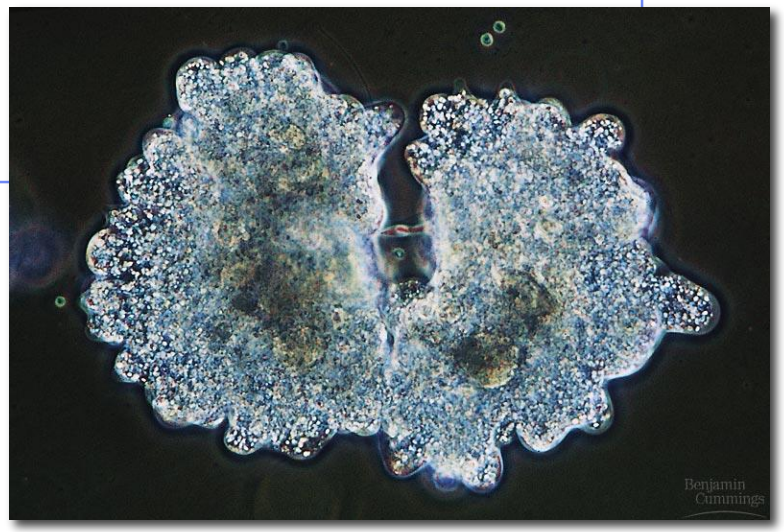
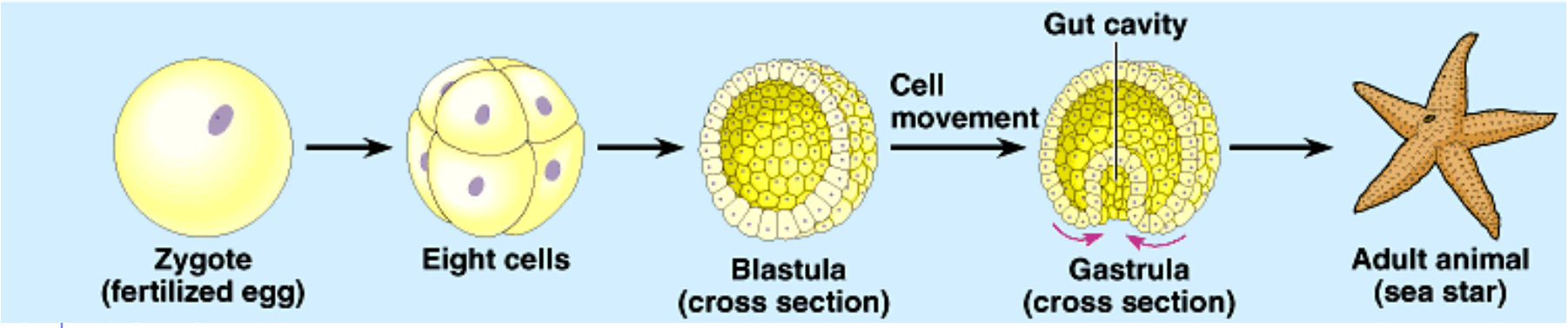
Biology is the only subject in which multiplication is the same thing as division…





MITOSIS:
Making New Cells
Making New DNA

Where it all began…

You started as a cell smaller than a period at the end of a sentence…

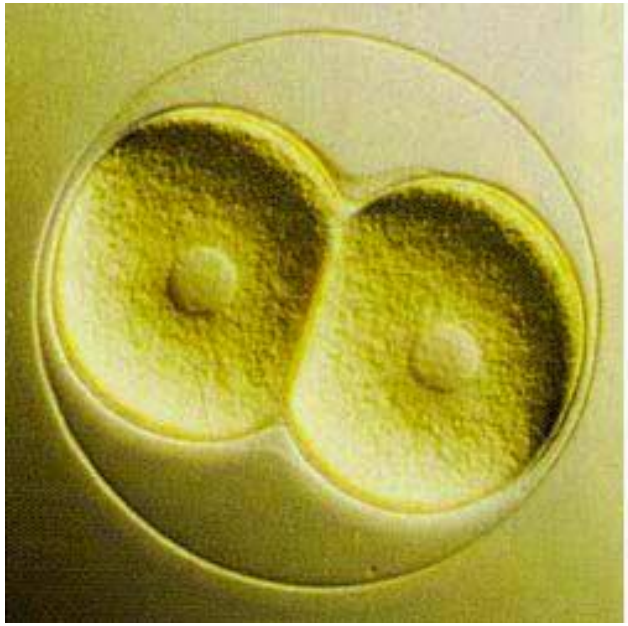
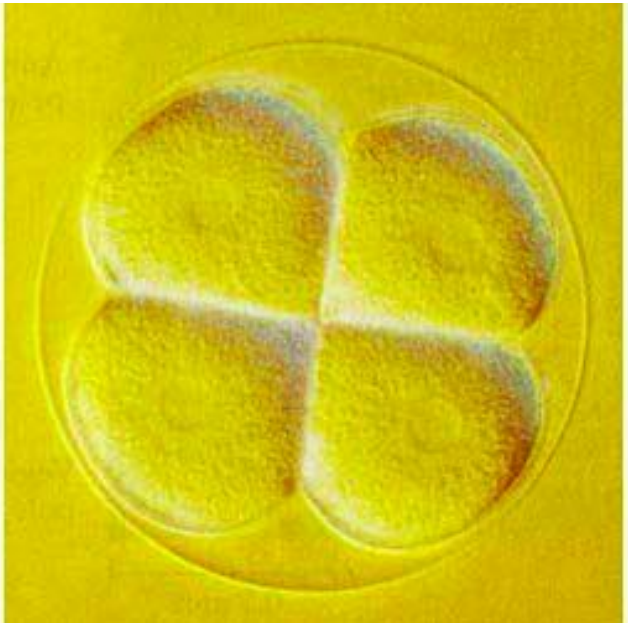
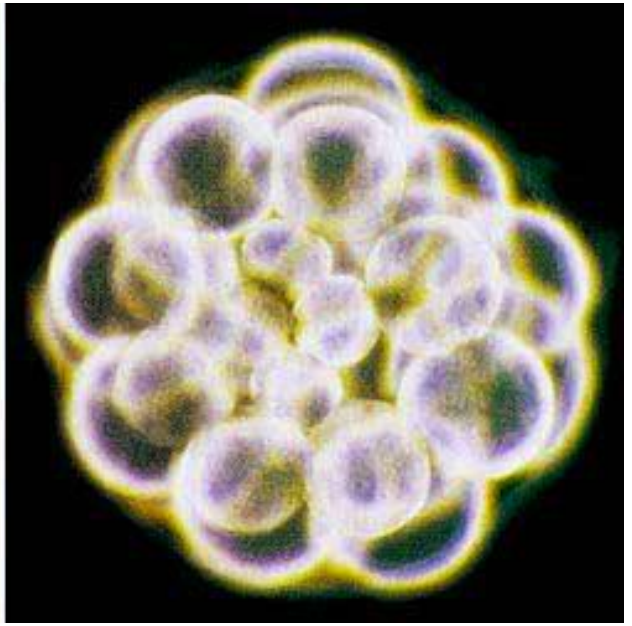
And now look at you…

37 trillion cells later!!

How did you get from there to here?

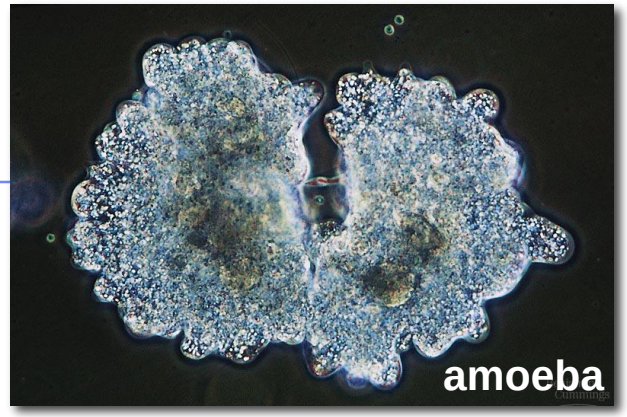
Getting from there to here…

- Going from egg to baby….
  - the original fertilized egg has to divide…
    - and divide…
      - and divide…
        - and divide…

