



NUCLEUS

KNOWN MOST EUKARYOTES

LOCATION CHROMOSOMES

NUCLEUS



NUCLEUS

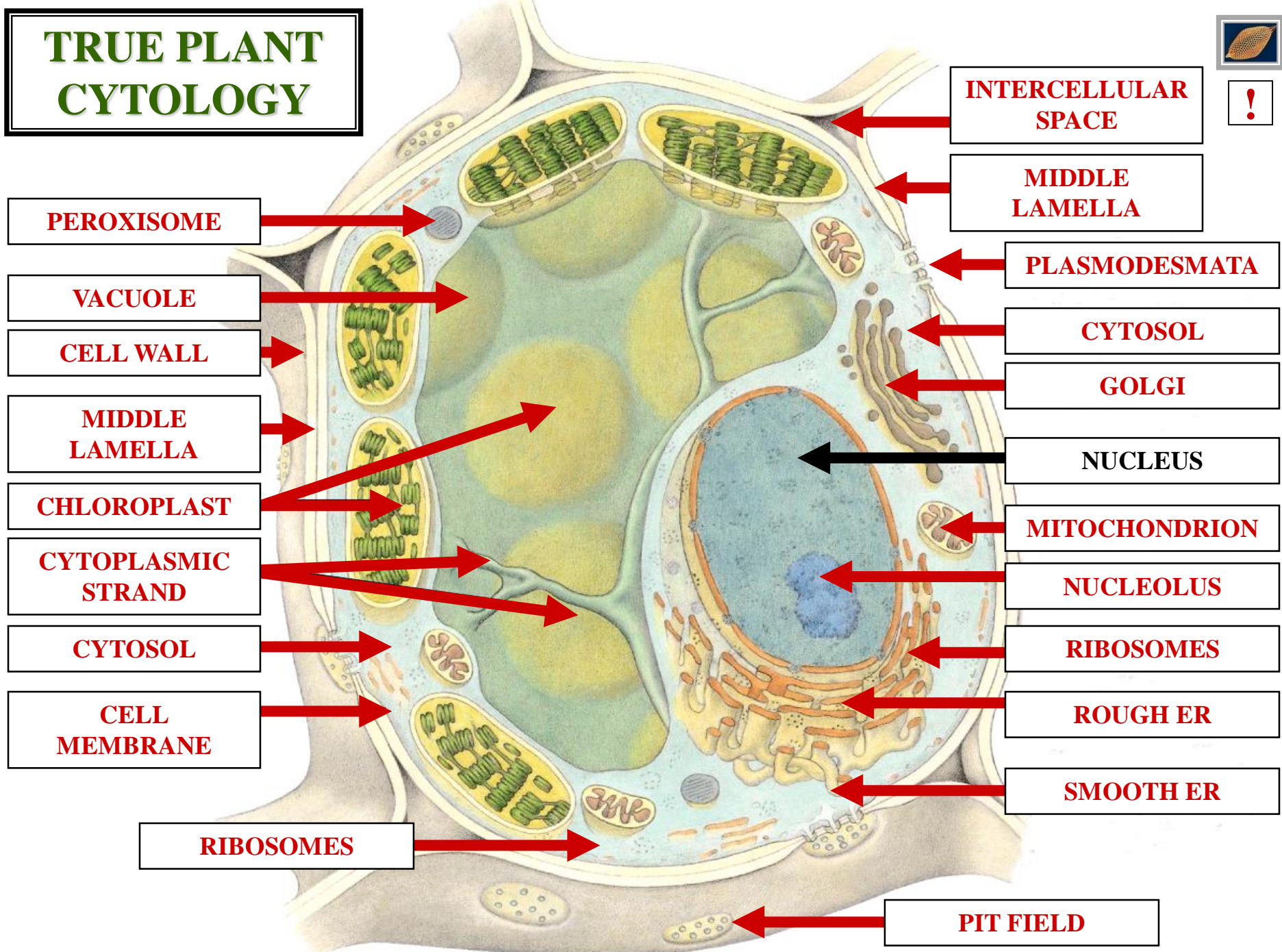
KNOWN MOST EUKARYOTES

LOCATION CHROMOSOMES

REGULATES
CELL METABOLISM

NUCLEUS

TRUE PLANT CYTOLOGY



PEROXISOME

VACUOLE

CELL WALL

MIDDLE
LAMELLA

CHLOROPLAST

CYTOPLASMIC
STRAND

CYTOSOL

CELL
MEMBRANE

RIBOSOMES

INTERCELLULAR
SPACE

MIDDLE
LAMELLA

PLASMODESMATA

CYTOSOL

GOLGI

NUCLEUS

MITOCHONDRION

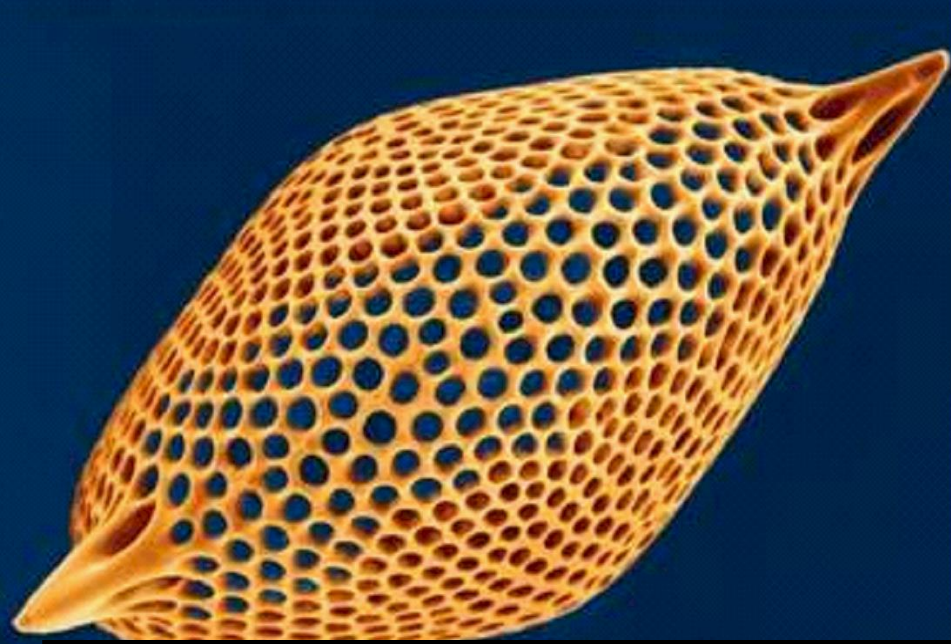
NUCLEOLUS

RIBOSOMES

ROUGH ER

SMOOTH ER

PIT FIELD

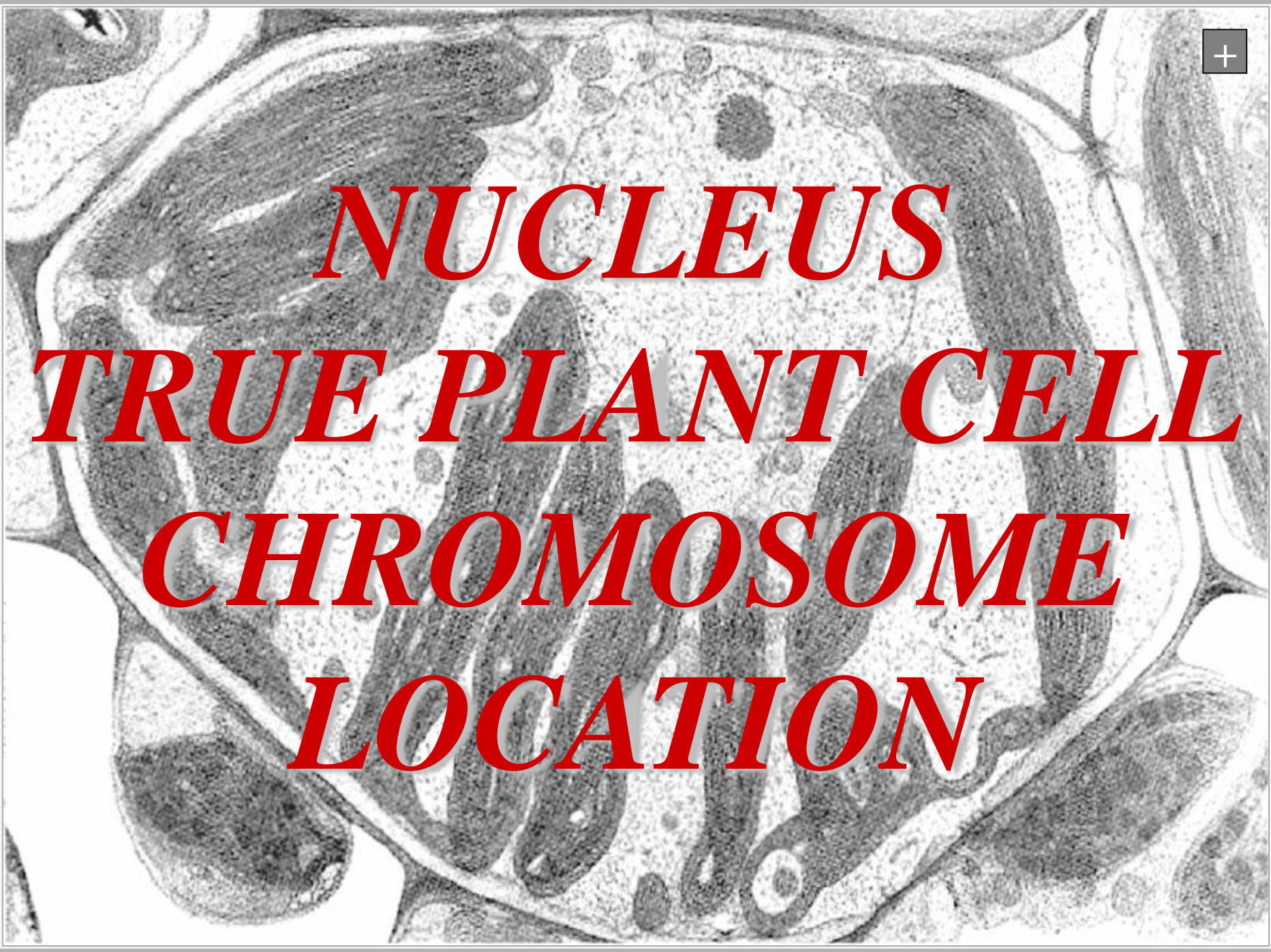


KNOWN MOST EUKARYOTES



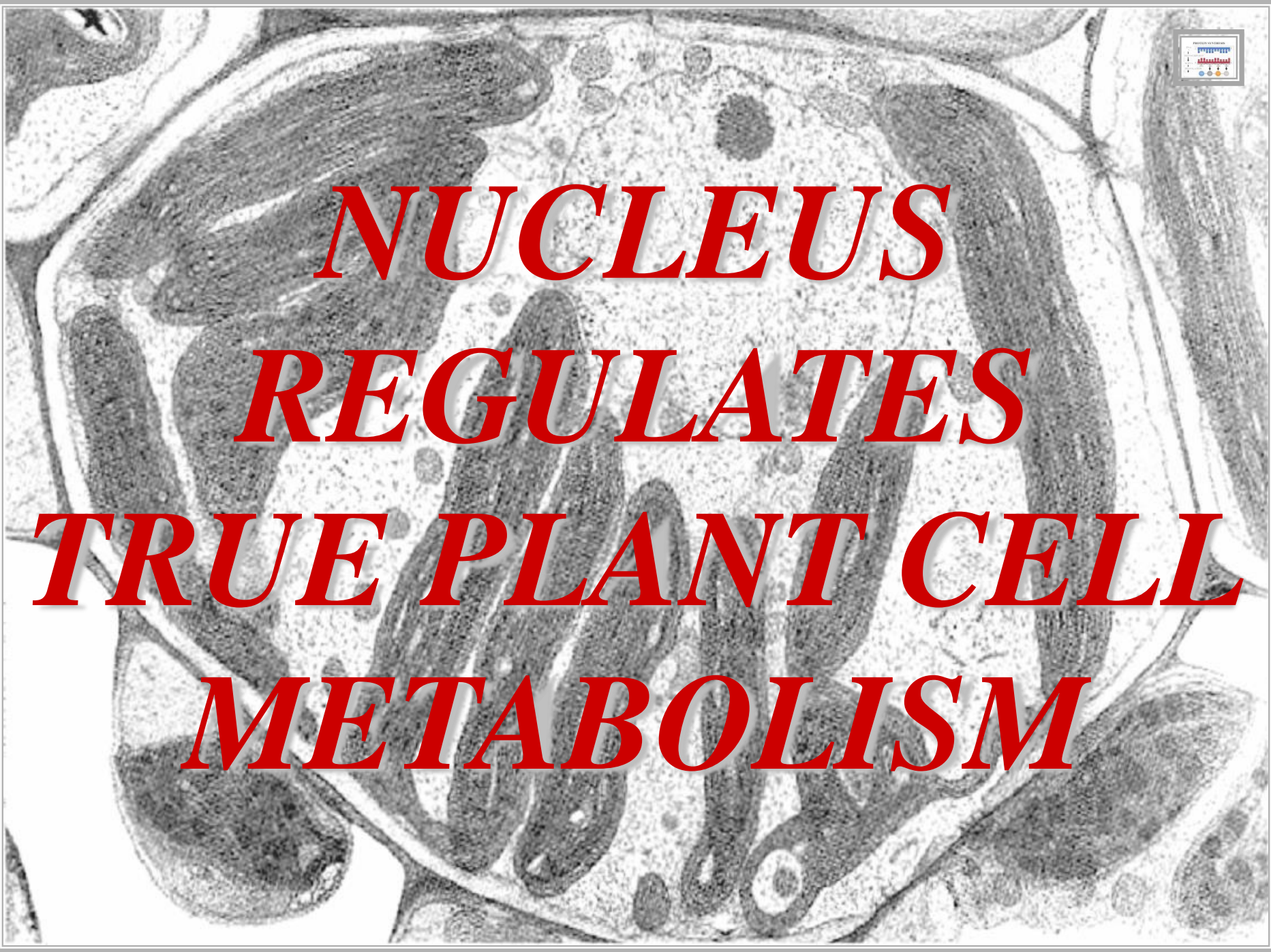


NUCLEUS
TRUE PLANT CELL
CHROMOSOME
LOCATION

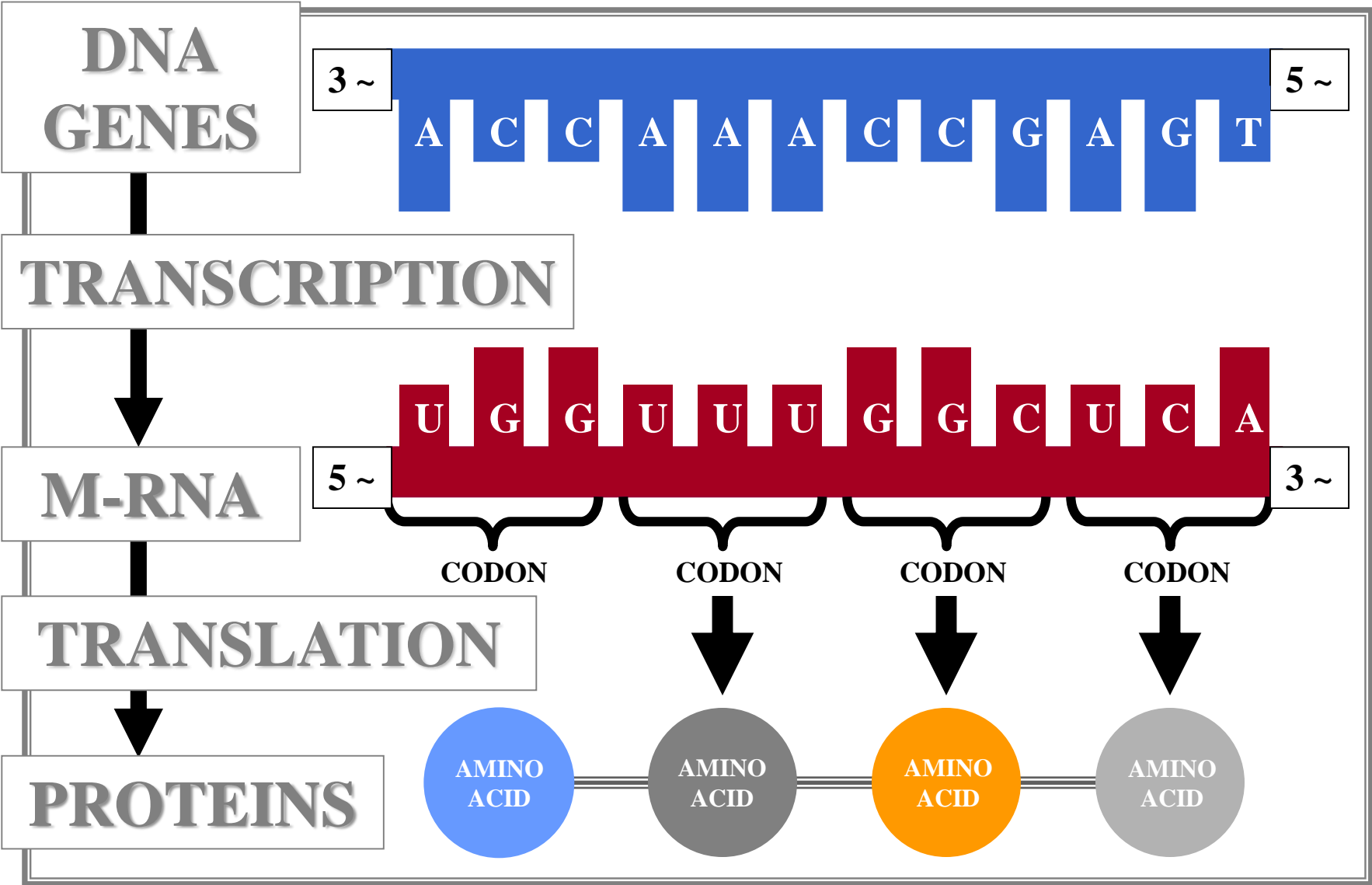




***NUCLEUS
REGULATES
TRUE PLANT CELL
METABOLISM***



PROTEIN SYNTHESIS



METABOLISM

GLUCOSE

METABOLISM

HEXOKINASE

ATP

EGY

ADP

+

GLUCOSE-6-PHOSPHATE

PHOSPHOGLUCOISOMERASE

ENZYMES

ENZYMES

RED = ENZYME

RED = ENZYME

FRUCTOSE-6-PHOSPHATE

PHOSPHOFRUCTOKINASE

