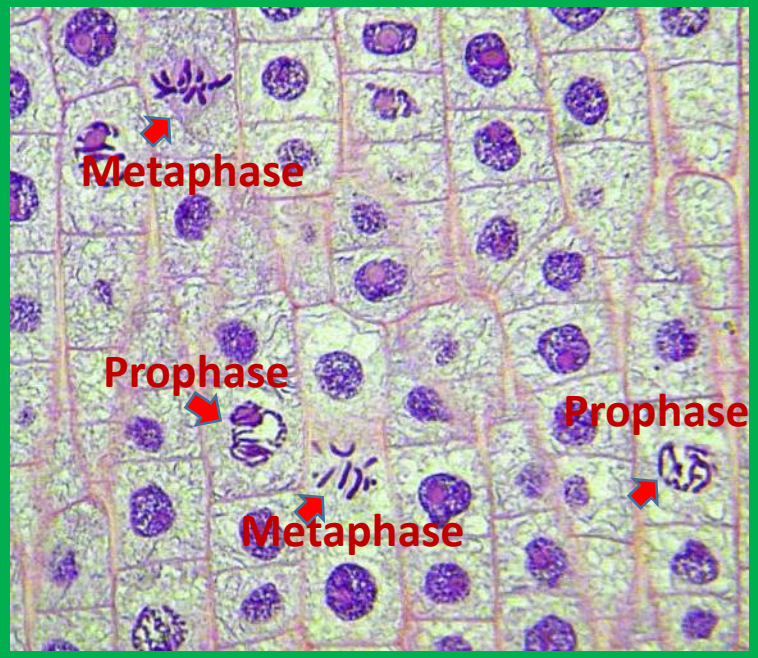
Daughter cells 2n: as DNA replicates

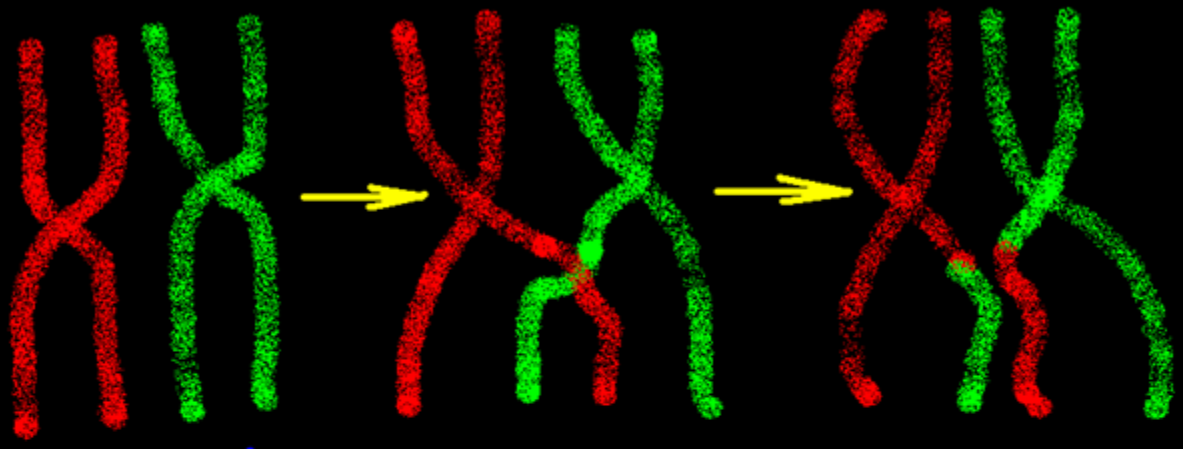




Mitosis in Plants: NO pinching off, no centrioles, cell plate forms