Why do cells divide…

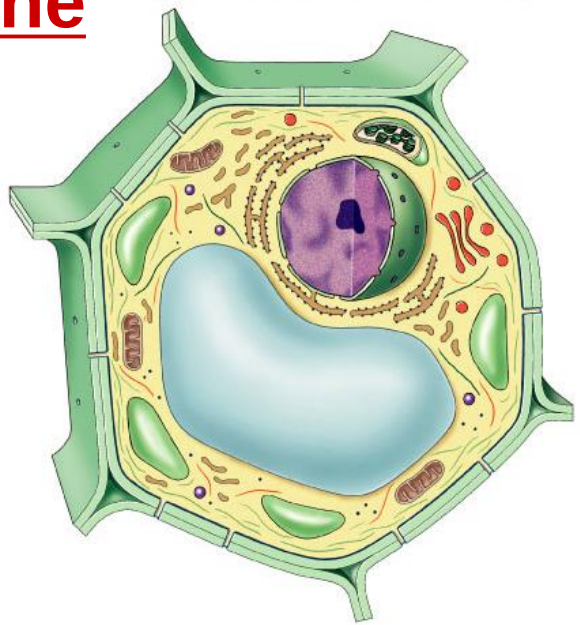
- One-celled organisms
  - for reproduction
  - asexual reproduction (clones)
- Multi-celled organisms
  - for growth & development
    - from fertilized egg to adult
  - for repair & replacement
    - replace cells that die from normal wear & tear or from injury



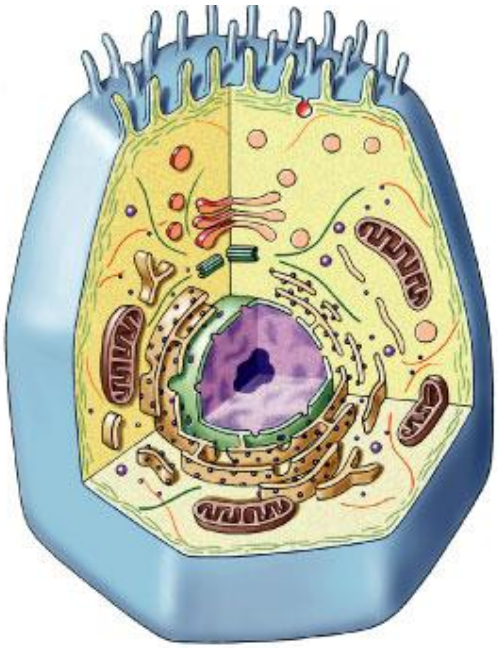
ology

Dividing cells…

- What has to be copied
  - DNA
  - organelles
  - cell membrane
  - lots of other molecules
    - enzymes



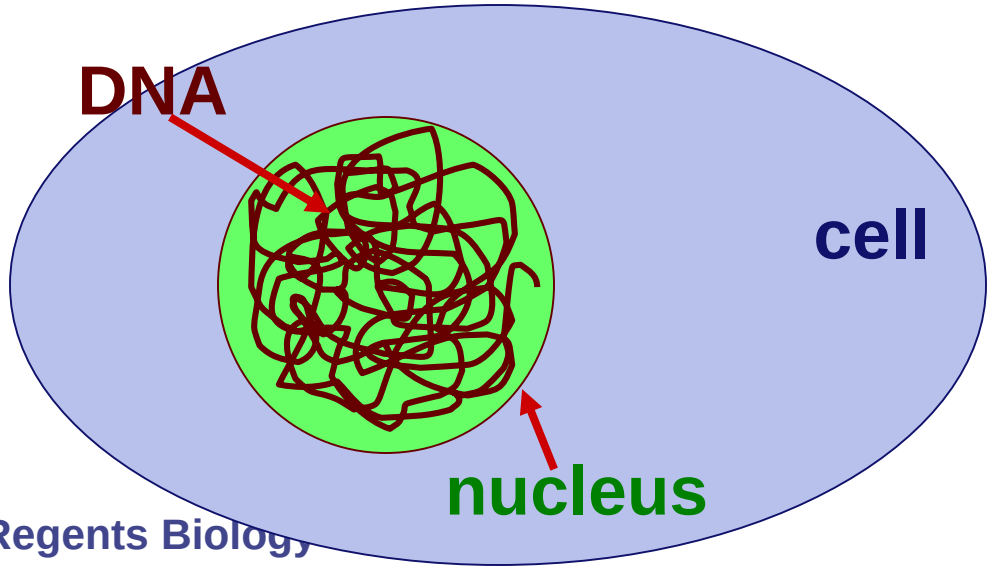
plant cell



animal cell

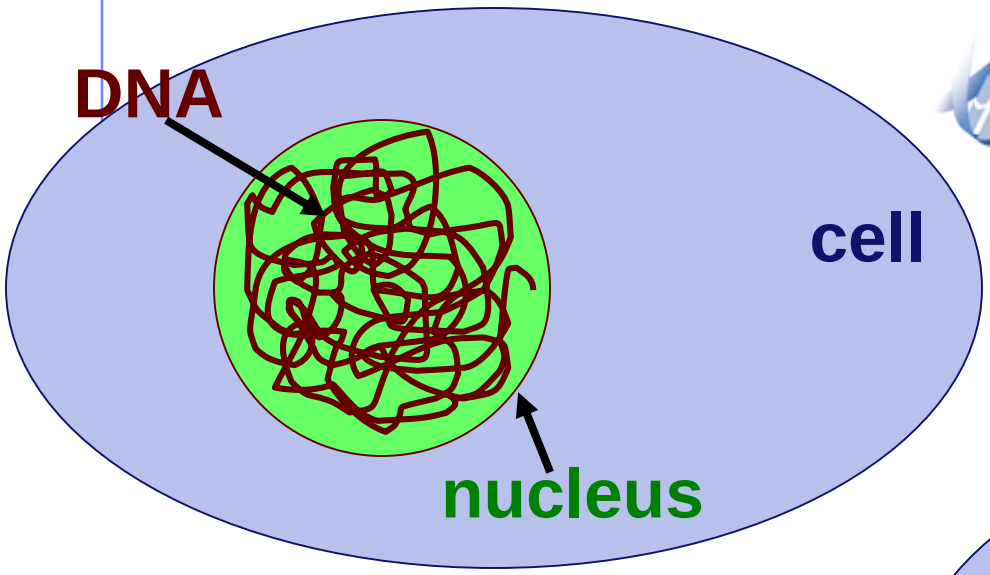
Copying DNA

- A dividing cell duplicates its DNA
  - creates 2 copies of all DNA
  - separates the 2 copies to opposite ends of the cell
  - splits into 2 daughter cells

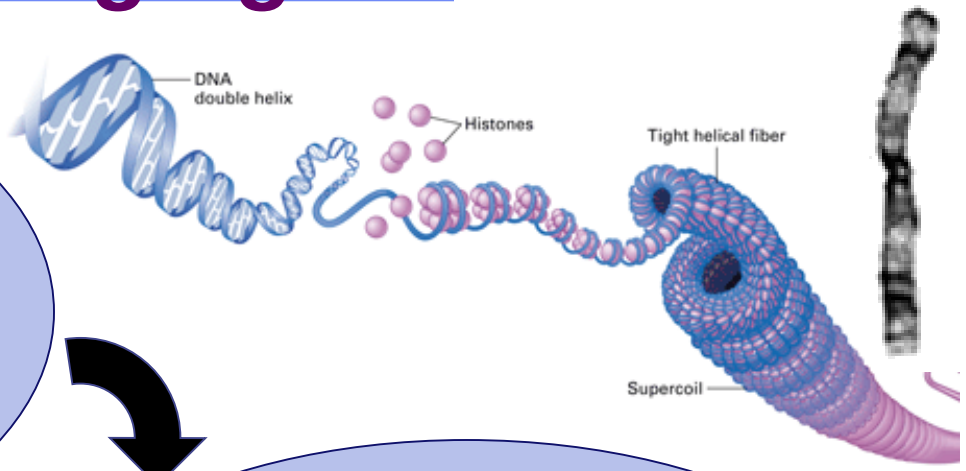


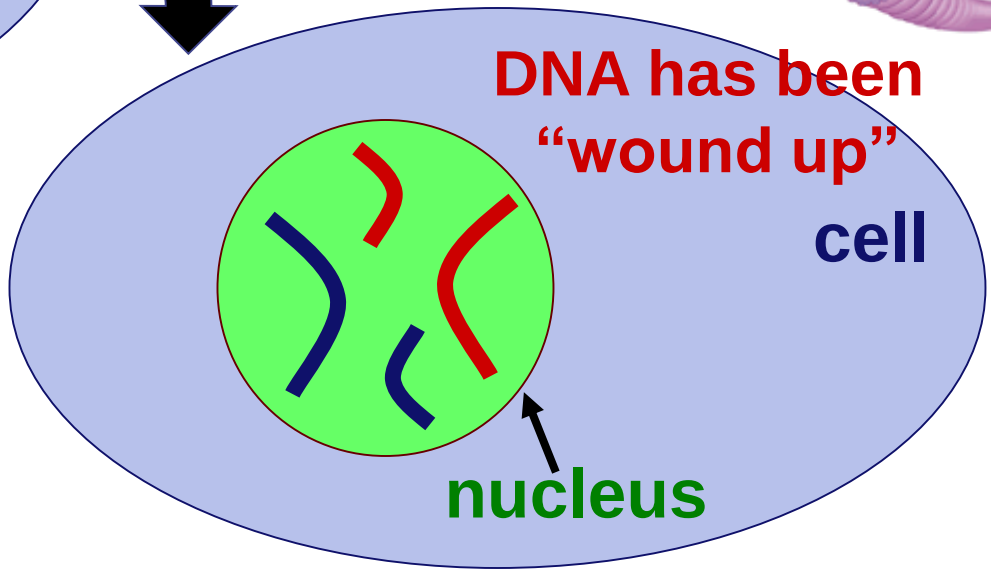
- But the DNA starts loosely wound in the nucleus
- If you tried to divide it like that, it could tangle & break