ATP

EGY

ADP

FRUCTOSE-1-6-PHOSPHATE



FRUCTOSE-1-6-PHOSPHATE

ENZYMES

ALDOLASE
ISOMERASE

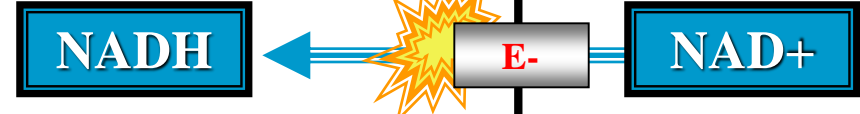
ENZYMES

PHOSPHOGLYCERALDEHYDE - PGAL

PHOSPHOGLYCERALDEHYDE - PGAL

TRI-PHOSPHATE DEHYDROGENASE

TRI-PHOSPHATE DEHYDROGENASE



1-3-BISPHOSPHOGLYCERATE

1-3-BISPHOSPHOGLYCERATE

PHOSPHOGLYCEROKINASE

PHOSPHOGLYCEROKINASE



3-PHOSPHOGLYCERATE - PGA

3-PHOSPHOGLYCERATE - PGA

3-PHOSPHOGLYCERATE - PGA

ENOLASE

3-PHOSPHOENOLPYRUVATE

PYRUVATE KINASE



PYRUVATE

ENZYMES

3-PHOSPHOGLYCERATE - PGA

ENOLASE

3-PHOSPHOENOLPYRUVATE

PYRUVATE KINASE



PYRUVATE

ENZYMES

NUCLEUS REGULATES ENZYME SYNTHESIS

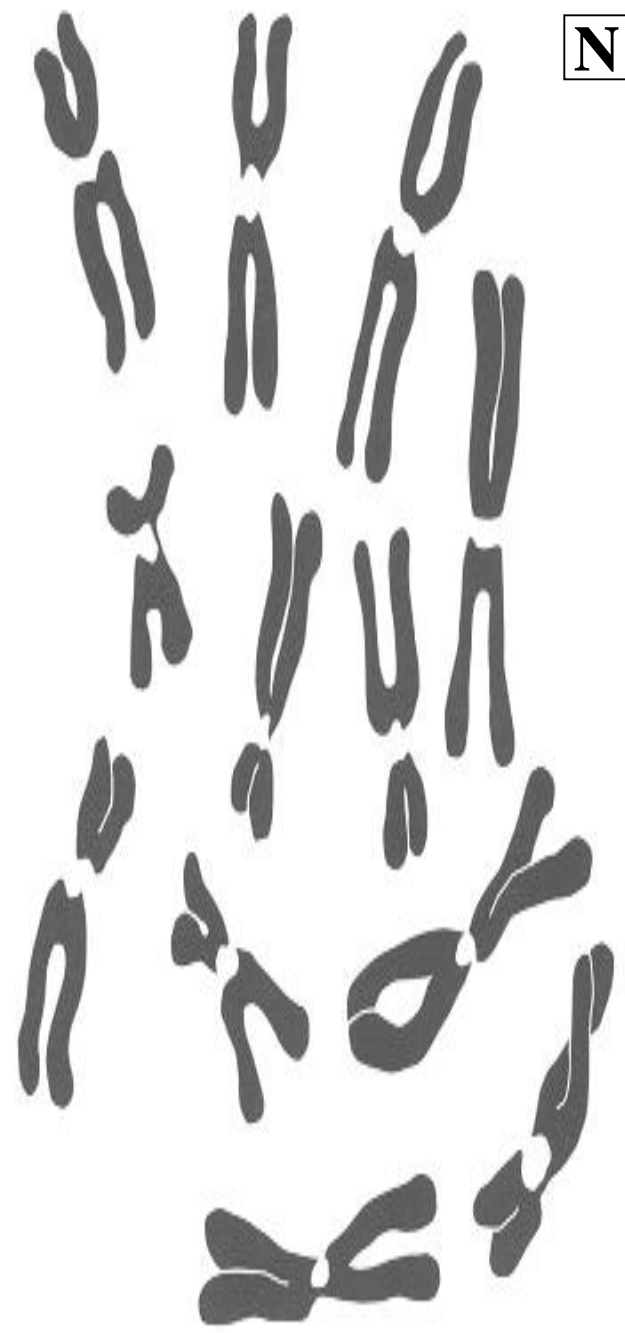
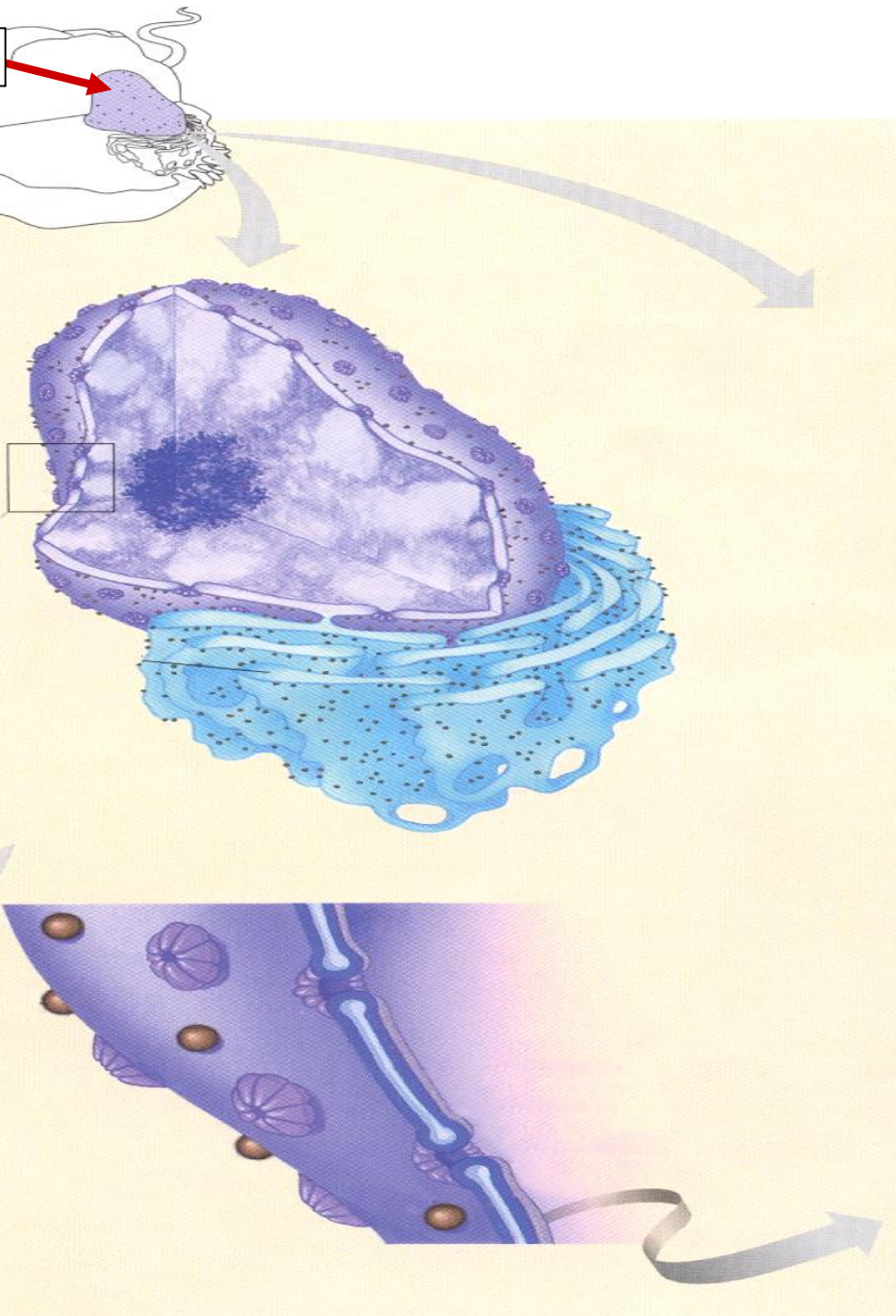
NUCLEUS REGULATES CELL METABOLISM



NUCLEUS

ULTRASTRUCTURE

NUCLEUS



NUCLEAR ENVELOPE

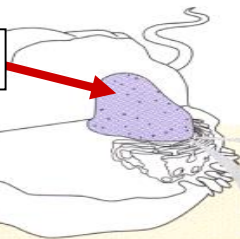


NUCLEAR ENVELOPE

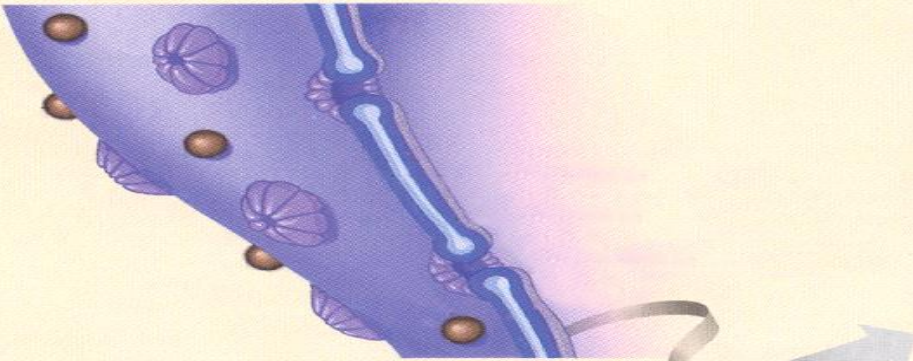
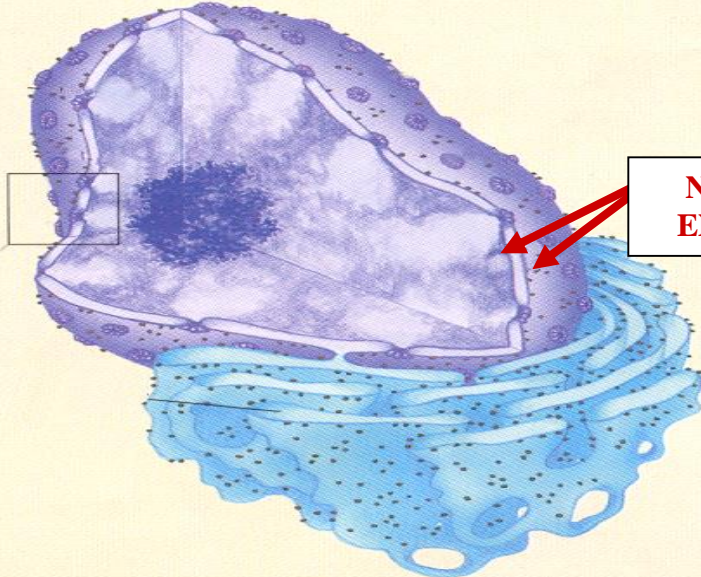
NUCLEUS
DOUBLE MEMBRANE