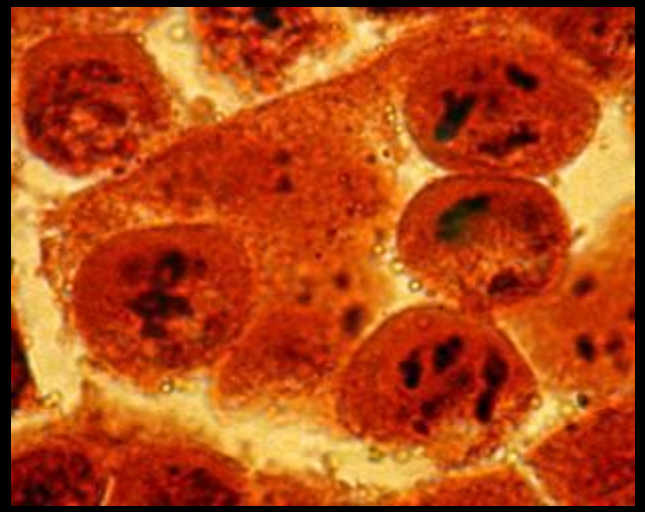


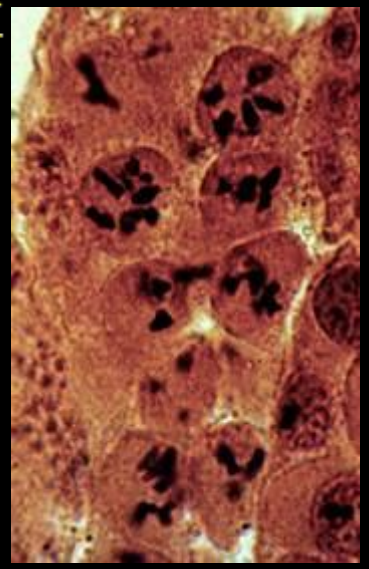


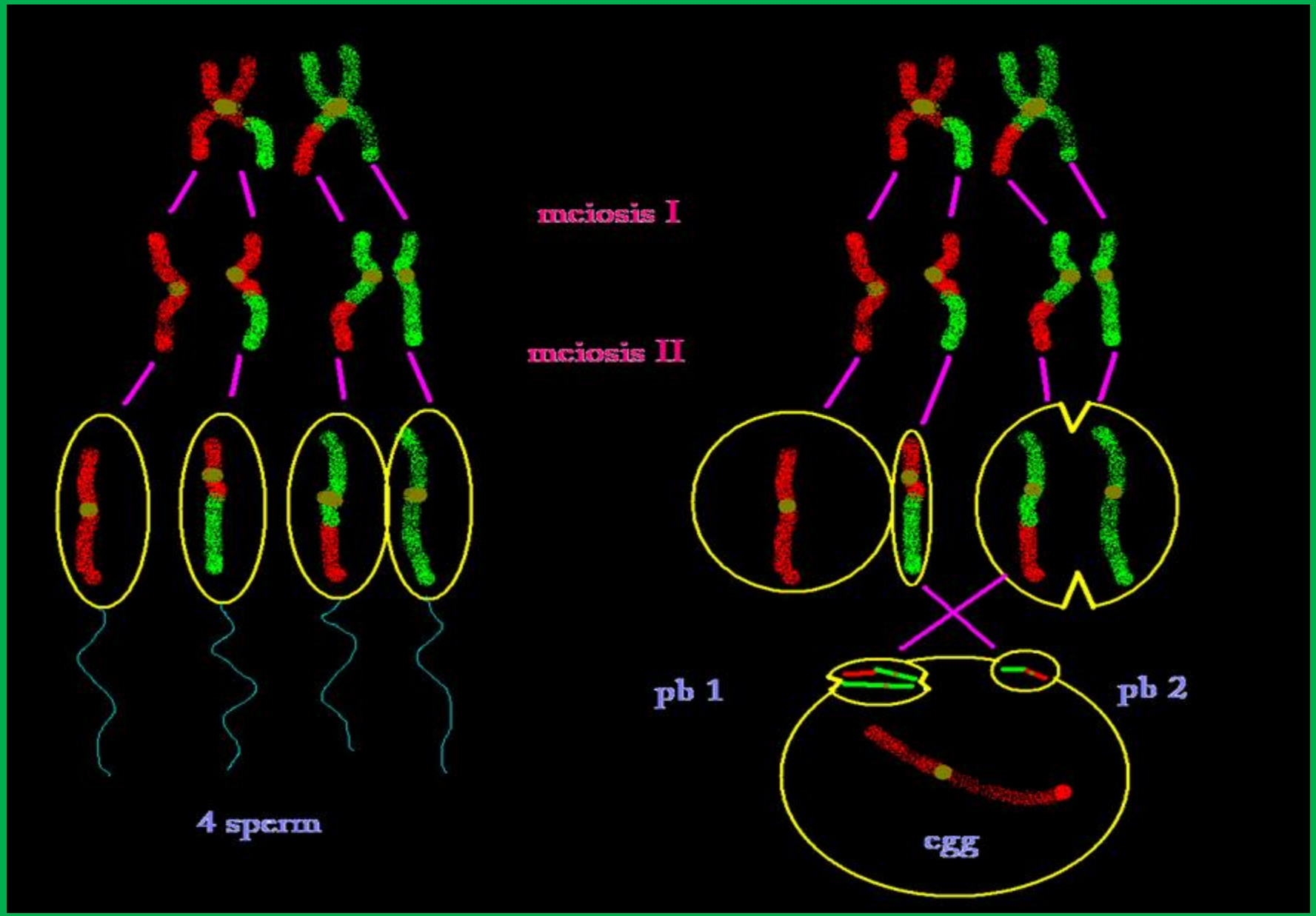


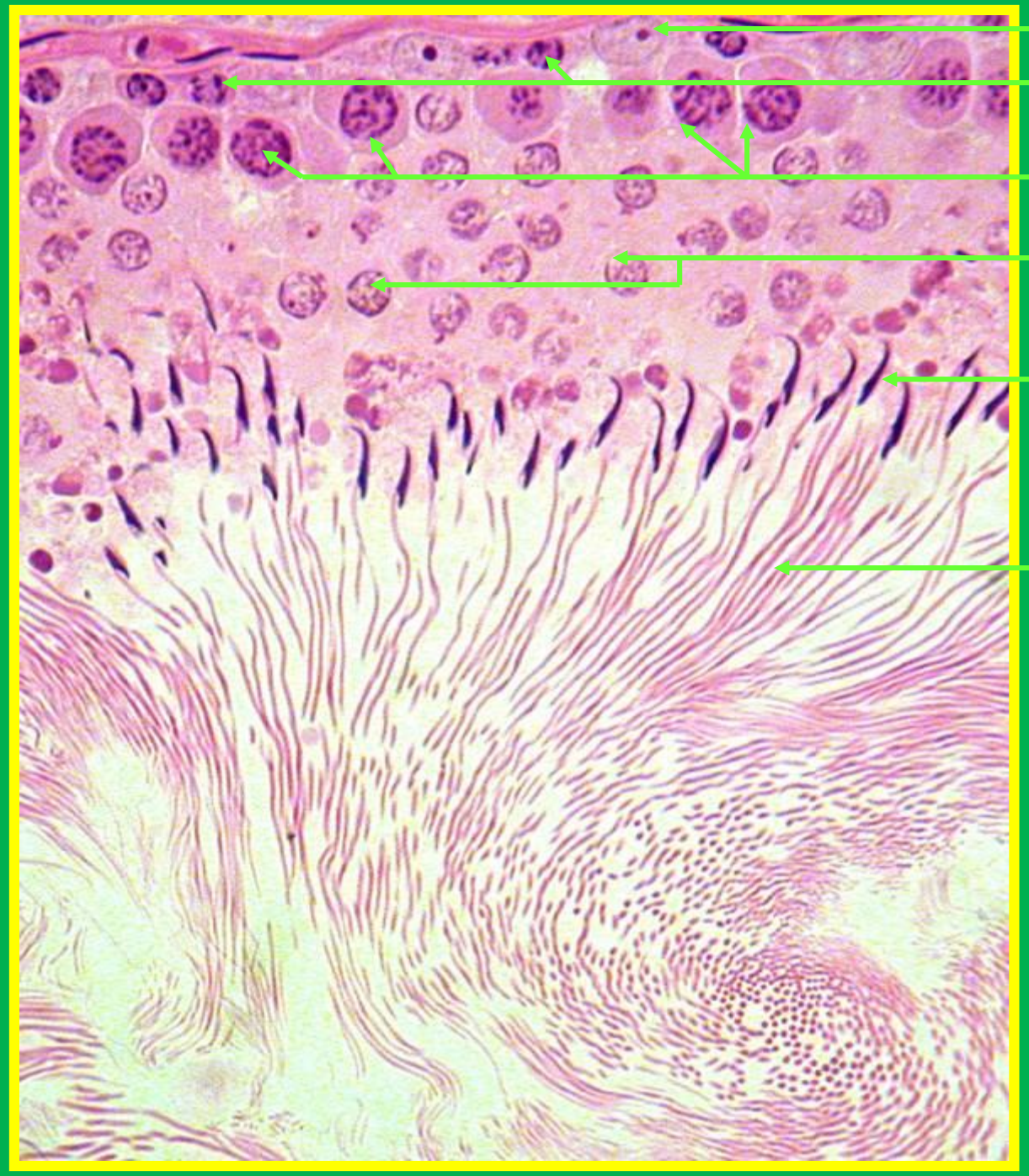
Crossingover (Recombination) = during prophase of Meiosis I

4 Chromatids in each pair of chromosmes: 1 set from each parent






meiosis I
meiosis II
4 sperm
pb 1
pb 2
egg



Spermatogenesis in Seminiferous Tubule (Rat)