Organizing & packaging DNA



DNA in chromosomes in everyday "working" cell

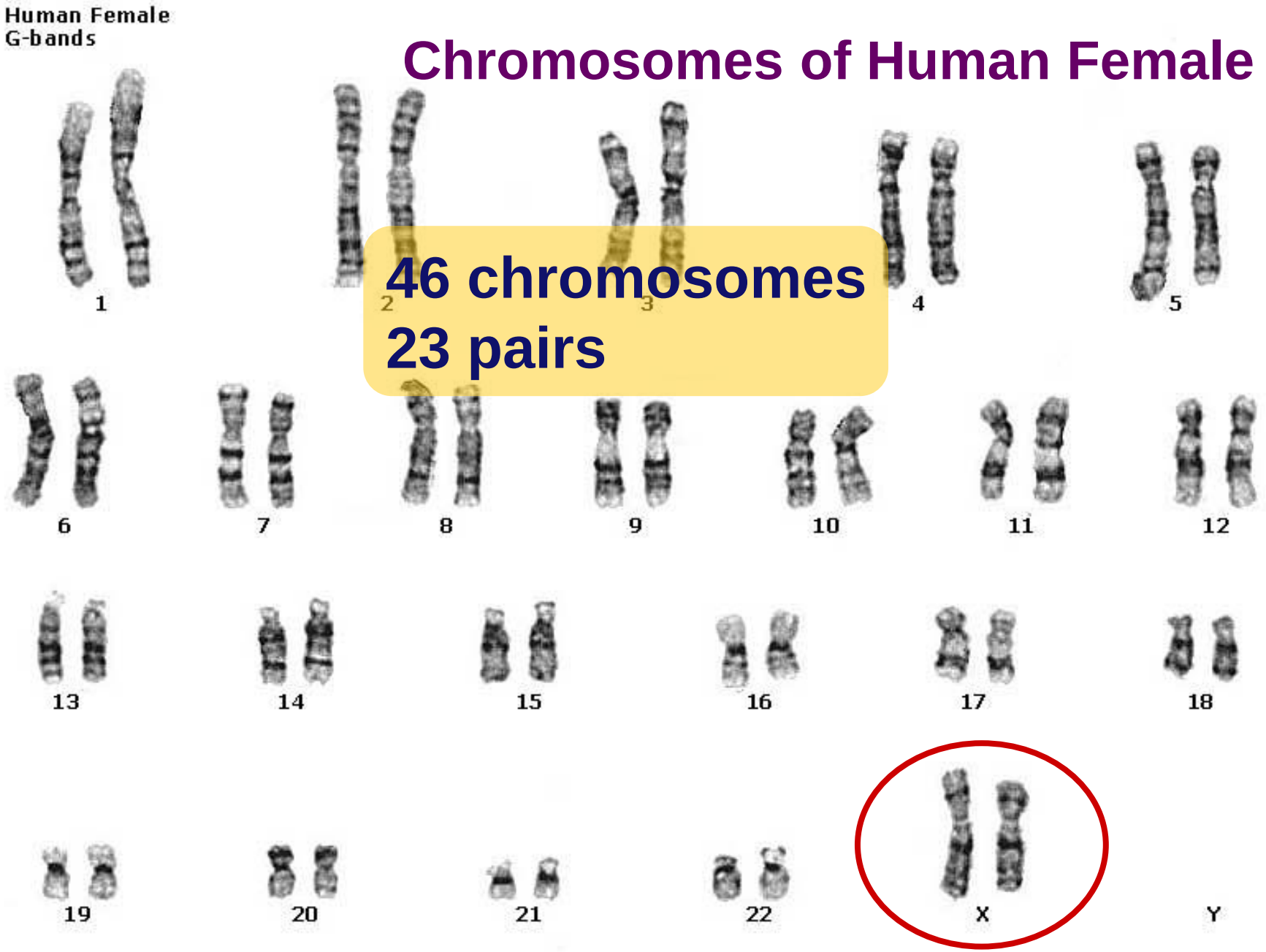




DNA in chromosomes in cell getting ready to divide

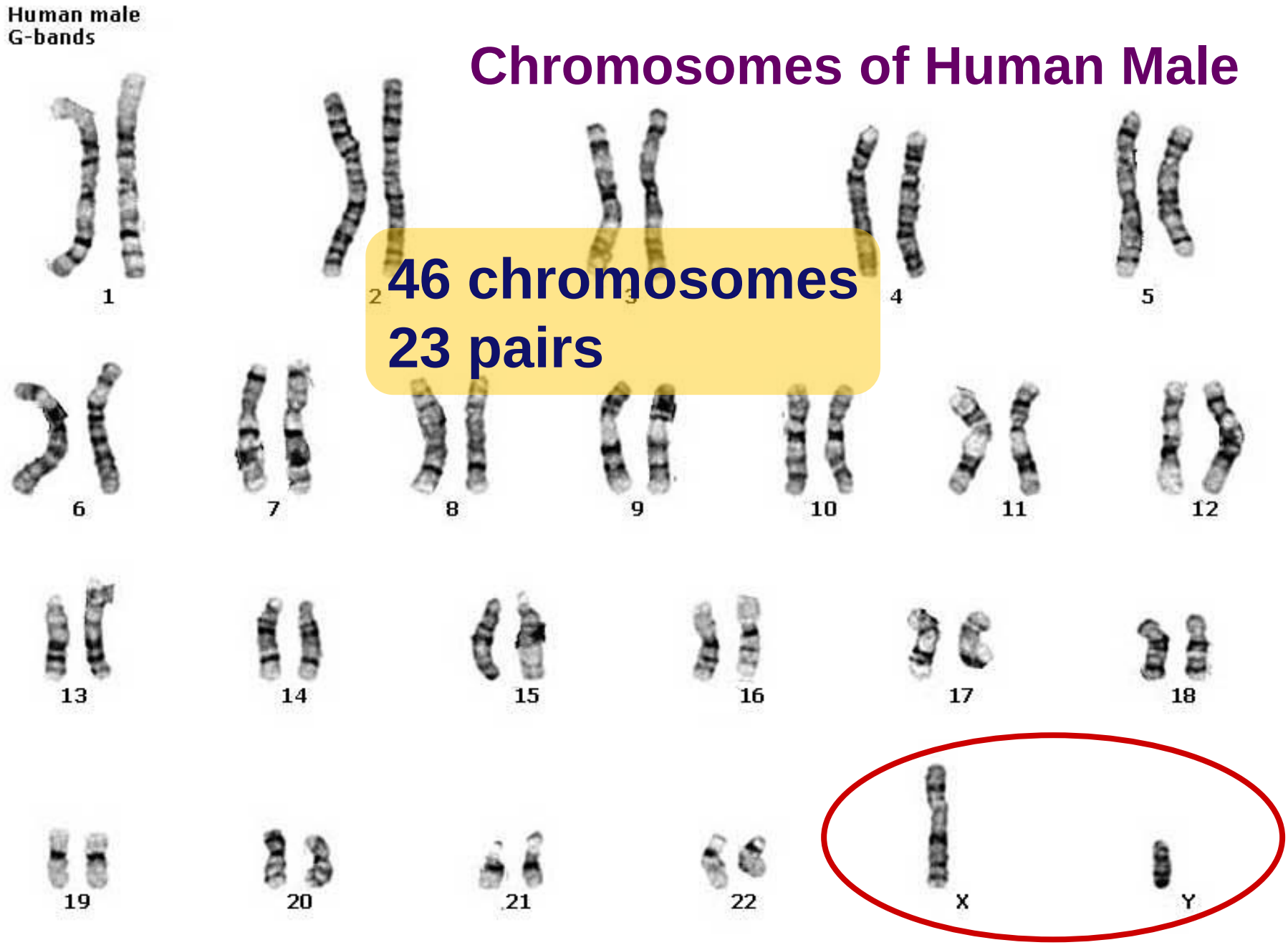
4 chromosomes in *this* organism

Chromosomes of Human Female



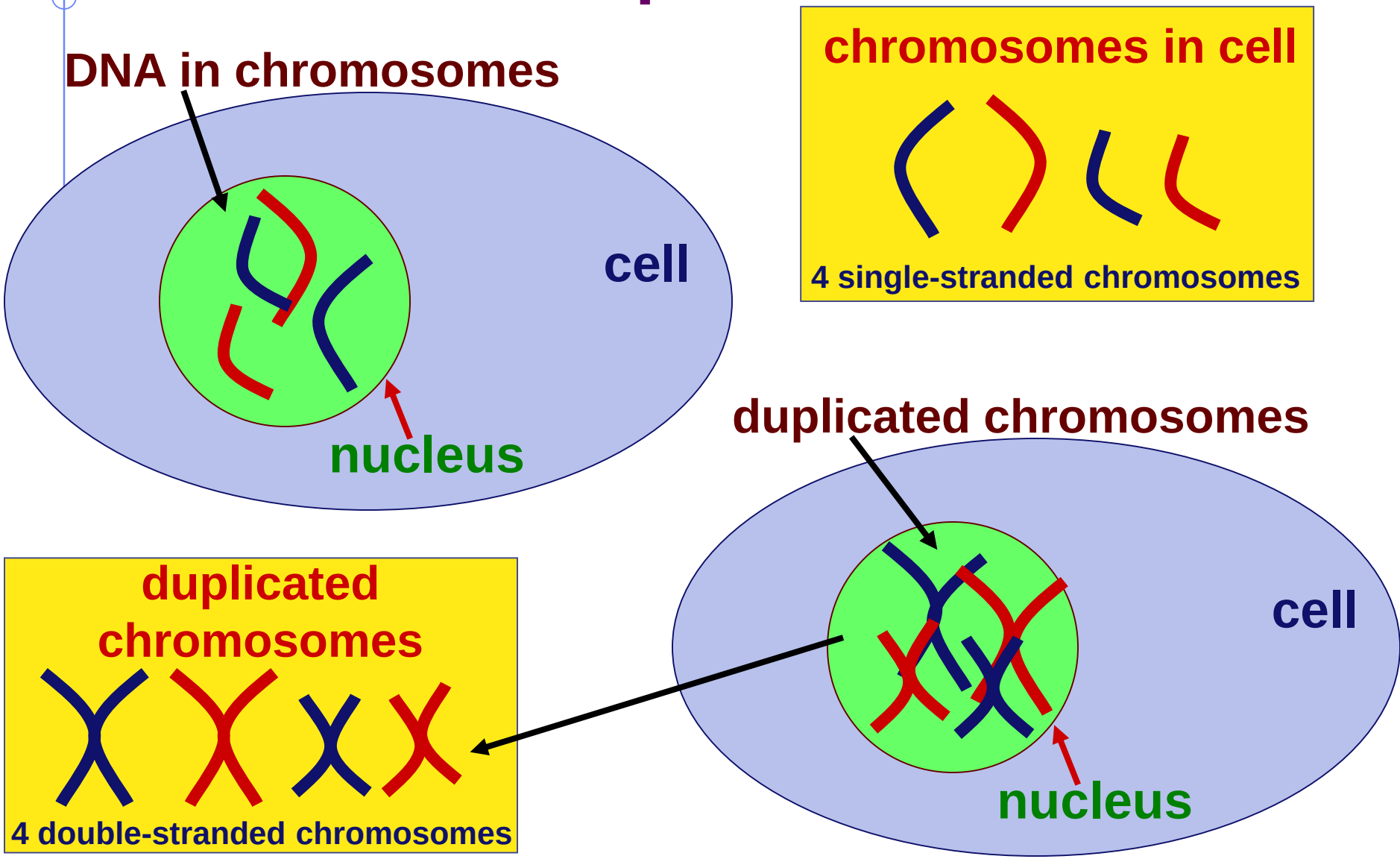
46 chromosomes
23 pairs

Chromosomes of Human Male

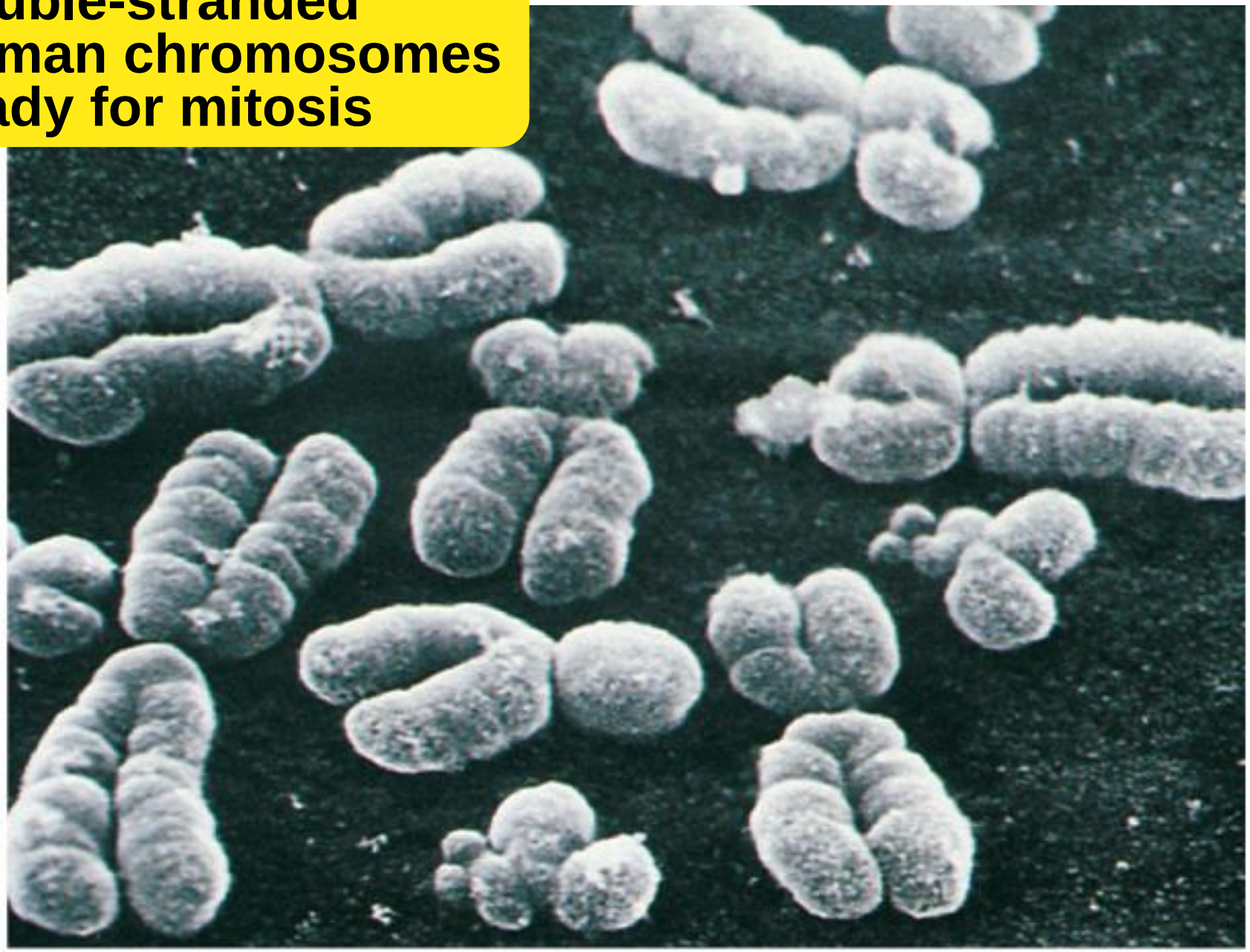


46 chromosomes
23 pairs

DNA must be duplicated…