NUCLEAR ENVELOPE

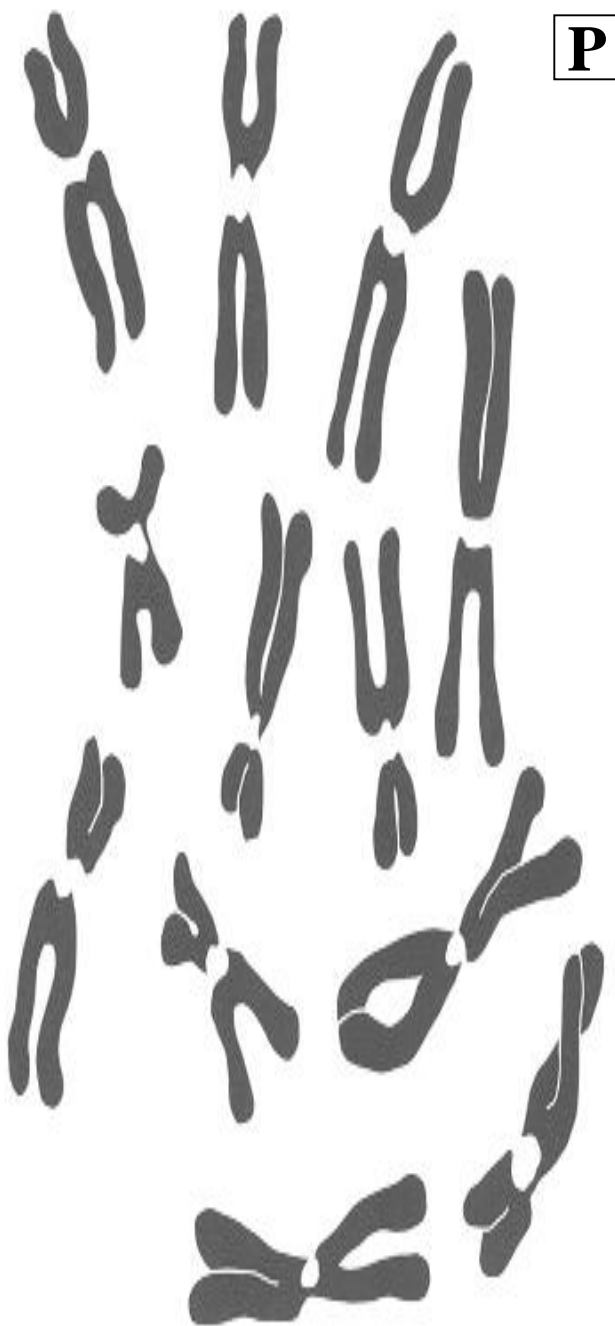
NUCLEUS



NUCLEAR ENVELOPE



P



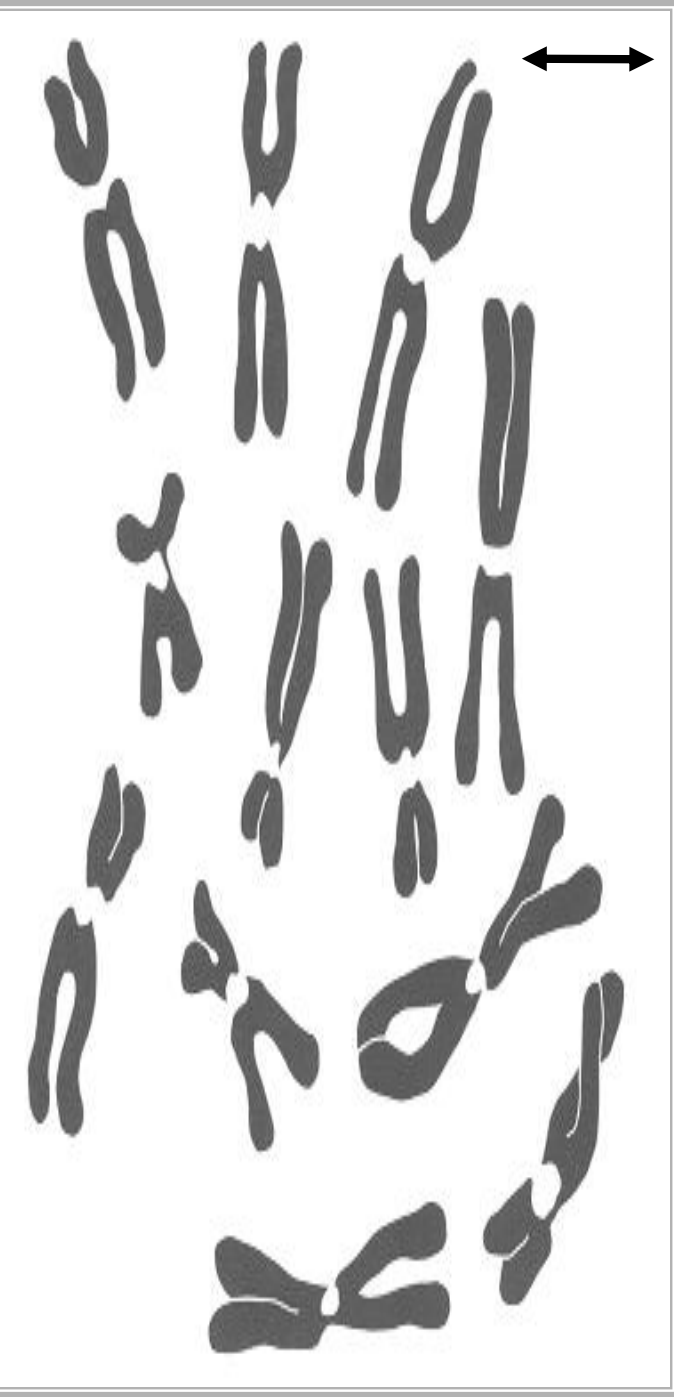
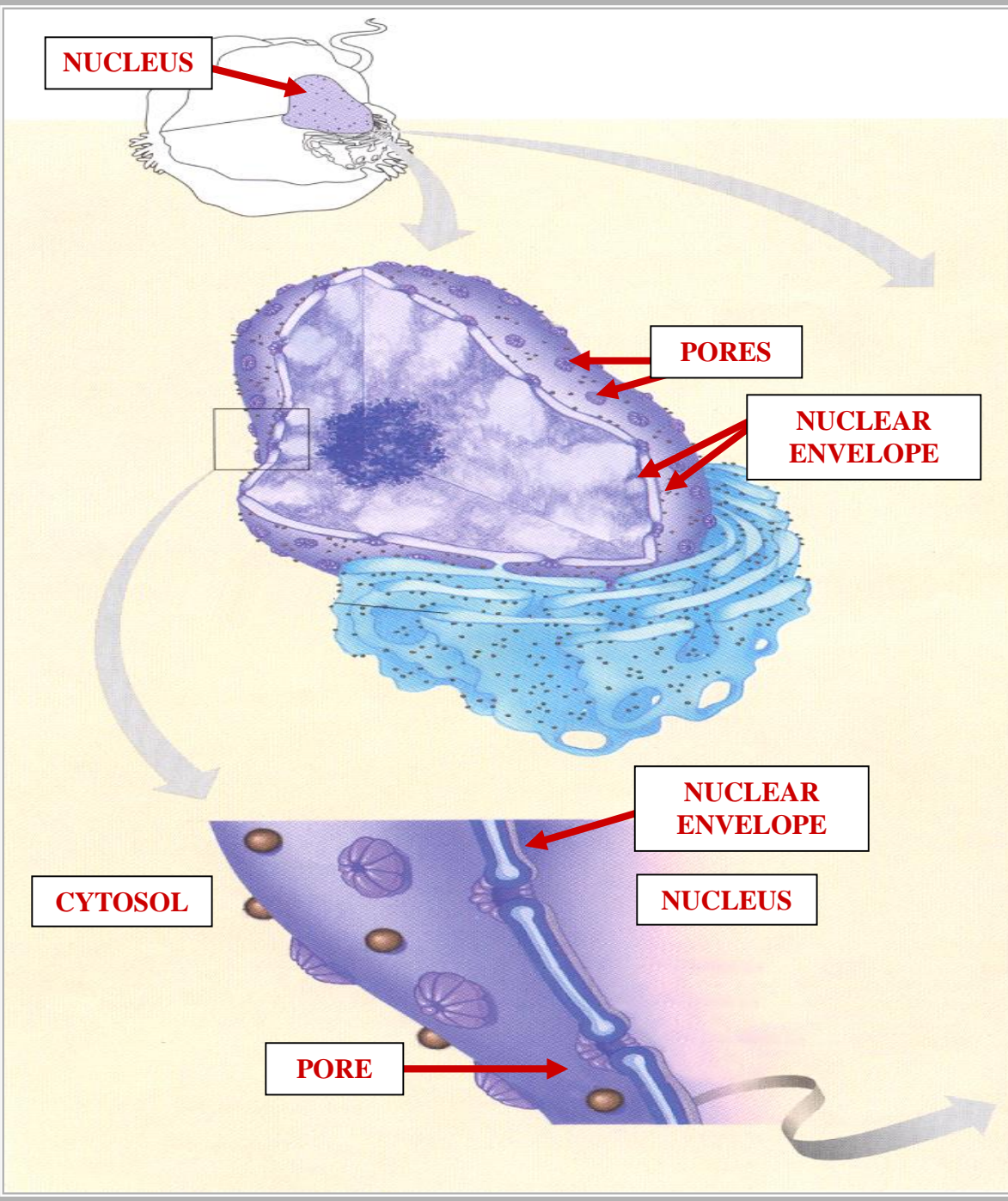
**NUCLEAR
ENVELOPE
PORES**

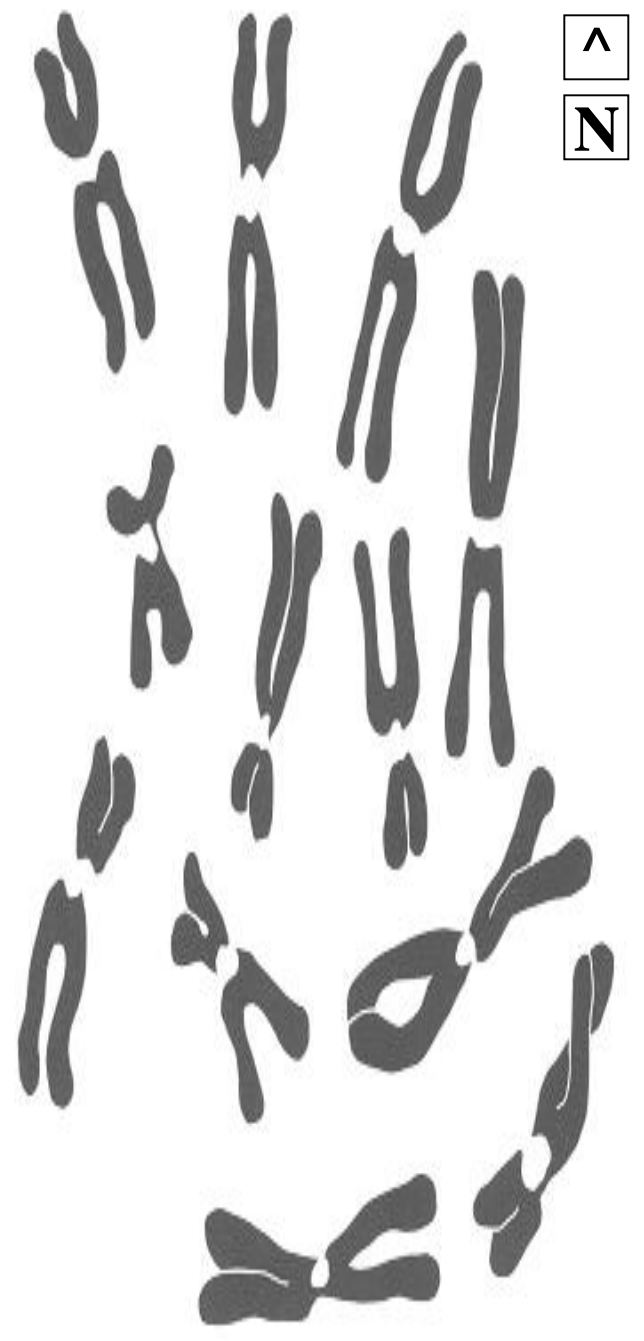
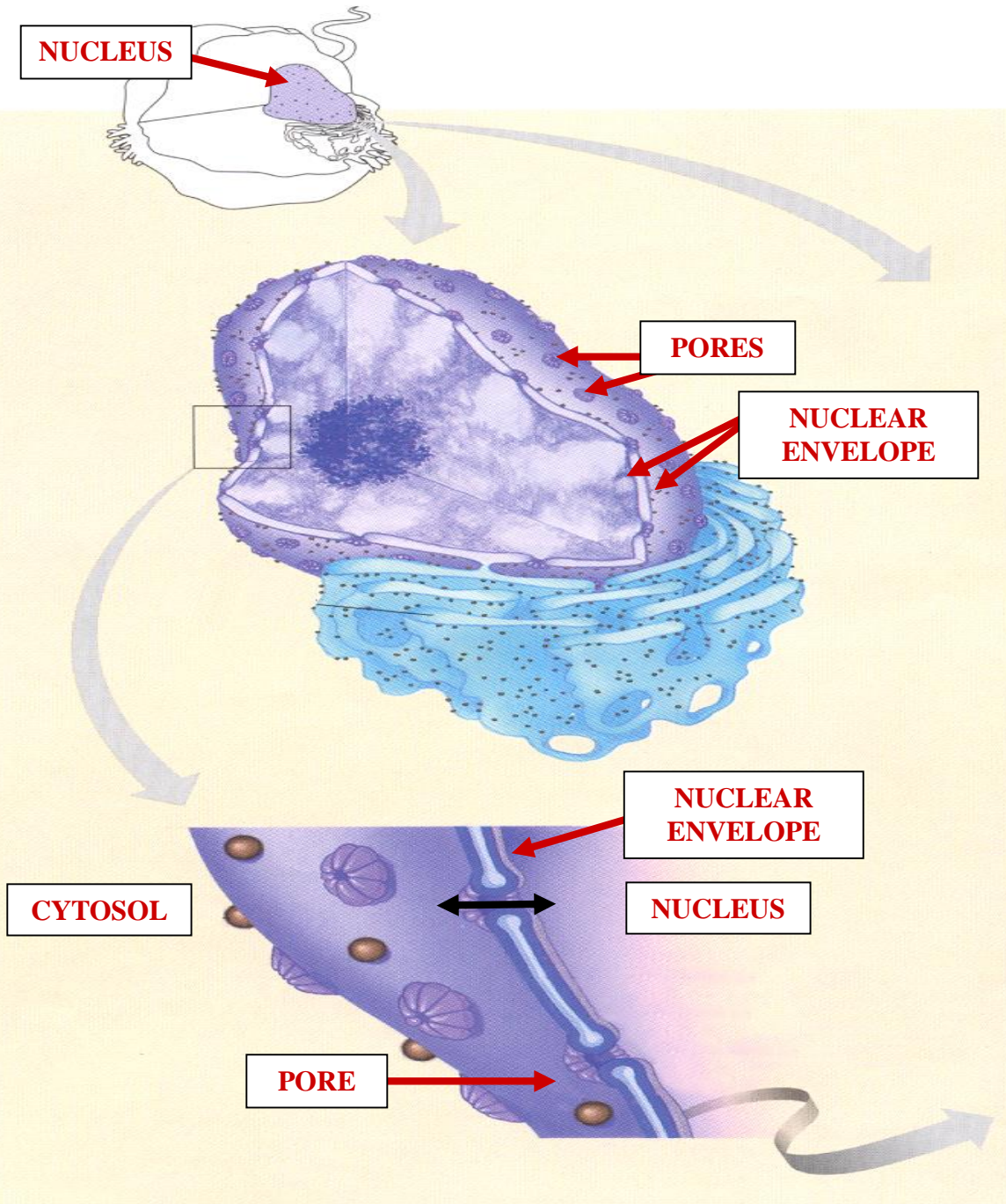


NUCLEAR ENVELOPE PORES

**COMMUNICATION
CONDUITS BETWEEN
NUCLEUS & CYTOSOL**

NUCLEAR ENVELOPE PORES





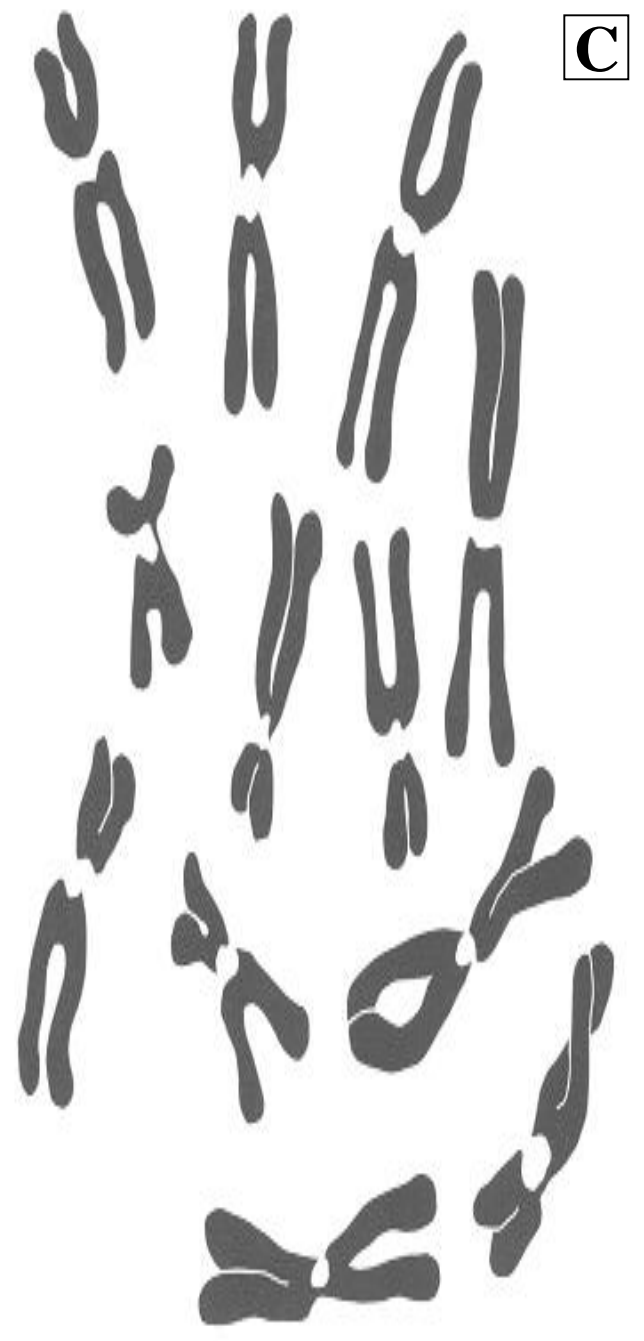
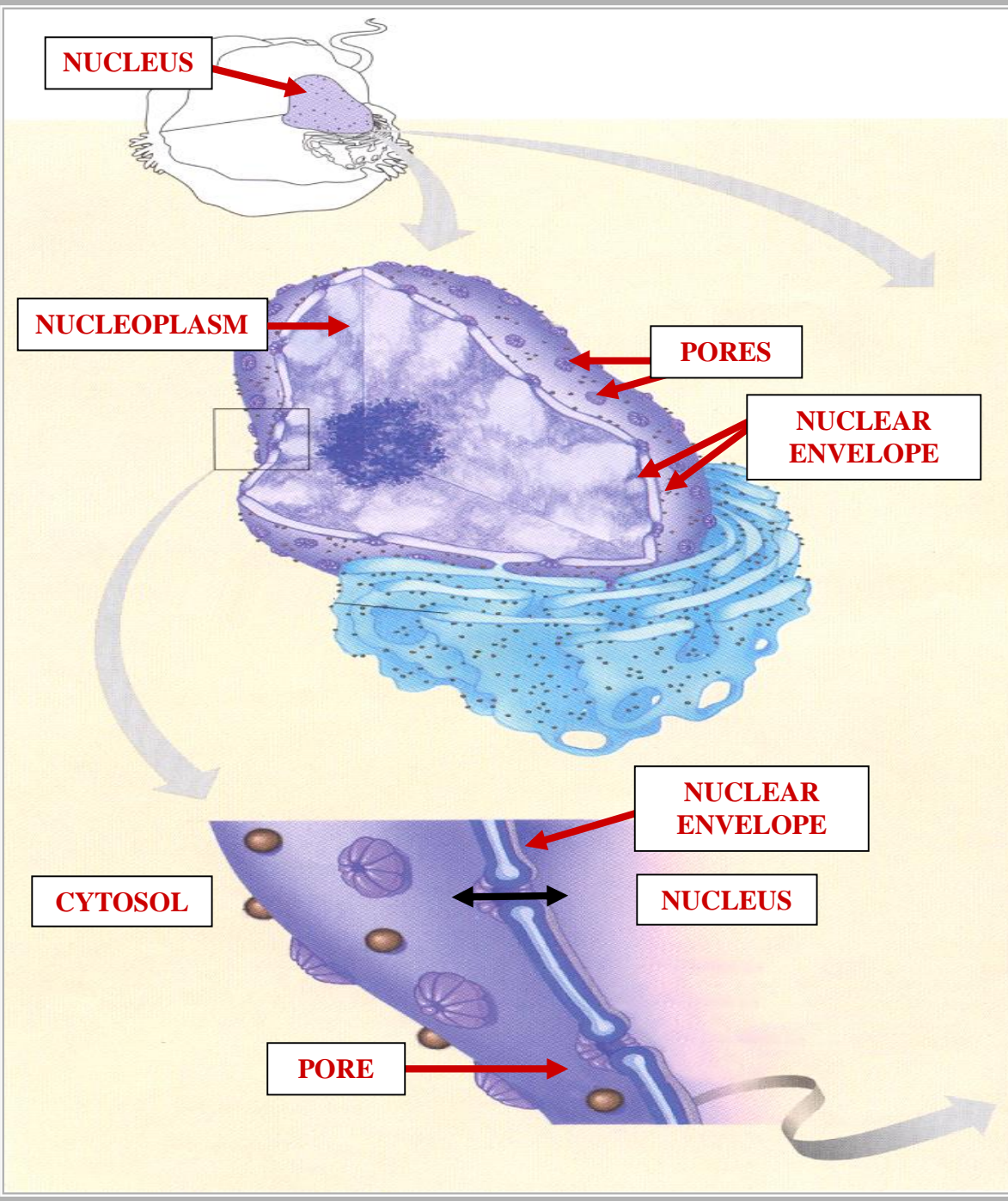
NUCLEOPLASM