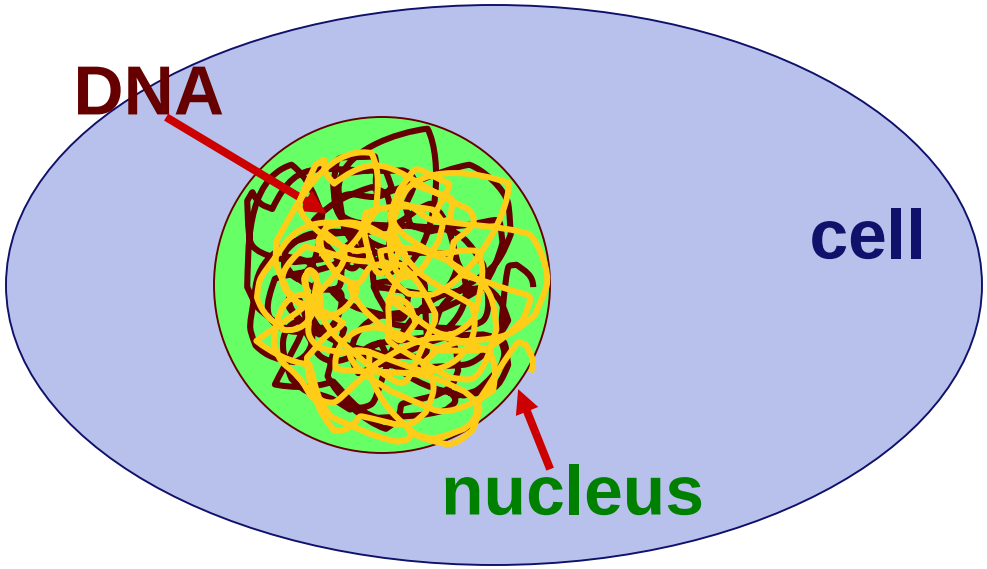


double-stranded human chromosomes ready for mitosis



Mitosis: Dividing DNA & cells

- Stage 1: cell copies DNA

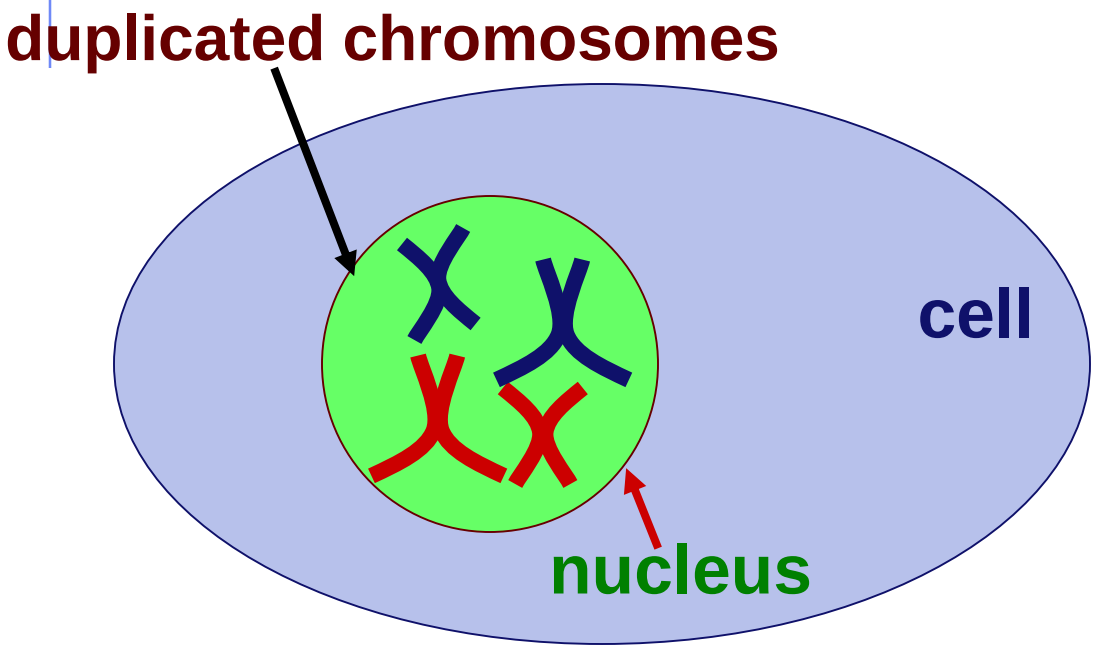


Copy DNA!

(interphase)

Mitosis: Dividing DNA & cells

- **Stage 2: DNA winds into chromosomes**
  - **DNA is wound up into chromosomes to keep it organized**



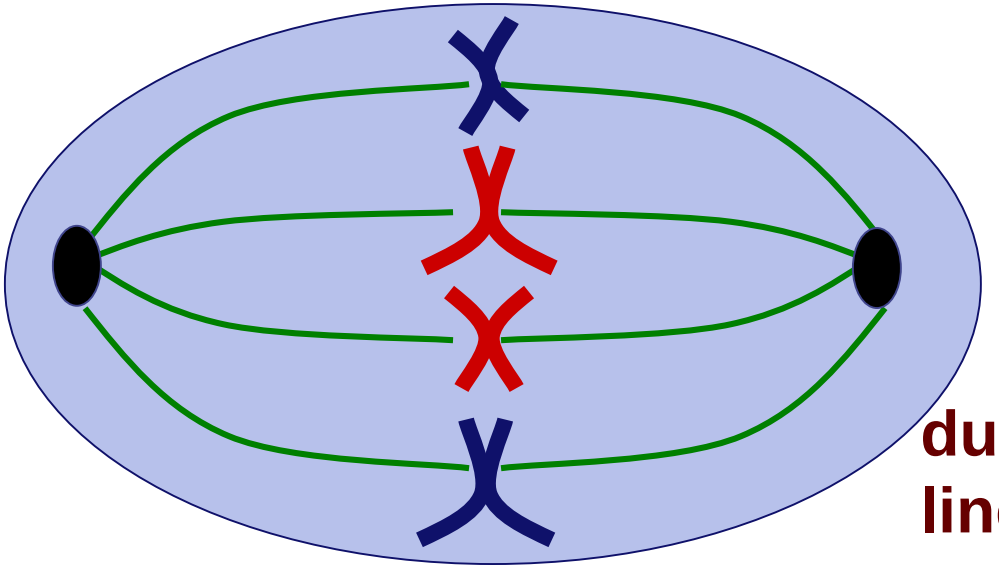
Wind up!

(prophase)

Mitosis: Dividing DNA & cells

- **Stage 3: Chromosomes line up**