NUCLEUS
NUCLEOPLASM

NUCLEUS
FLUID MATRIX

NUCLEUS
NUCLEOPLASM



TRUE PLANT CHROMOSOMES



NUCLEUS
CHROMOSOMES

LINEAR DNA

NUCLEUS
CHROMOSOMES

NUCLEUS
CHROMOSOMES

LINEAR DNA

HISTONE PROTEINS
PRESENT

NUCLEUS
CHROMOSOMES



NUCLEUS

CHROMOSOMES

L

NUCLEOPLASM

PORES

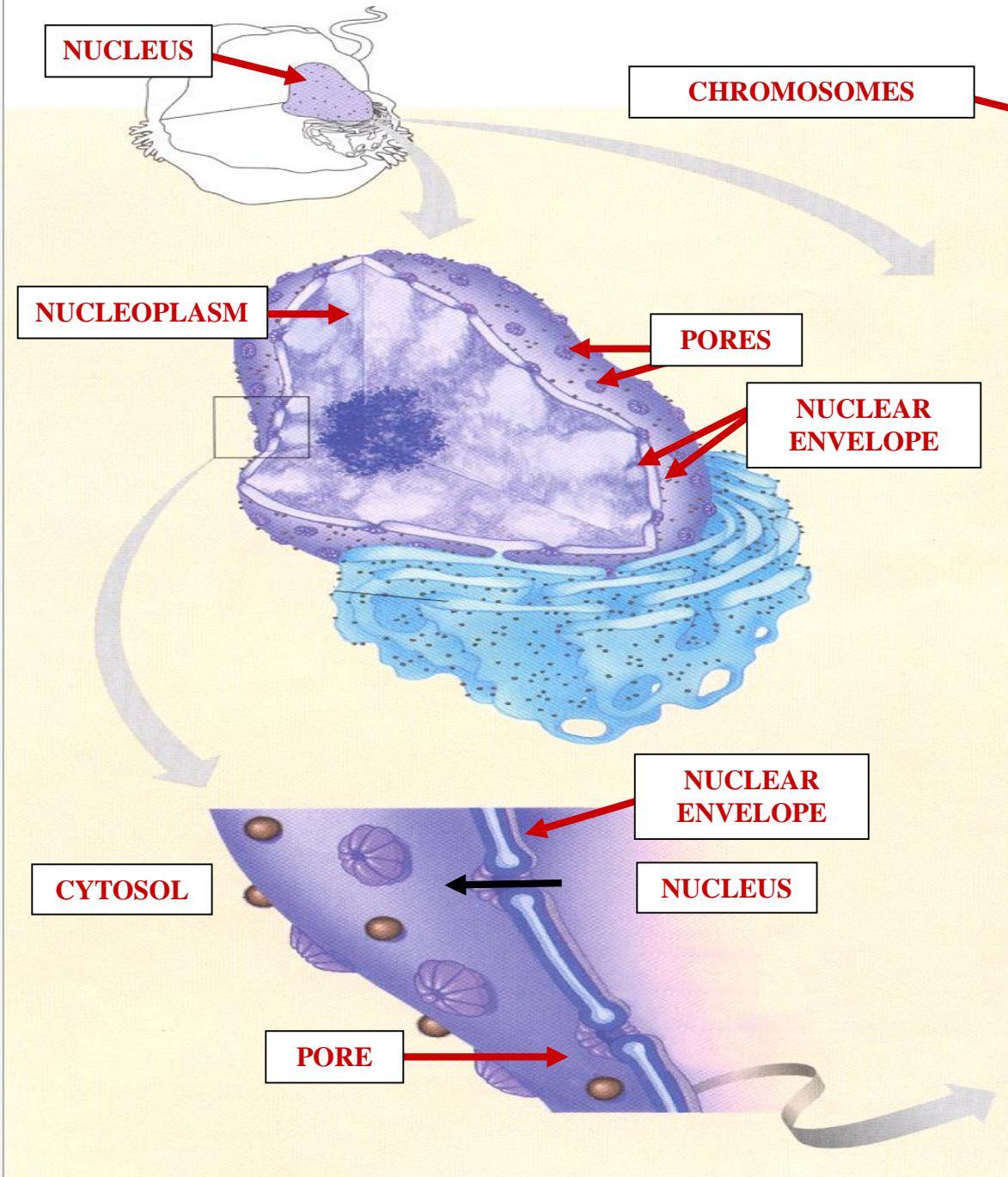
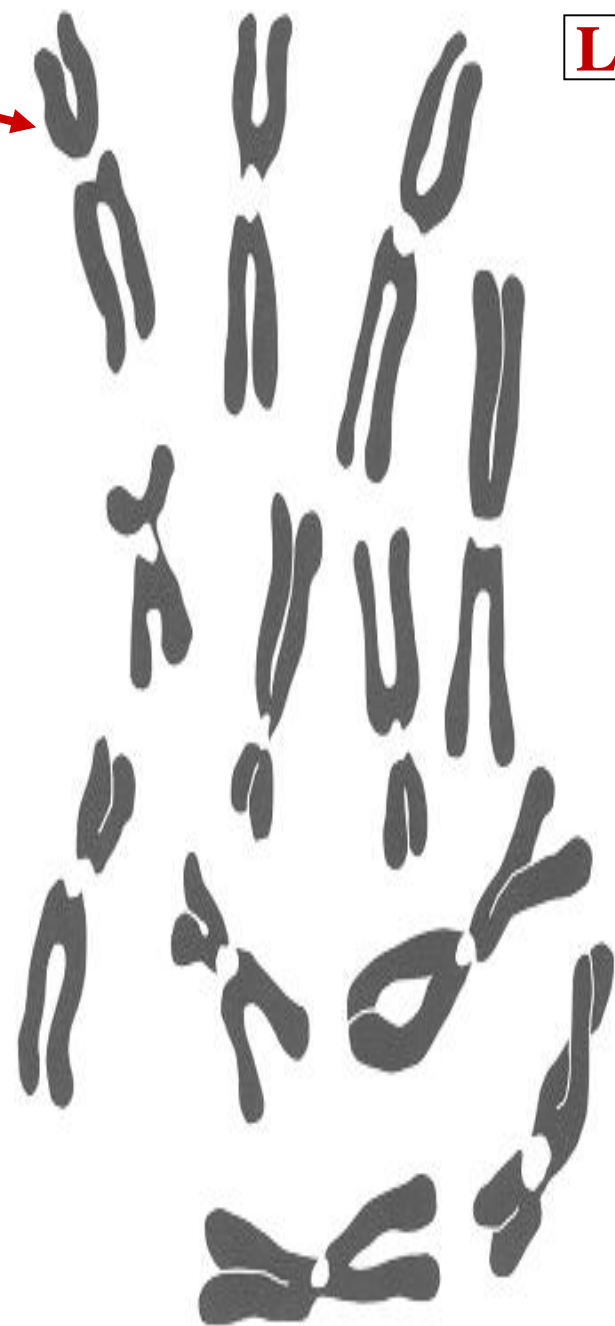
NUCLEAR ENVELOPE

CYTOSOL

NUCLEAR ENVELOPE

NUCLEUS

PORE



NUCLEUS

**CHROMOSOMES
LINEAR DNA**



NUCLEOPLASM

PORES

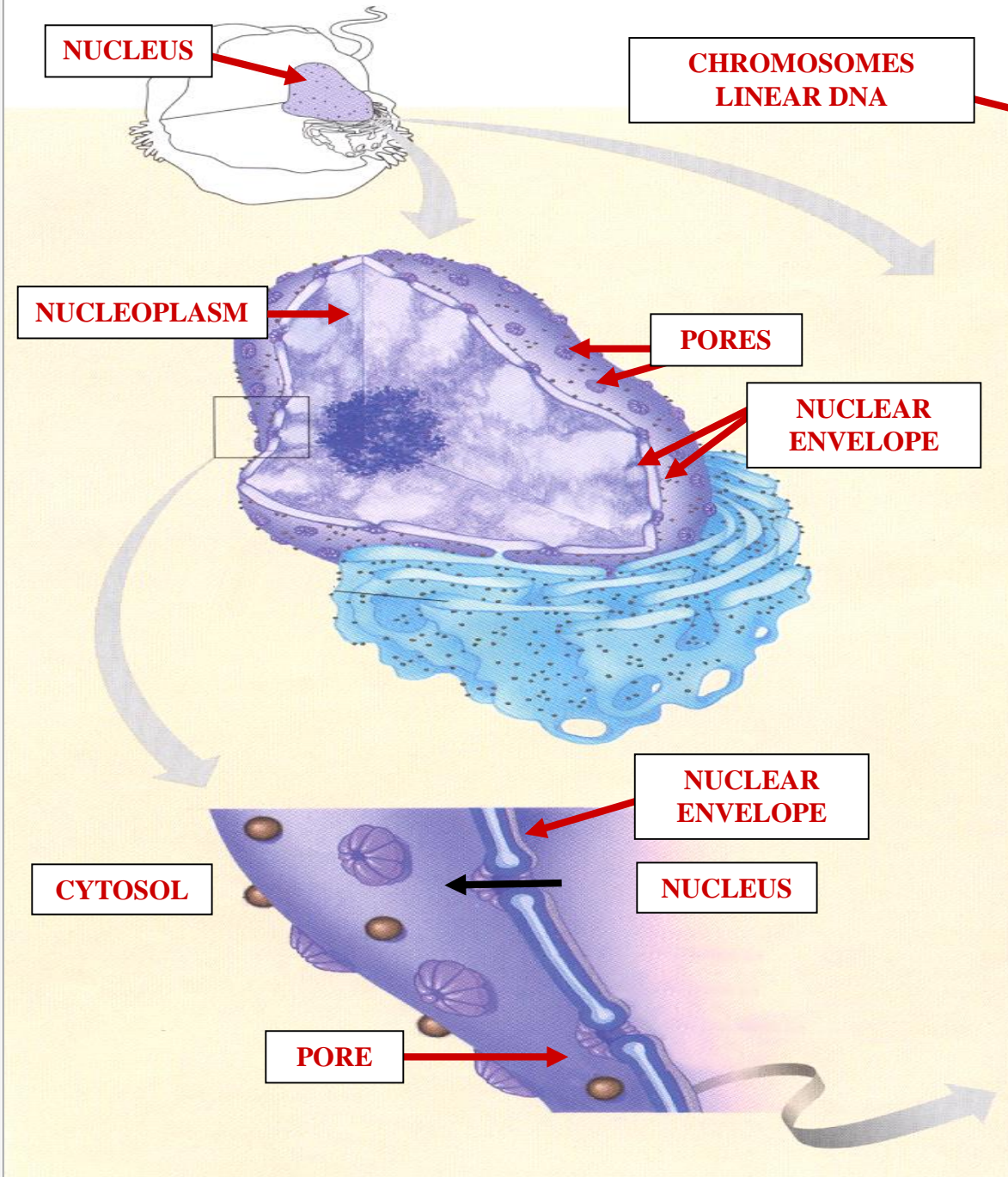
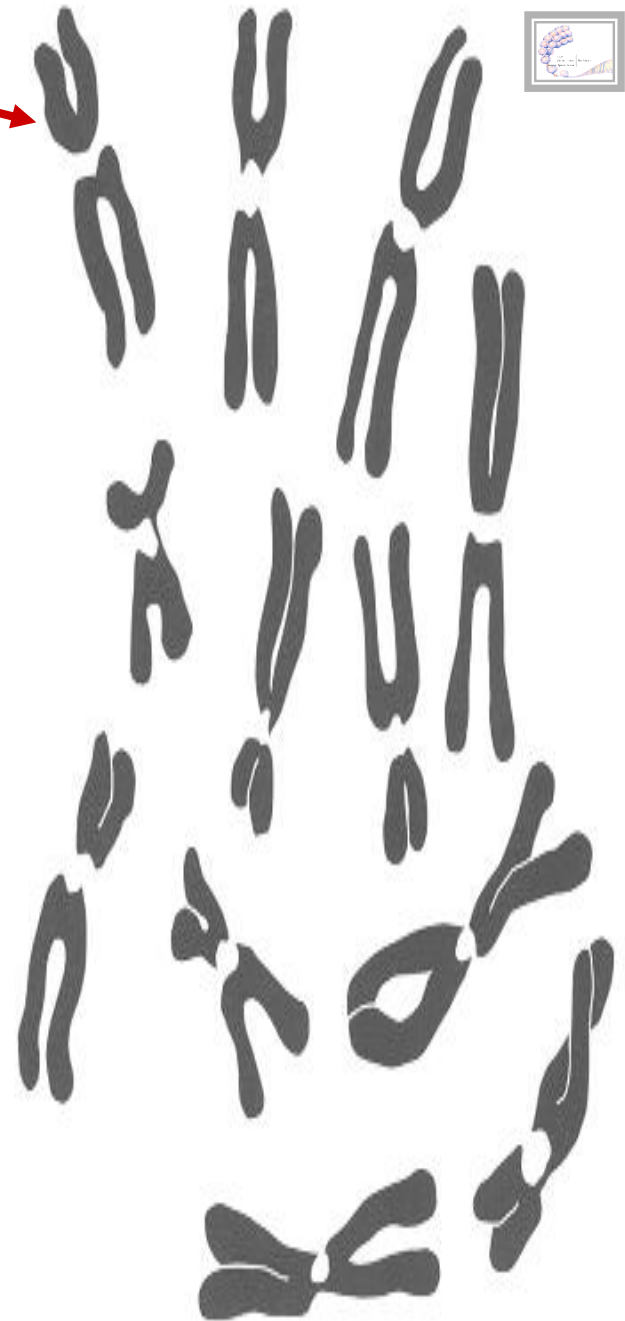
**NUCLEAR
ENVELOPE**