  - chromosomes line up in ***middle***
  - attached to protein "cables" (microtubules) that will help them move

Line up!



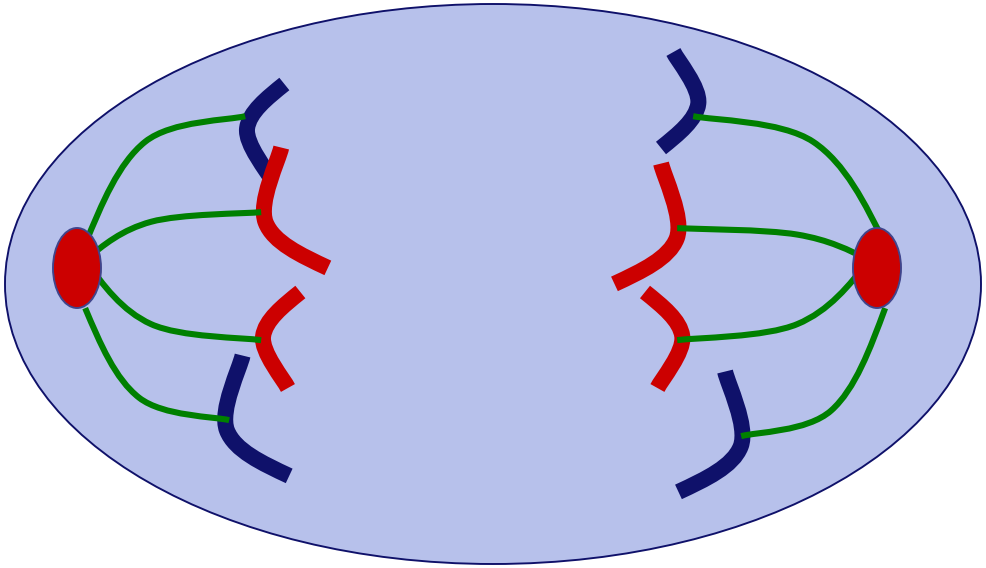
duplicated chromosomes lined up in middle of cell

(metaphase)

Mitosis: Dividing DNA & cells

- **Stage 4: Chromosomes separate**
  - chromosomes split, separating pairs
  - start moving to opposite ends

Separate!

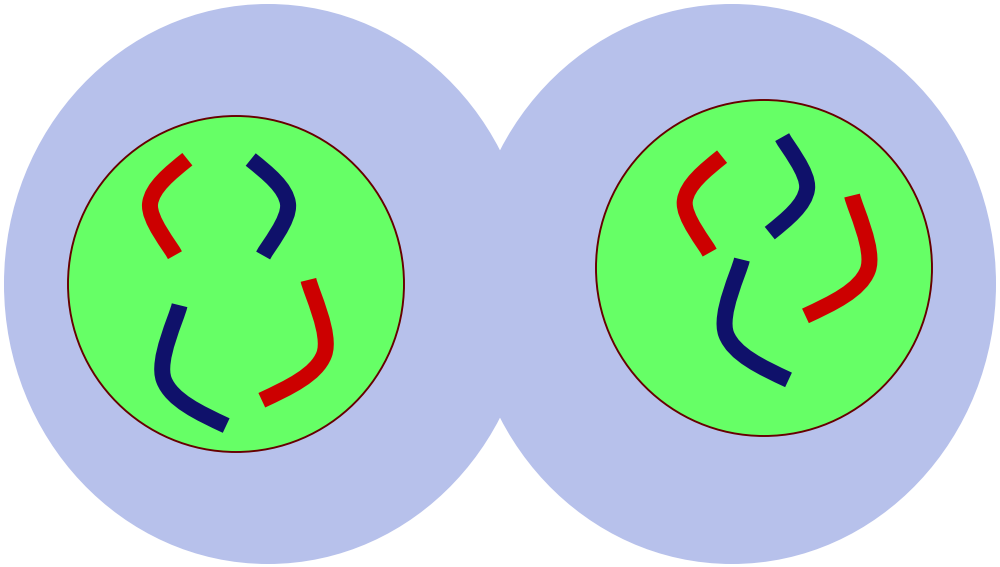


chromosomes split & move to opposite ends

(anaphase)