CYTOSOL

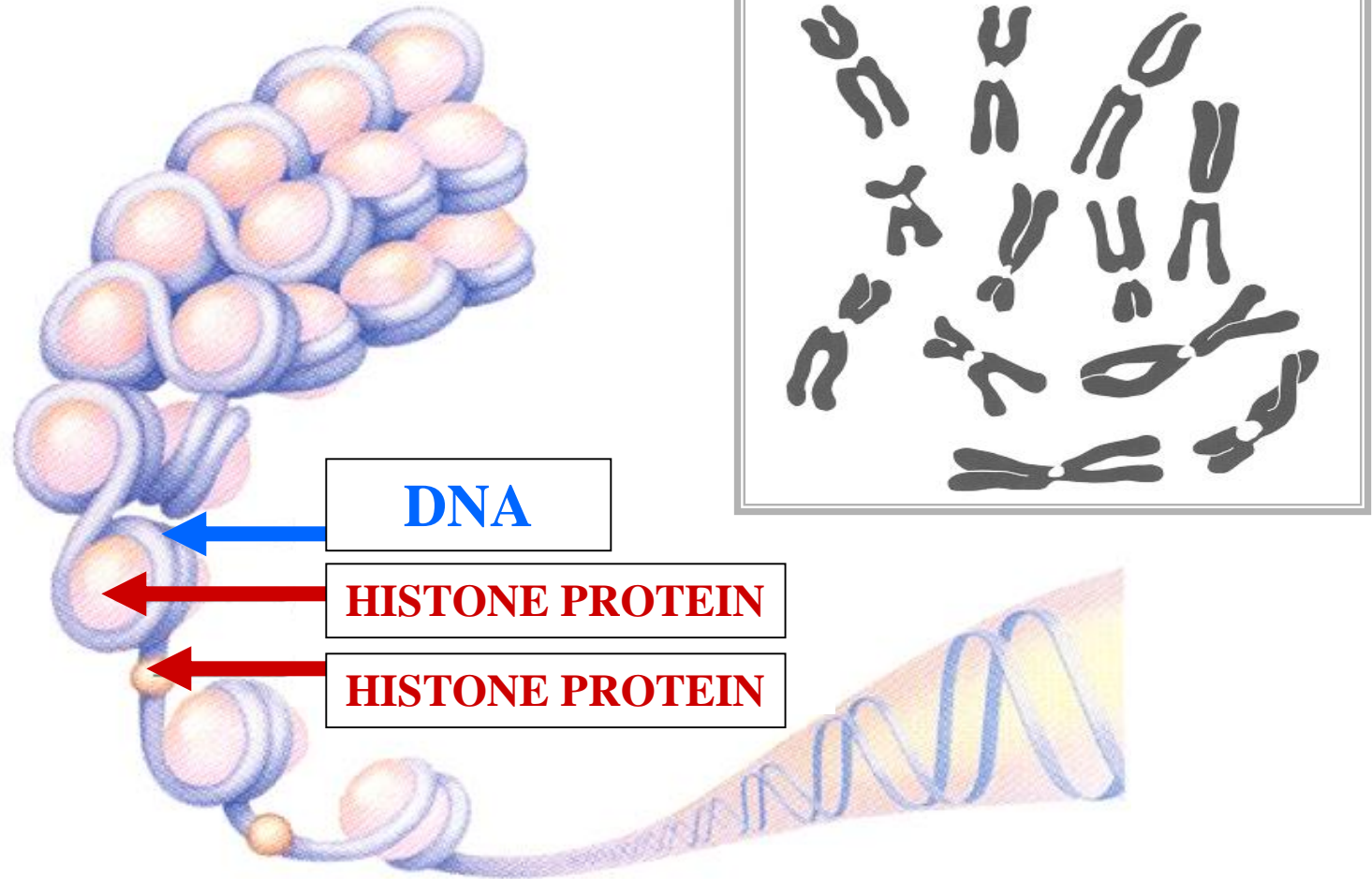
**NUCLEAR
ENVELOPE**

NUCLEUS

PORE



EUKARYOTE CHROMOSOME



EUKARYOTE CHROMOSOME: HISTONE PROTEINS **PRESENT**

NUCLEOLUS



NUCLEOLUS

SITE: RIBOSOME SYNTHESIS

NUCLEOLUS

NUCLEUS

CHROMOSOME



NUCLEOPLASM

PORES

NUCLEOLUS

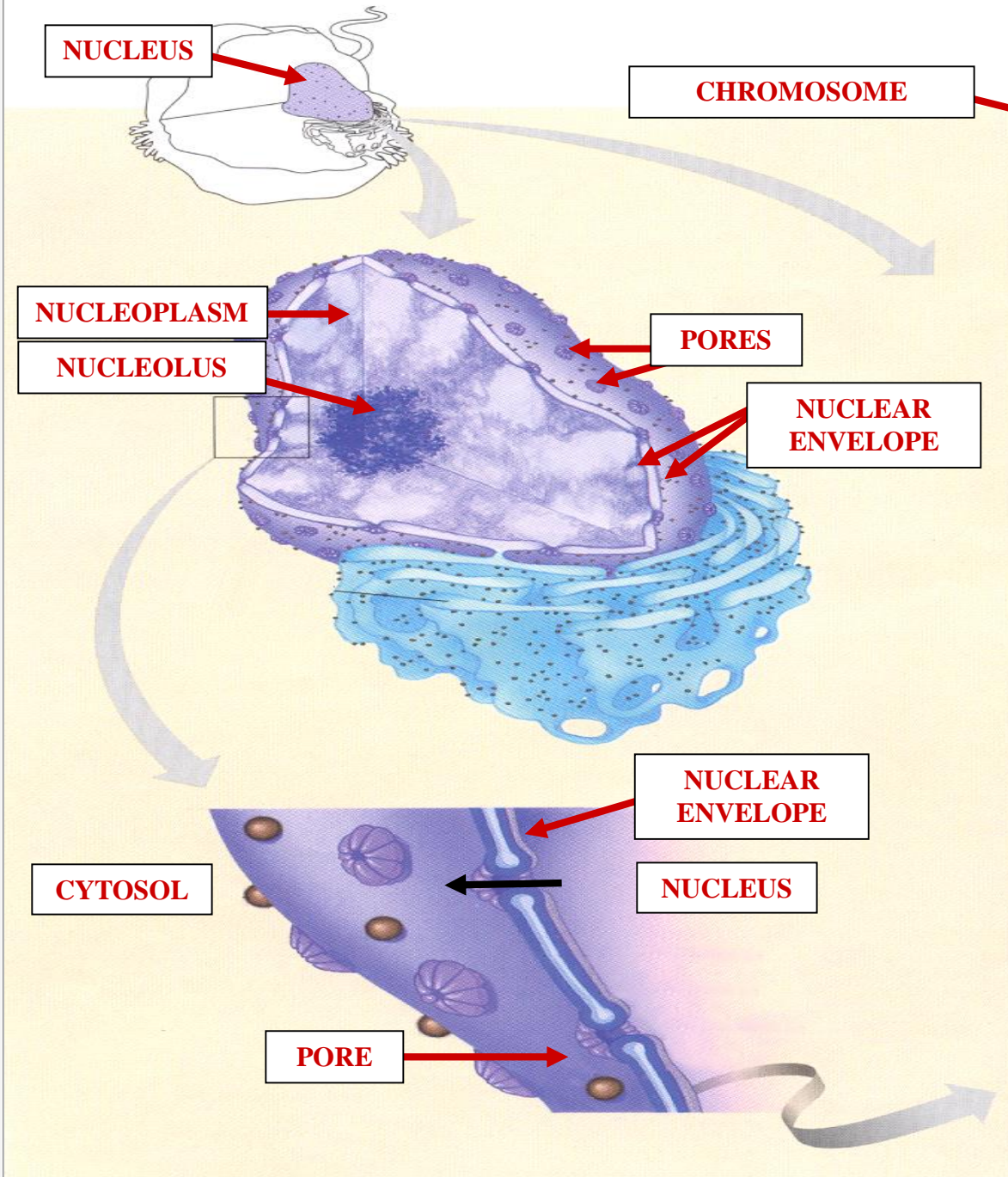
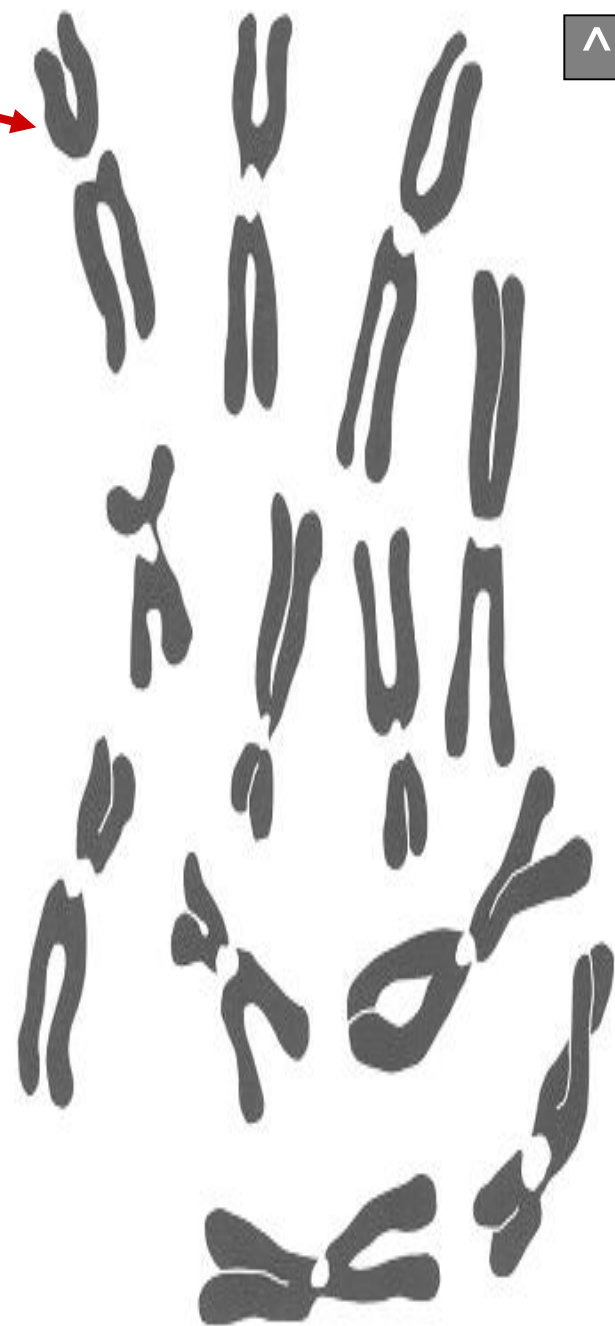
NUCLEAR ENVELOPE

CYTOSOL

NUCLEAR ENVELOPE

NUCLEUS

PORE





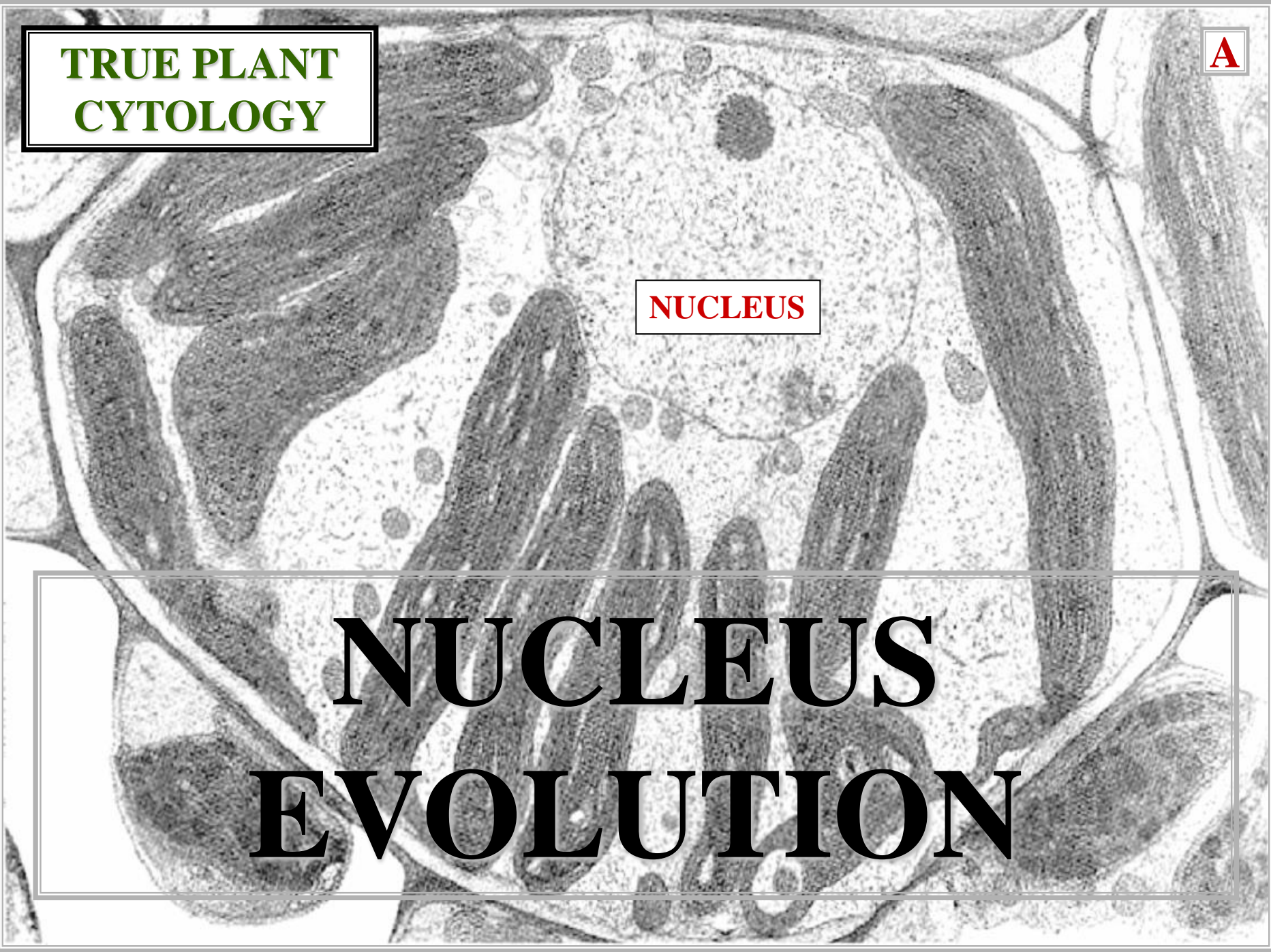
NUCLEUS EVOLUTION

**TRUE PLANT
CYTOLOGY**

A

NUCLEUS

**NUCLEUS
EVOLUTION**



An electron micrograph of a plant cell. The cell is roughly hexagonal in shape. In the center, there is a large, roughly circular nucleus with a darker nucleolus inside. Surrounding the nucleus are several large, dark, oval-shaped chloroplasts with visible internal membranes (grana). The cytoplasm is filled with various organelles and small vesicles. The cell wall is visible as a thin, dark line. In the top right corner, there is a small black square with a white upward-pointing arrow.

**TRUE PLANT
CYTOLOGY**

NUCLEUS

**AUTOGENOUS
THEORY**

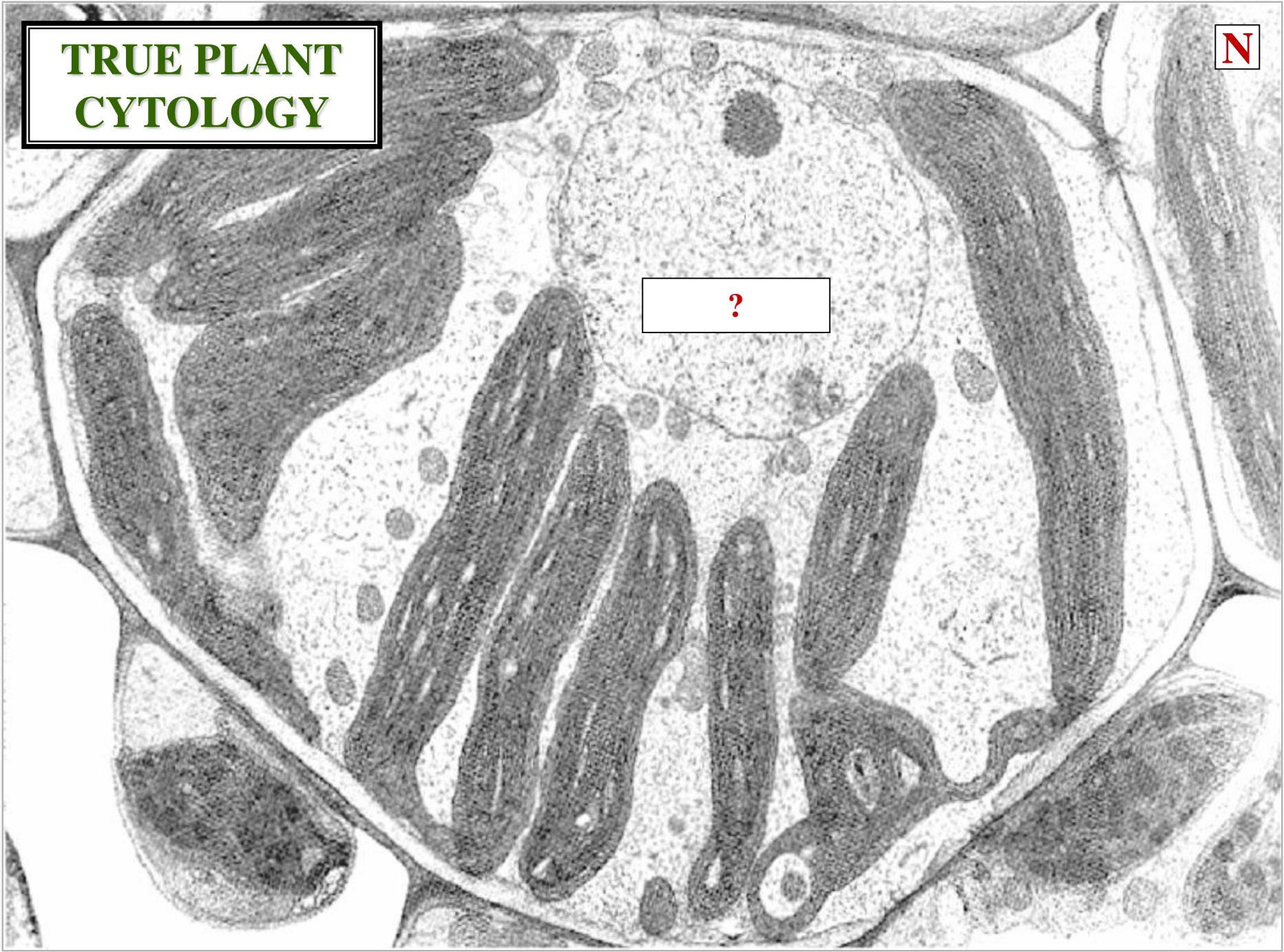


**DOUBLE
MEMBRANE
BOUND
ORGANELLES
SUMMARY**

TRUE PLANT CYTOLOGY

N

?

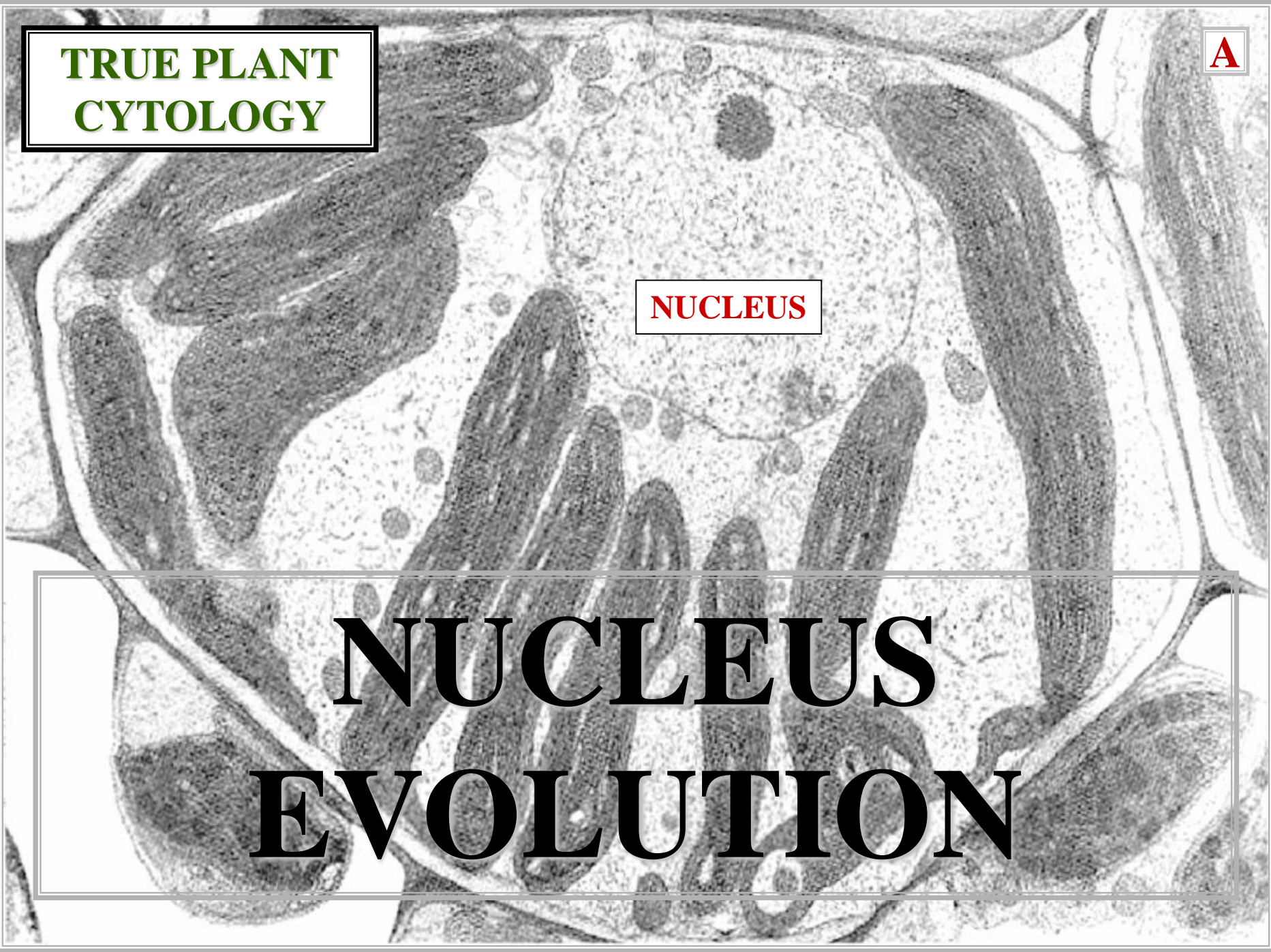


**TRUE PLANT
CYTOLOGY**

A

NUCLEUS

**NUCLEUS
EVOLUTION**



An electron micrograph of a plant cell. The image shows a large, roughly circular nucleus in the center, surrounded by a network of cytoplasm. Several large, dark, elongated structures, likely chloroplasts, are visible, some with internal membranes. The cell wall is visible as a thin, dark line. In the top right corner, there is a small black square containing a white question mark. The text 'TRUE PLANT CYTOLOGY' is in the top left, 'NUCLEUS' is in the center, and 'AUTOGENOUS THEORY' is in the bottom center.

**TRUE PLANT
CYTOLOGY**

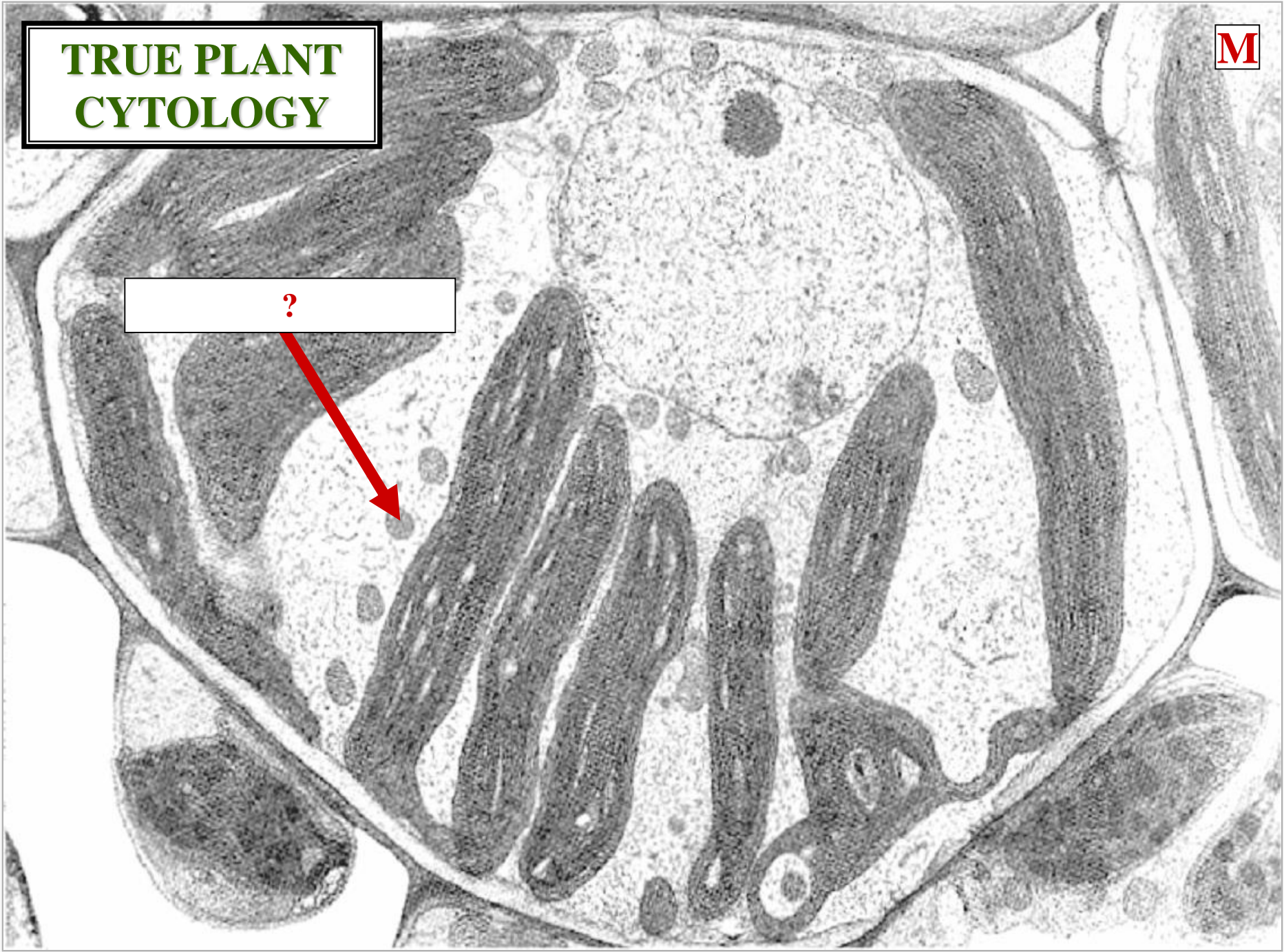
NUCLEUS

**AUTOGENOUS
THEORY**

TRUE PLANT CYTOLOGY

M

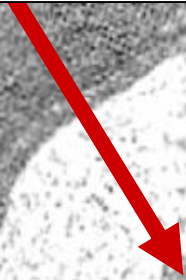
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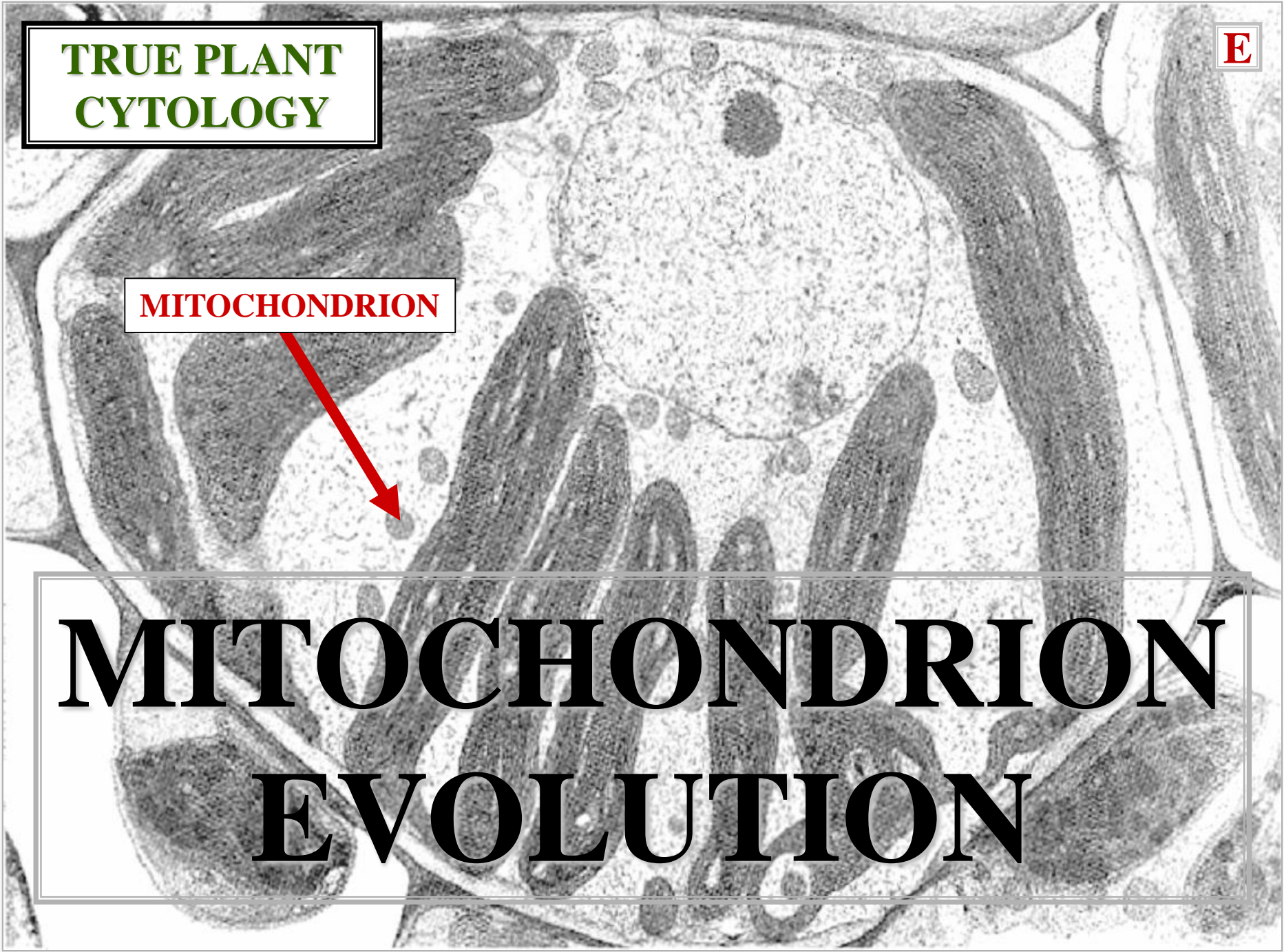
**TRUE PLANT
CYTOLOGY**

E

MITOCHONDRION



**MITOCHONDRION
EVOLUTION**





**TRUE PLANT
CYTOLOGY**

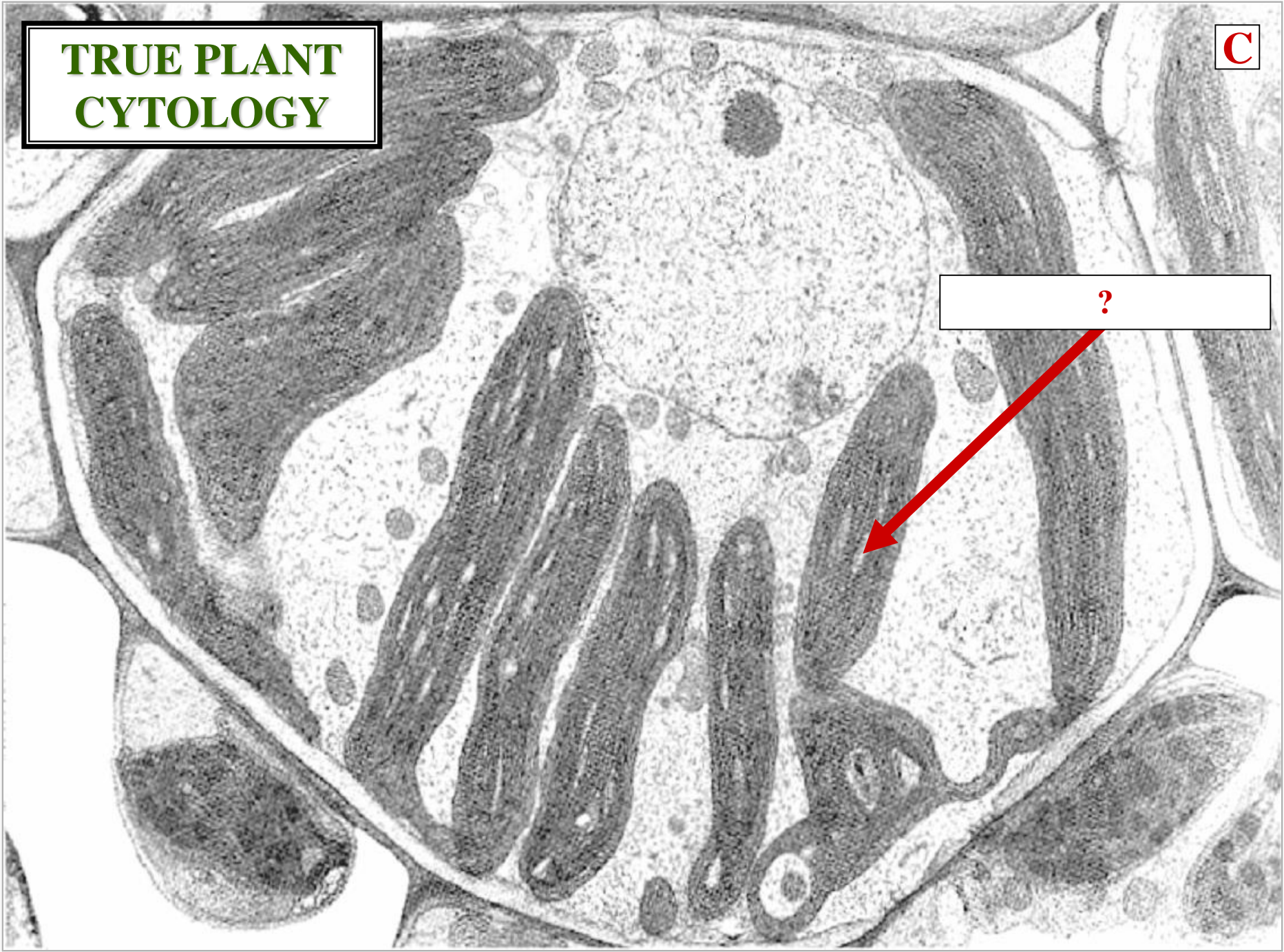
MITOCHONDRION

**ENDOSYMBIOTIC
THEORY**

?