Mitosis: Dividing DNA & cells

- **Stage 5: Cell starts to divide**
  - cells start to divide
  - nucleus forms again



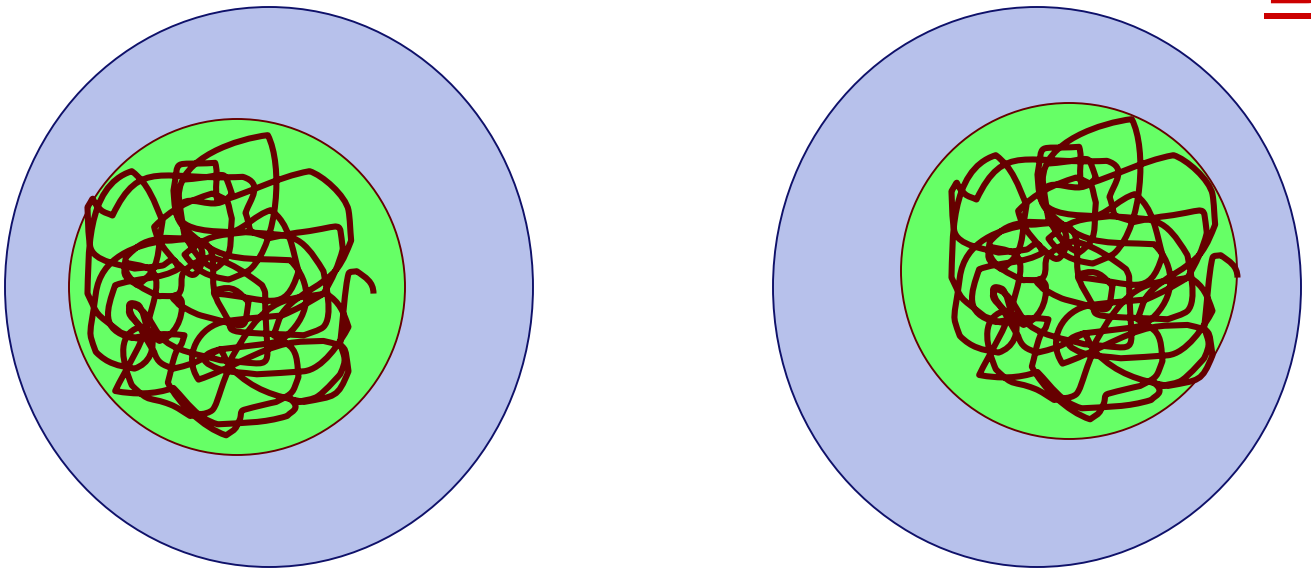
Divide!

(telophase)

Mitosis: Dividing DNA & cells

- **Stage 6: DNA unwinds again**
  - **cells separate**
  - **now they can do their every day jobs**

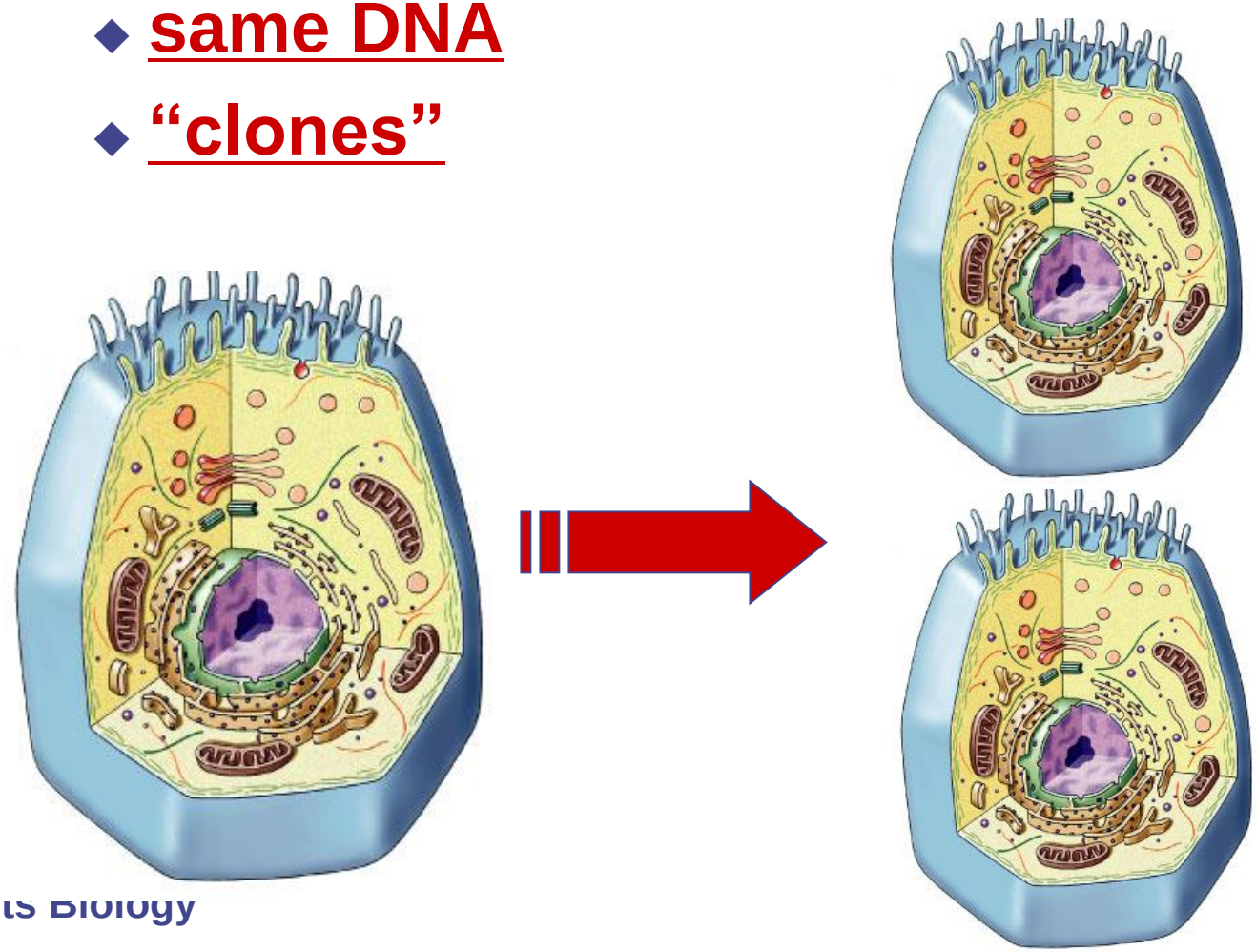
Bye Bye!



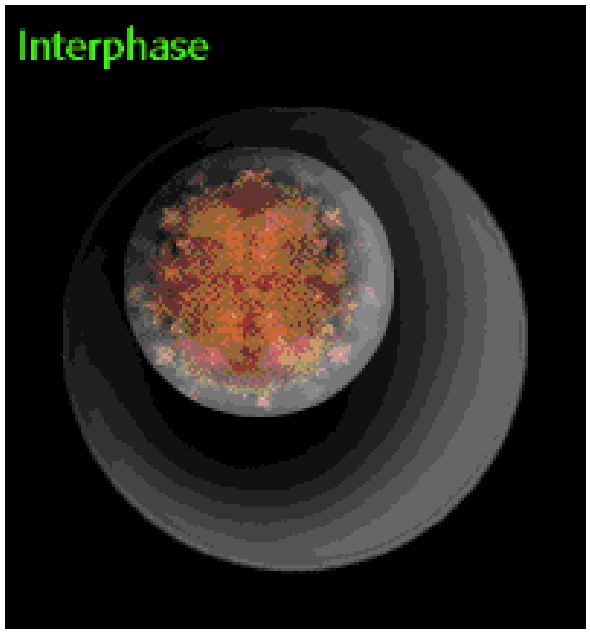
(cytokinesis)