TRUE PLANT CYTOLOGY

C



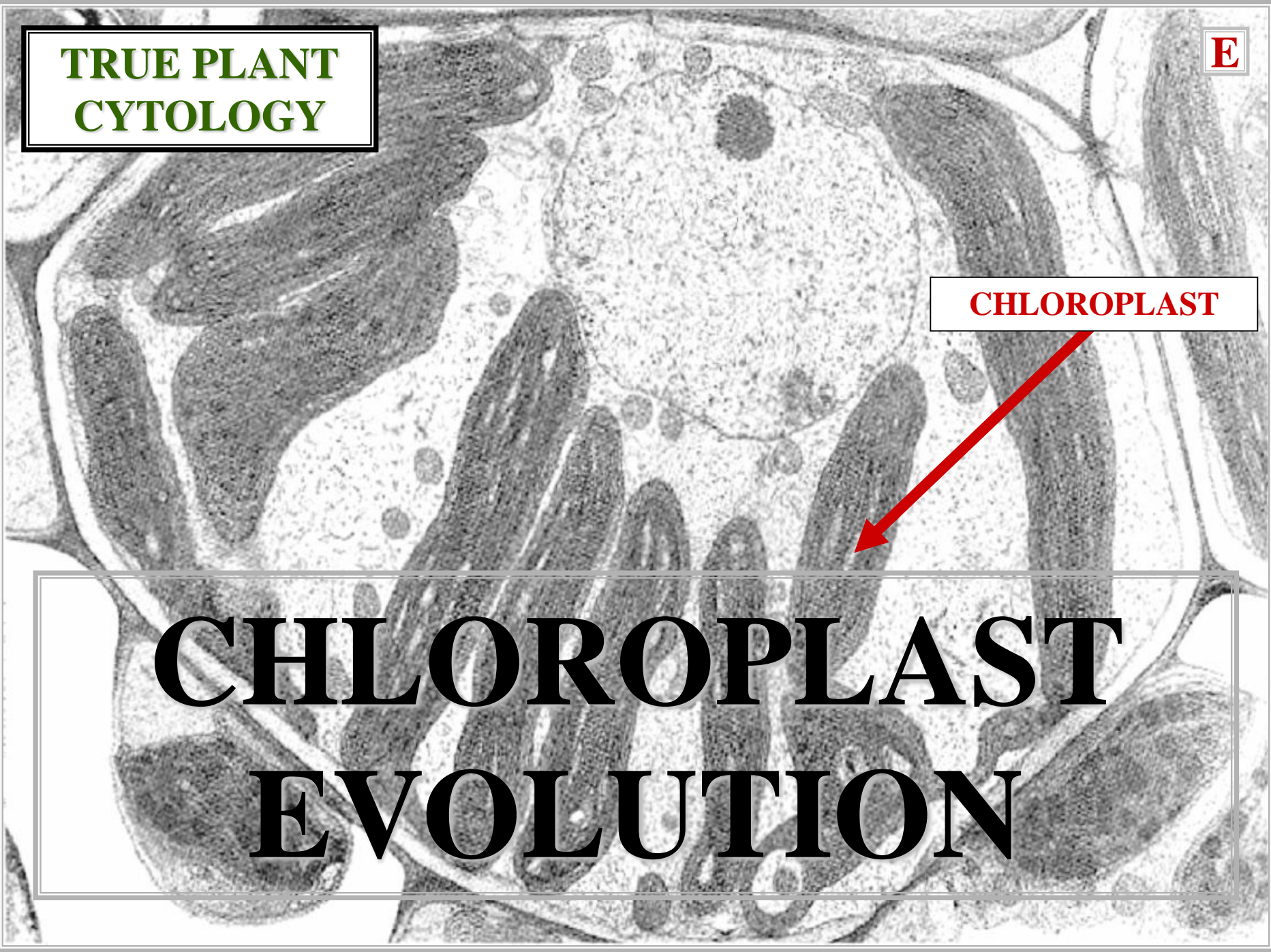
?

**TRUE PLANT
CYTOLOGY**

E

CHLOROPLAST

**CHLOROPLAST
EVOLUTION**

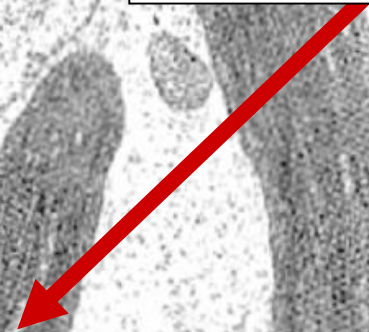


**TRUE PLANT
CYTOLOGY**

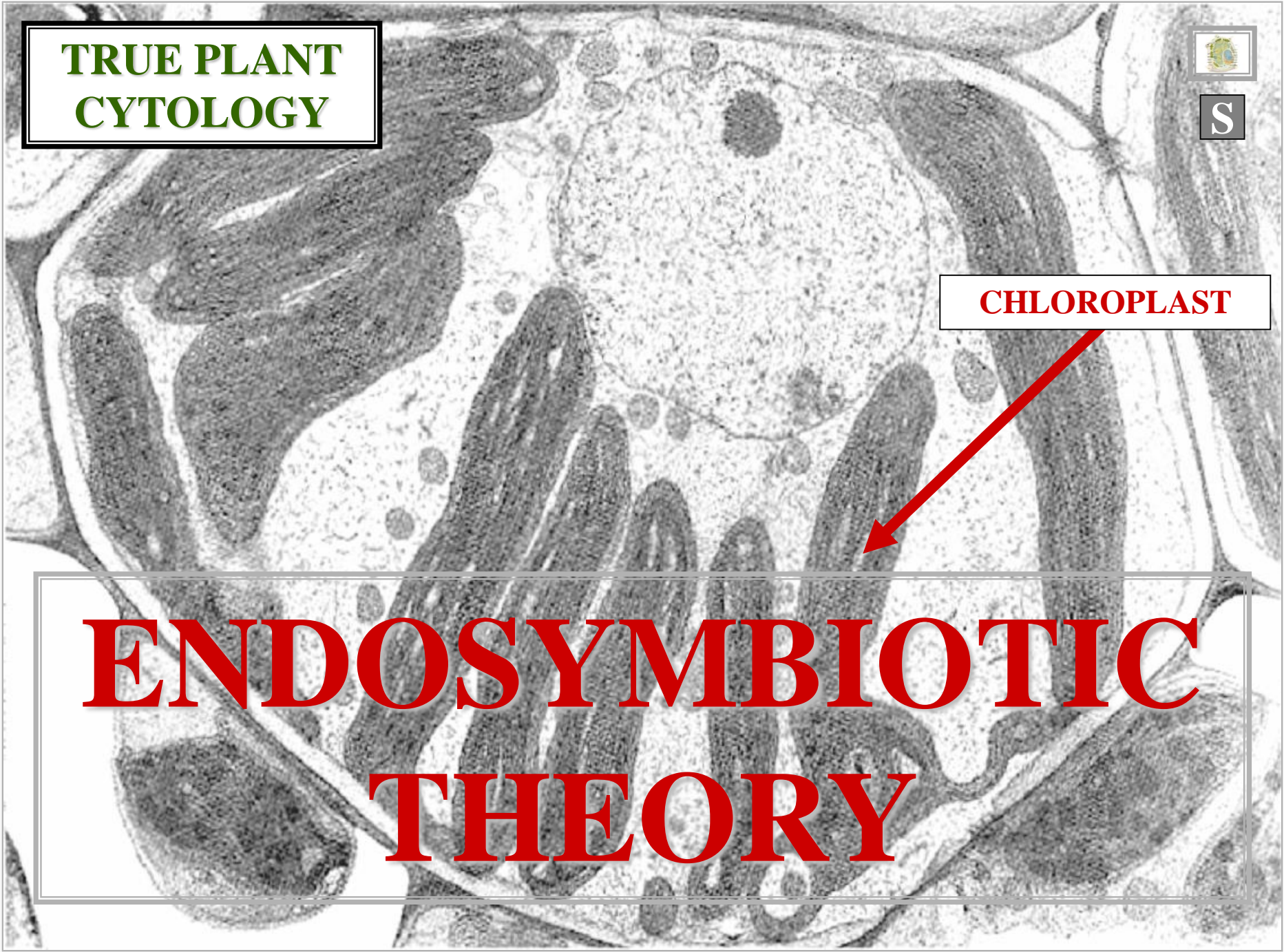


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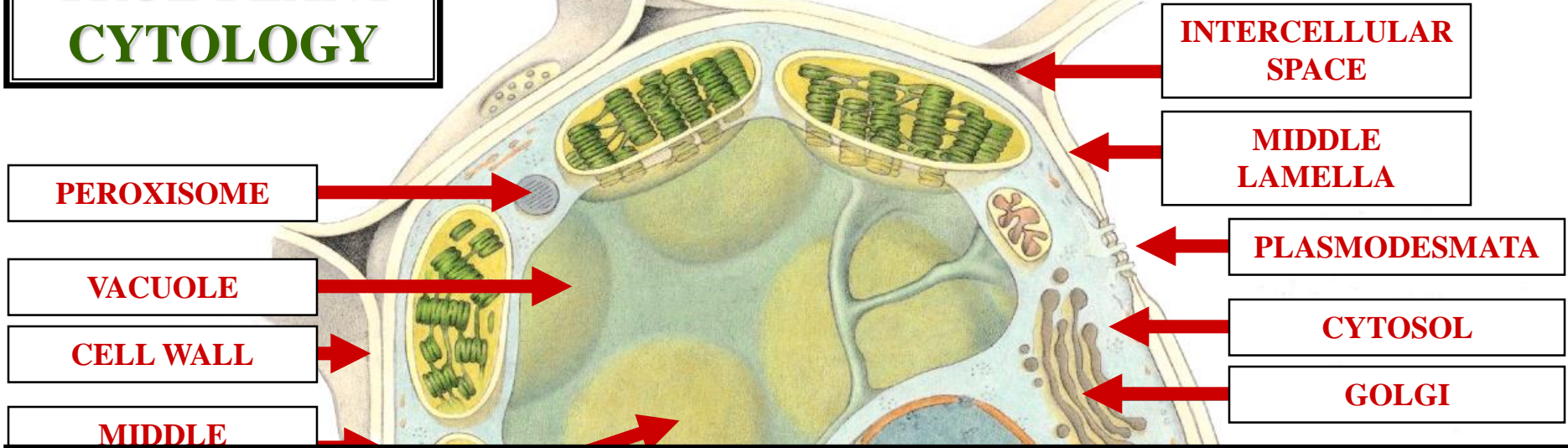
CHLOROPLAST