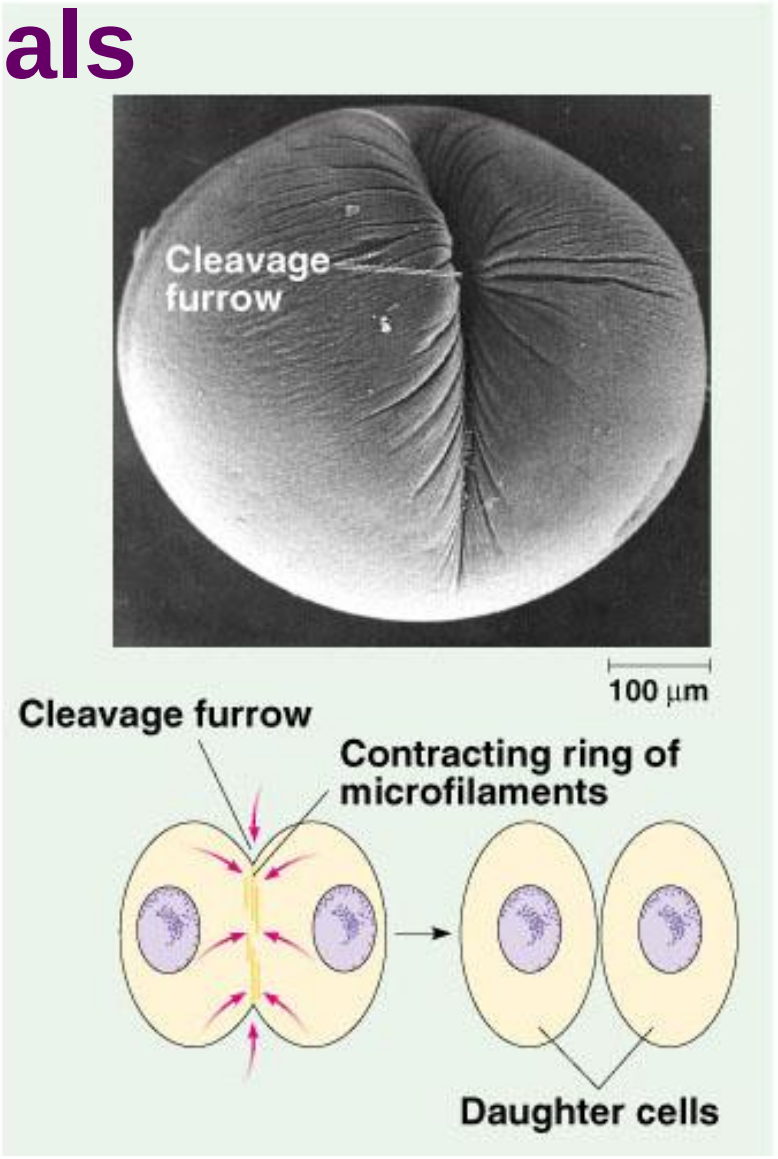
New “daughter” cells

- Get 2 exact copies of original cells
  - same DNA
  - “clones”

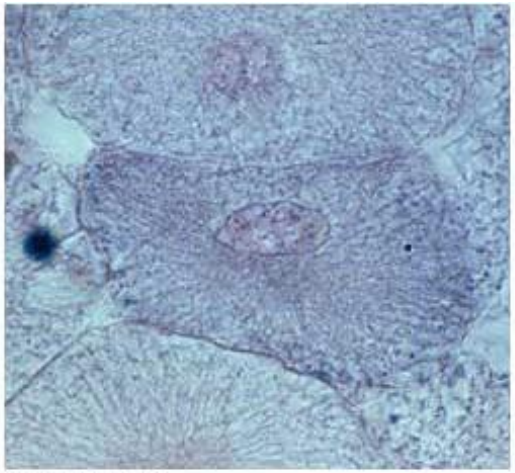


Cell division in Animals

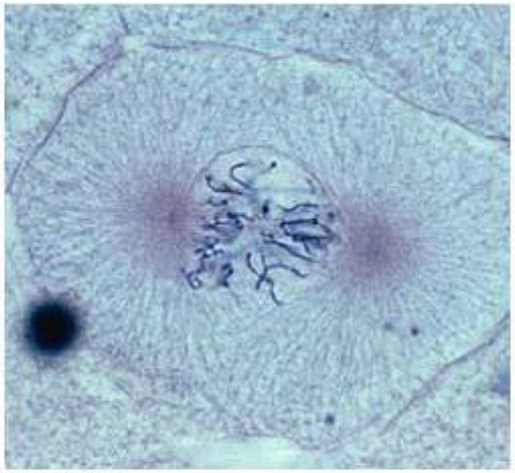




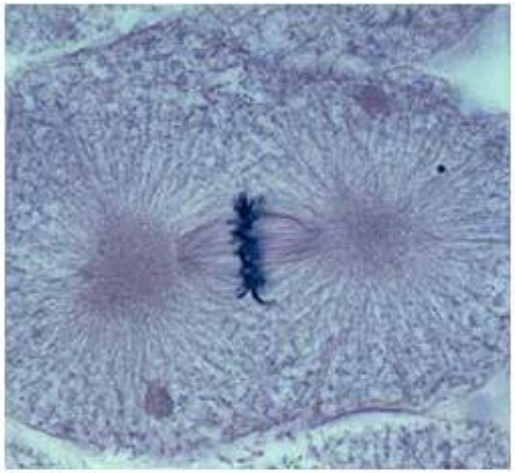
Mitosis in whitefish embryo



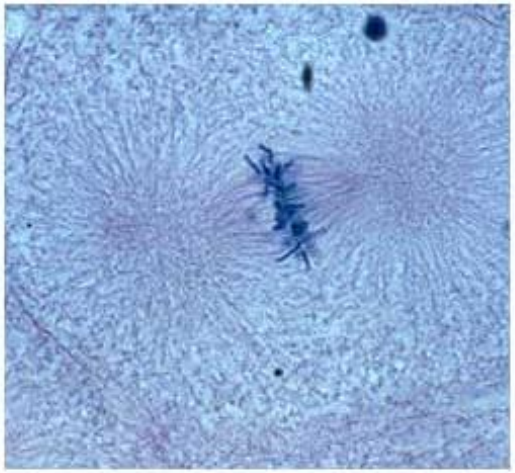
Interphase



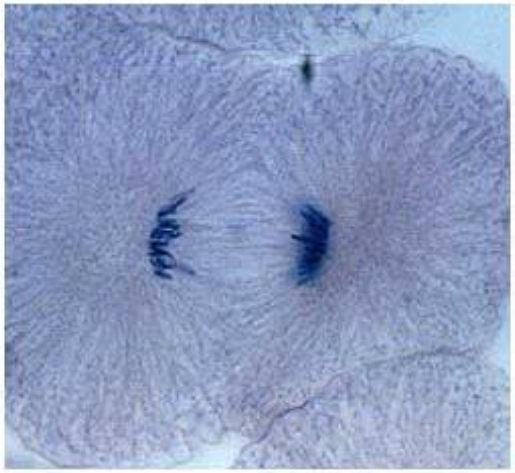
Prophase



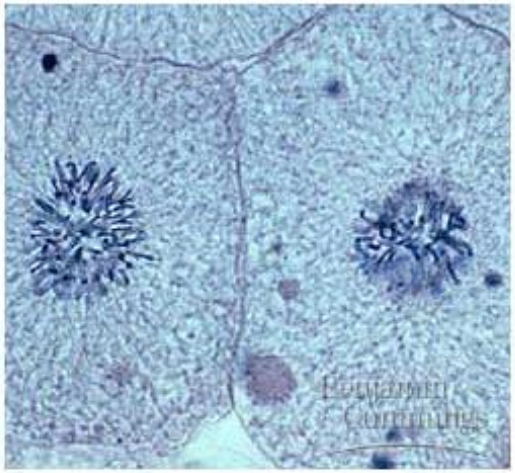
Metaphase



Anaphase

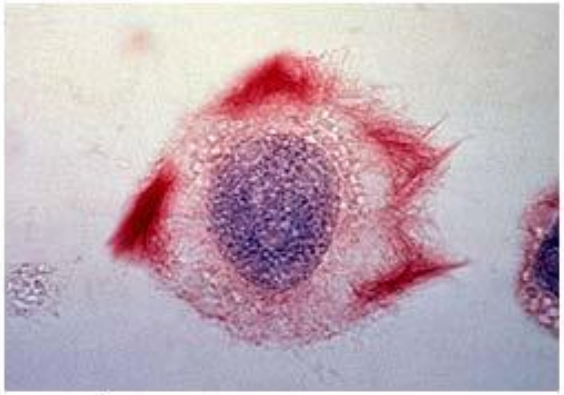


Early Telophase

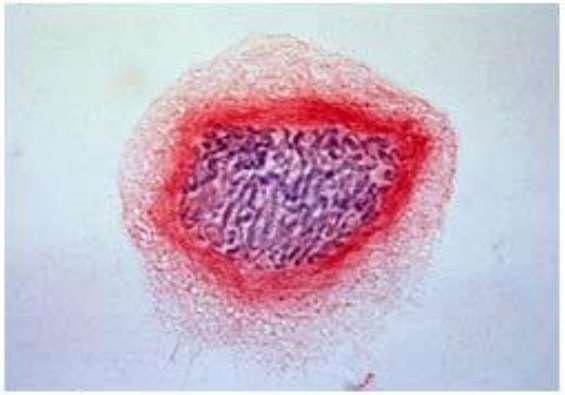


Late Telophase

Mitosis in plant cell



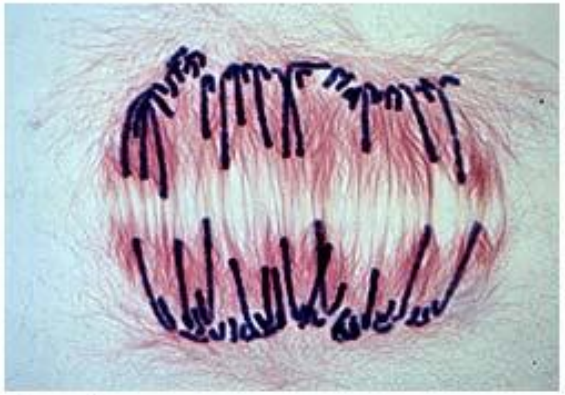
Interphase



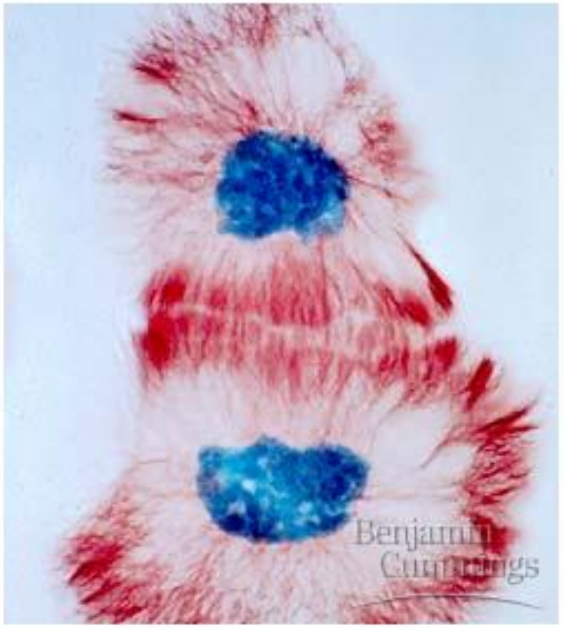
Prophase

Prometaphase

Metaphase



Anaphase

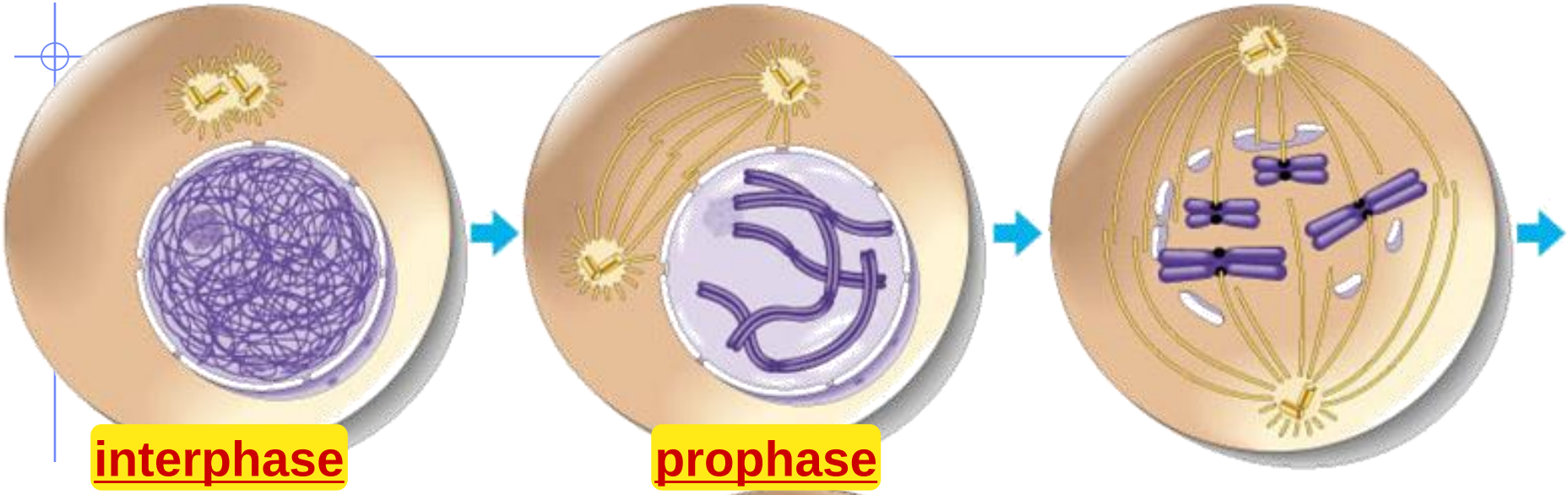


Telophase

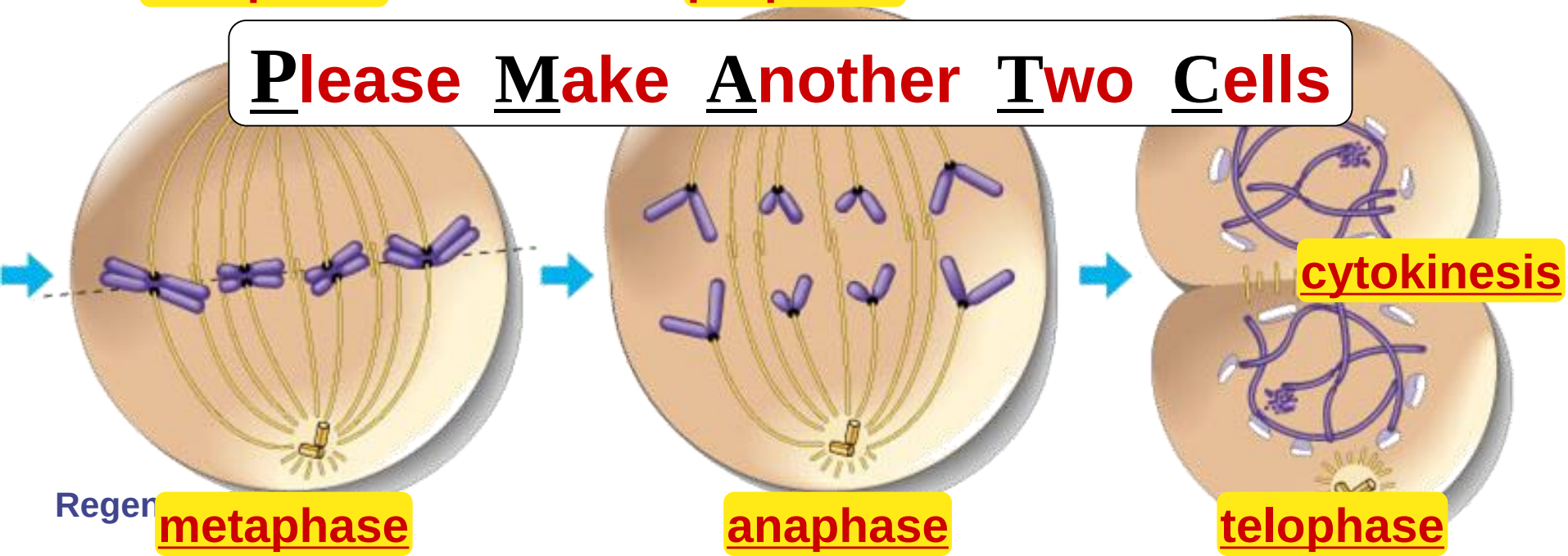

onion root tip
Benjamin
Cummings

I.P.M.A.T.C.

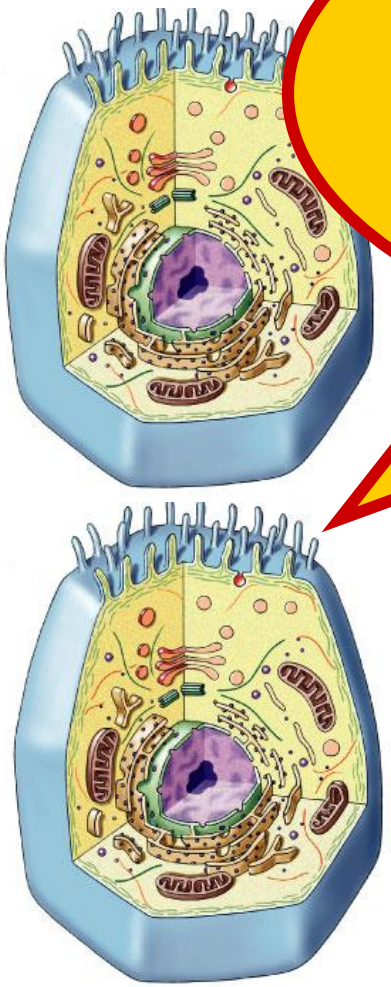
Overview of mitosis



Please **M**ake **A**nother **T**wo **C**ells



Regen



Any Questions??

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