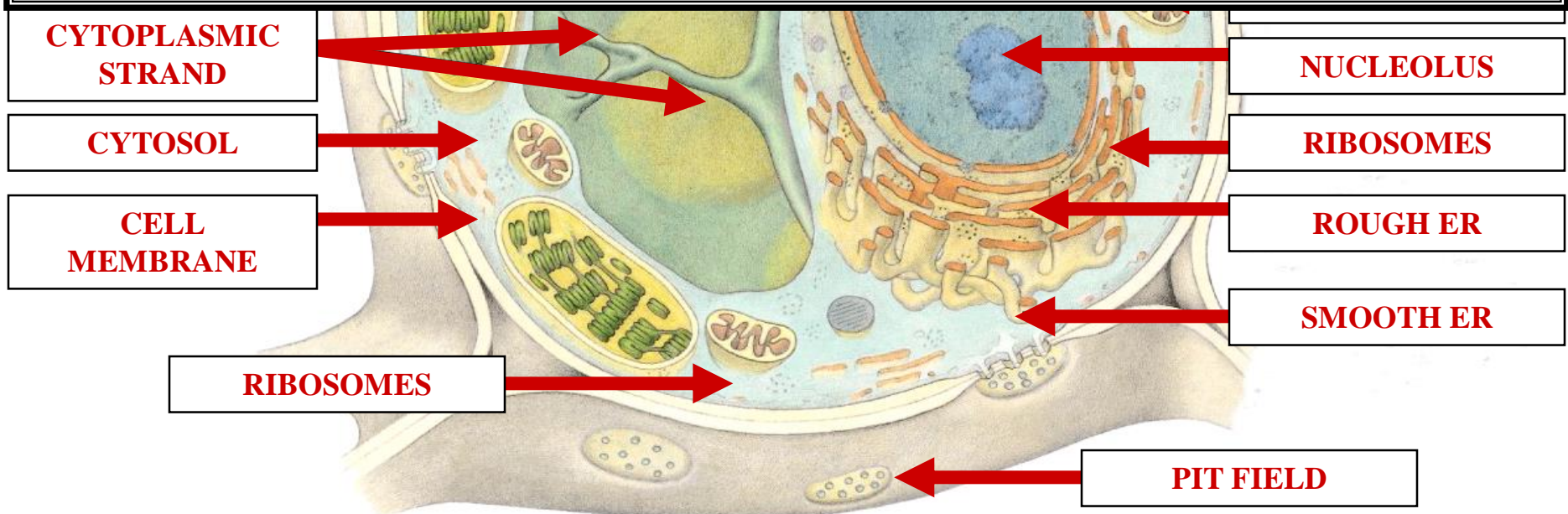
**ENDOSYMBIOTIC
THEORY**



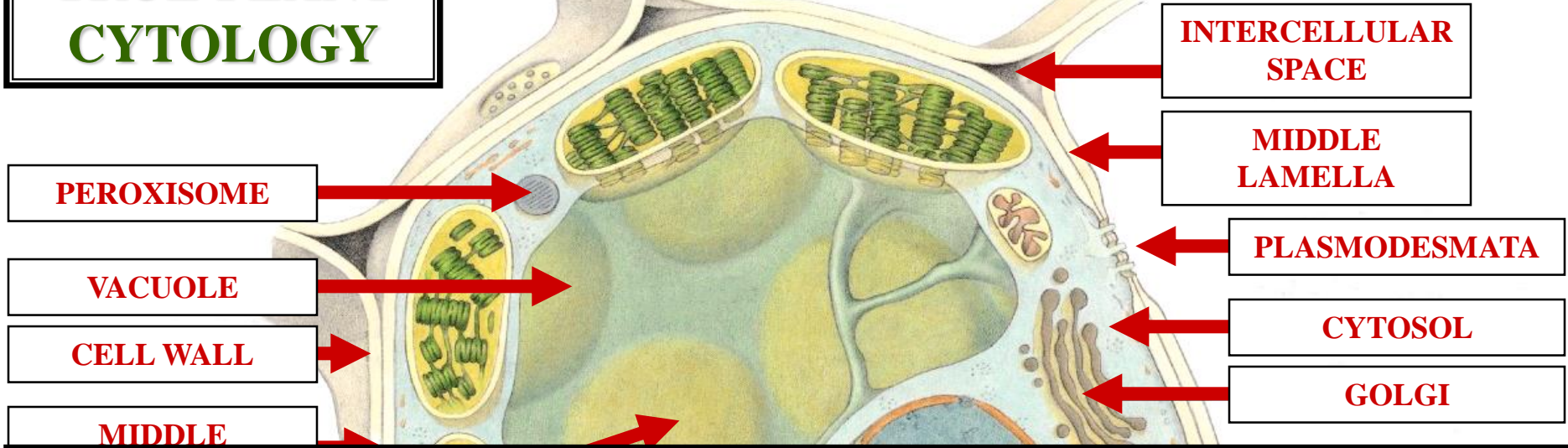
TRUE PLANT CYTOLOGY



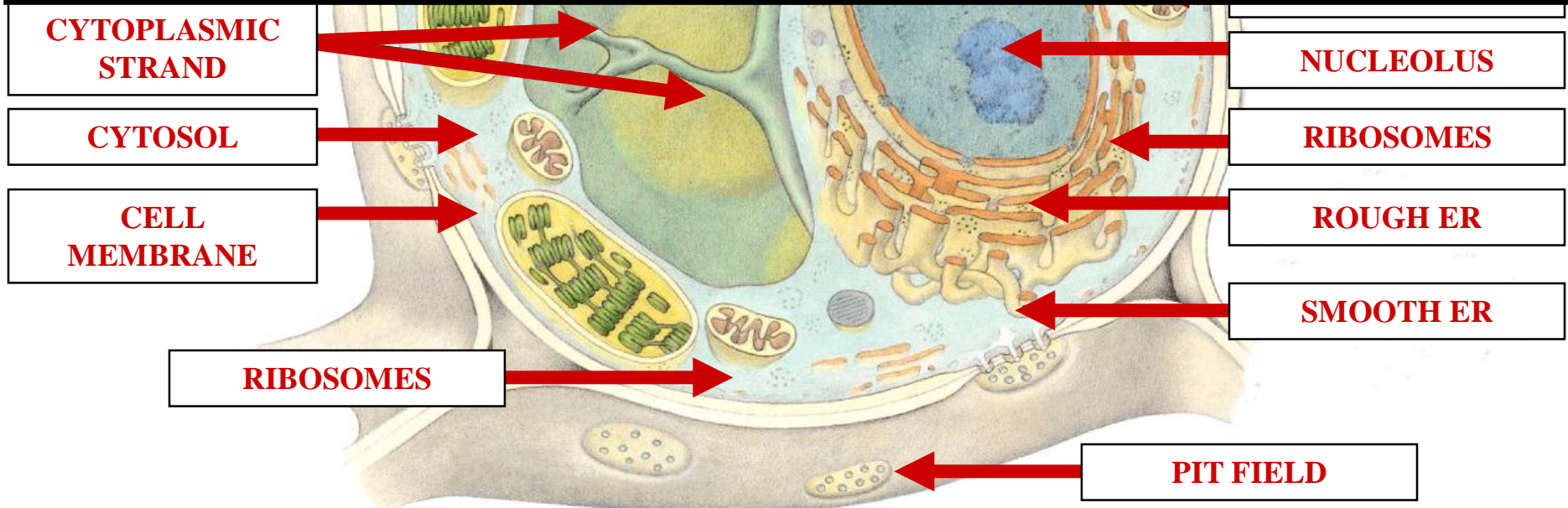
SUMMARY



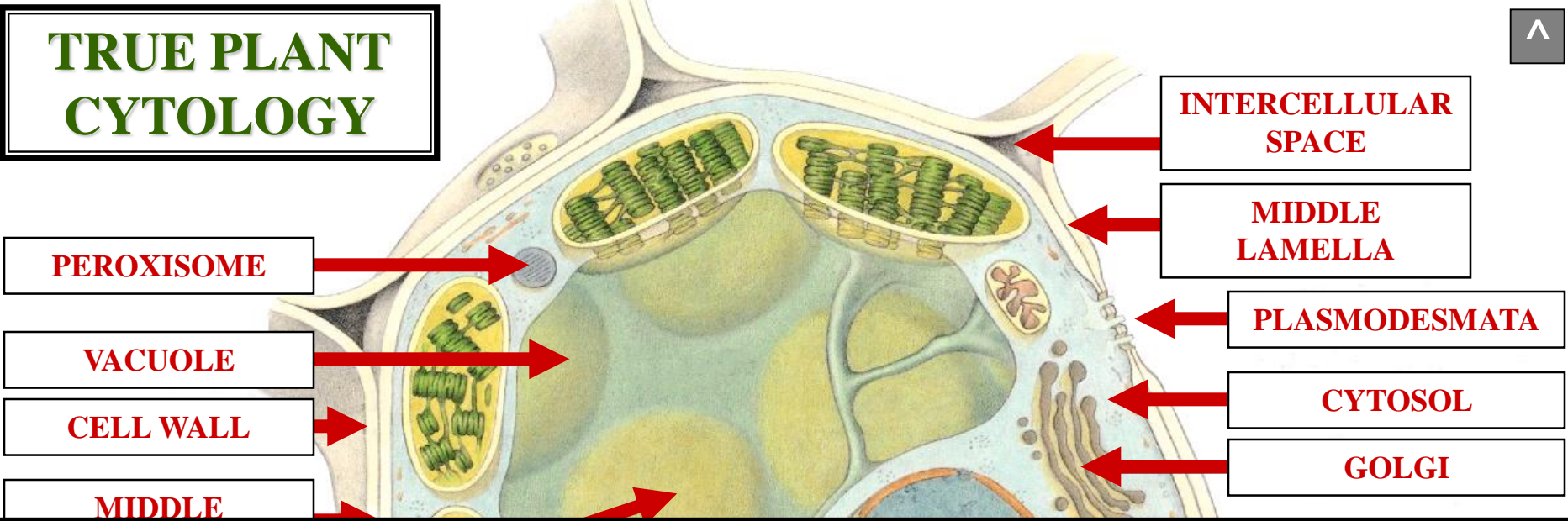
TRUE PLANT CYTOLOGY



DOUBLE-MB ORGANELLES



TRUE PLANT CYTOLOGY



PEROXISOME

VACUOLE

CELL WALL

MIDDLE

INTERCELLULAR SPACE

MIDDLE LAMELLA

PLASMODESMATA

CYTOSOL

GOLGI

SINGLE-MB ORGANELLES

CYTOPLASMIC STRAND

CYTOSOL

CELL MEMBRANE

RIBOSOMES

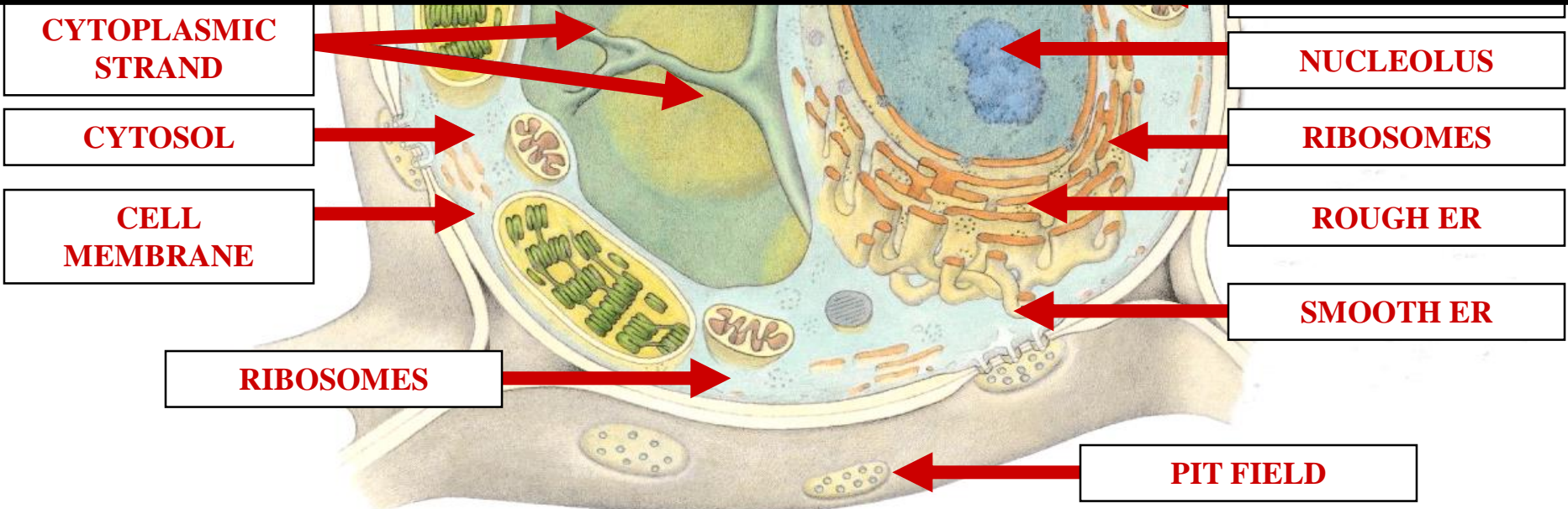
NUCLEOLUS

RIBOSOMES

ROUGH ER

SMOOTH ER

PIT FIELD





SINGLE MEMBRANE BOUND ORGANELLES

**SINGLE
MEMBRANE
BOUND
ORGANELLE
TYPES**

SMBO
ORGANELLE TYPES

VACUOLE

SMBO
ORGANELLE TYPES



SMBO
ORGANELLE TYPES

VACUOLE
PEROXISOME

SMBO
ORGANELLE TYPES

VACUOLE

VACUOLE

VACUOLE



PLANT CELLS ONLY

VACUOLE

VACUOLE



PLANT CELLS ONLY

LARGEST ORGANELLE

VACUOLE

VACUOLE



PLANT CELLS ONLY

LARGEST ORGANELLE

STORAGE ORGANELLE

VACUOLE

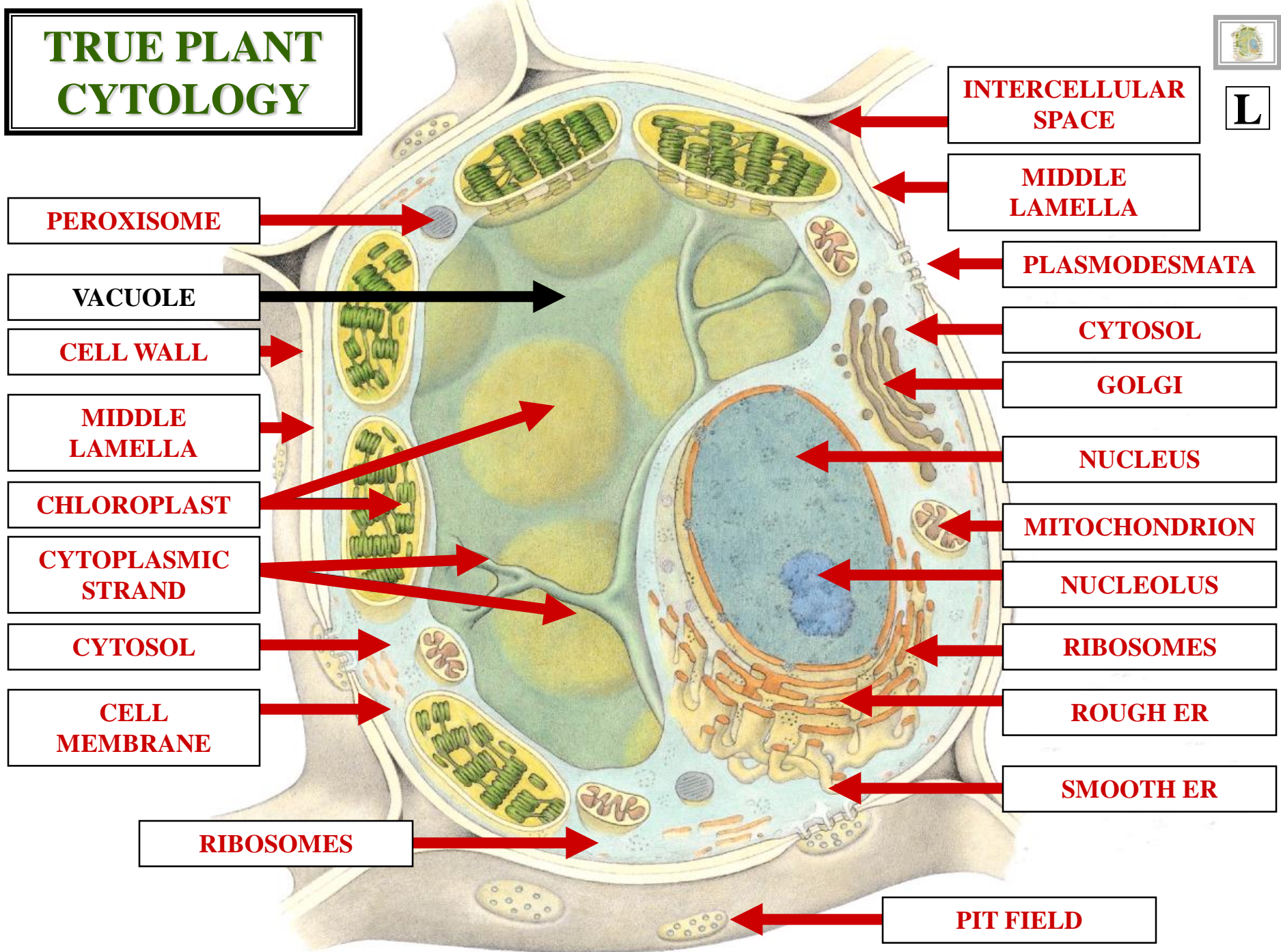


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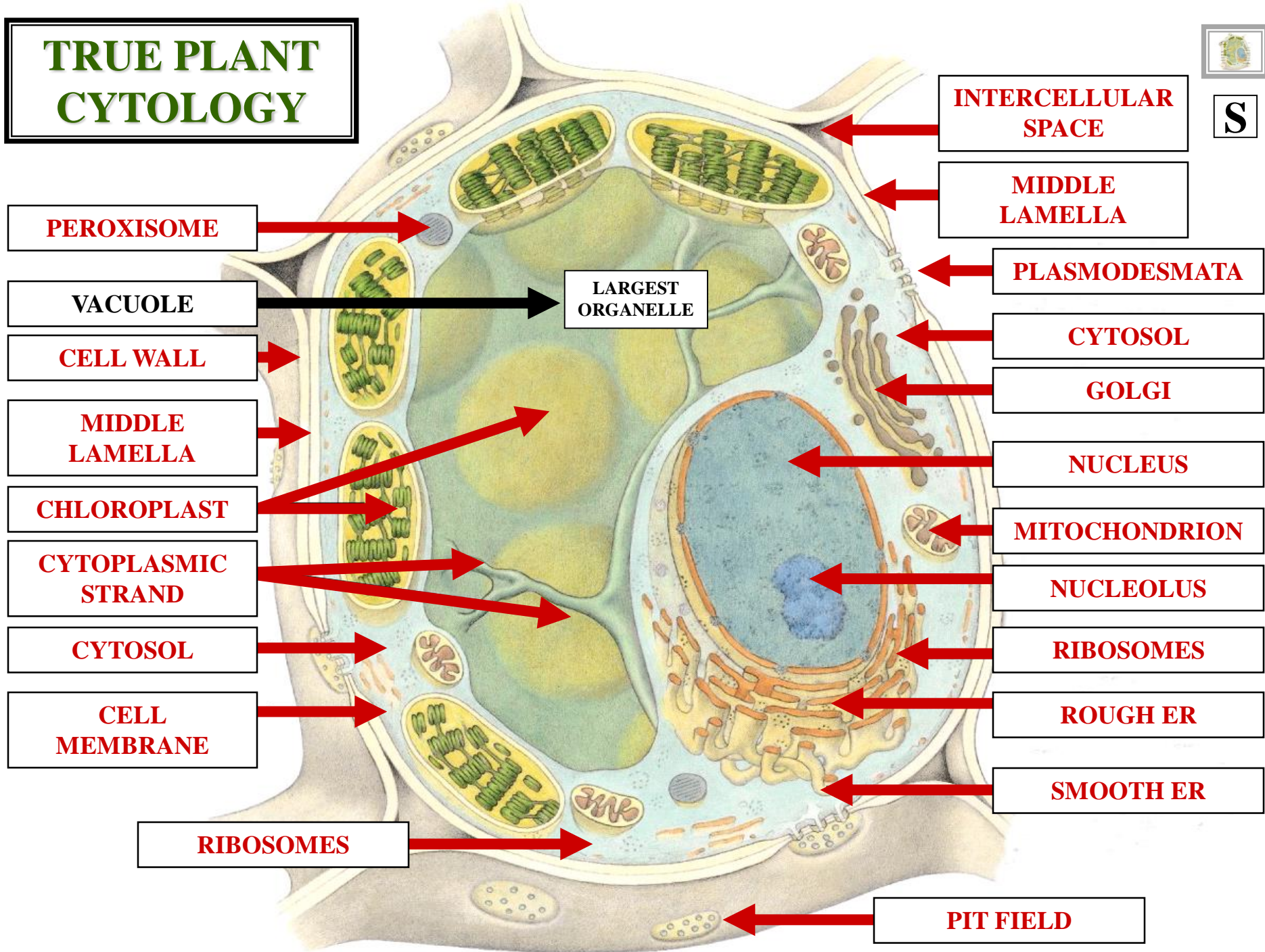
PLANT CELLS ONLY



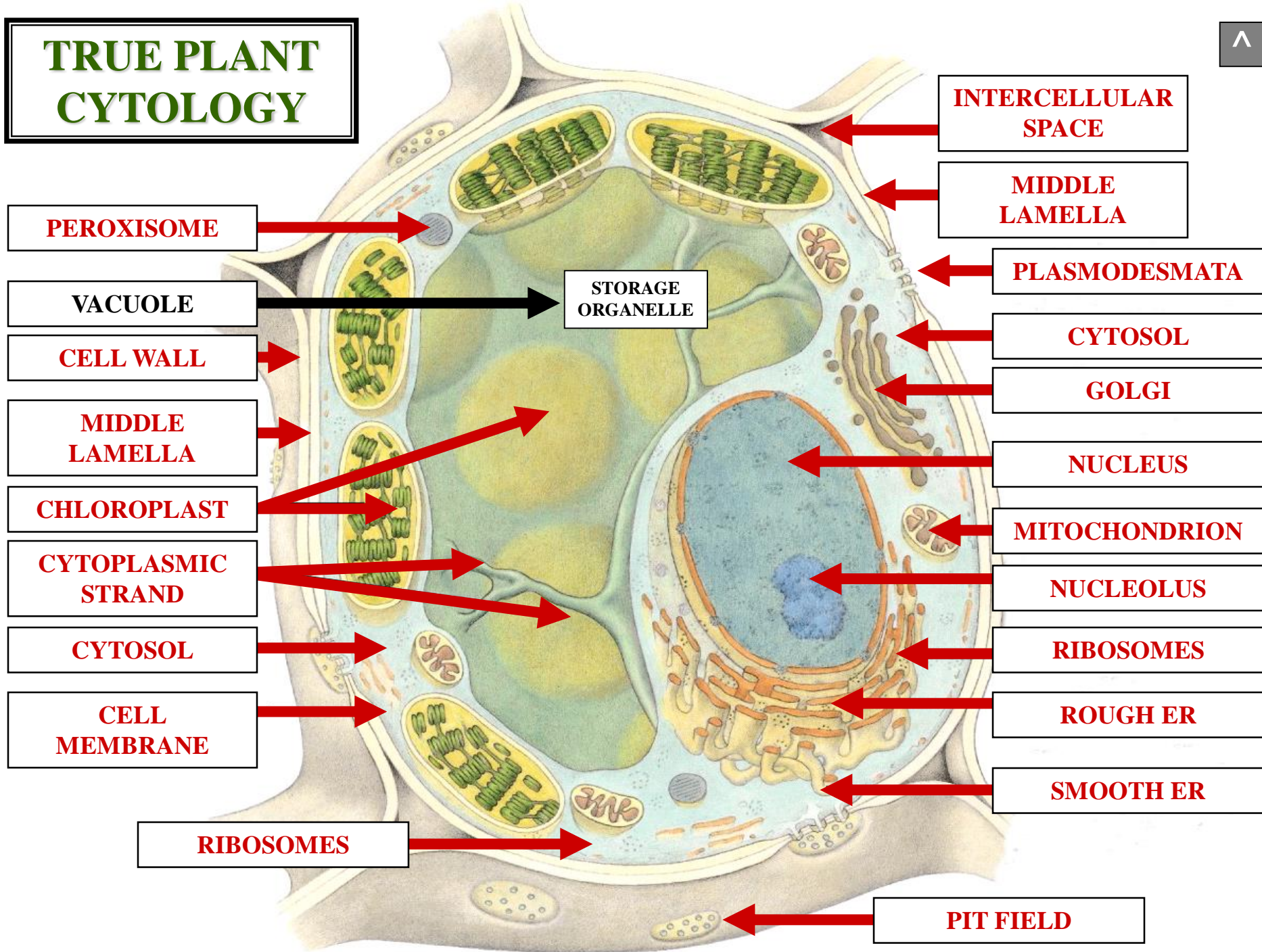
TRUE PLANT CYTOLOGY



TRUE PLANT CYTOLOGY

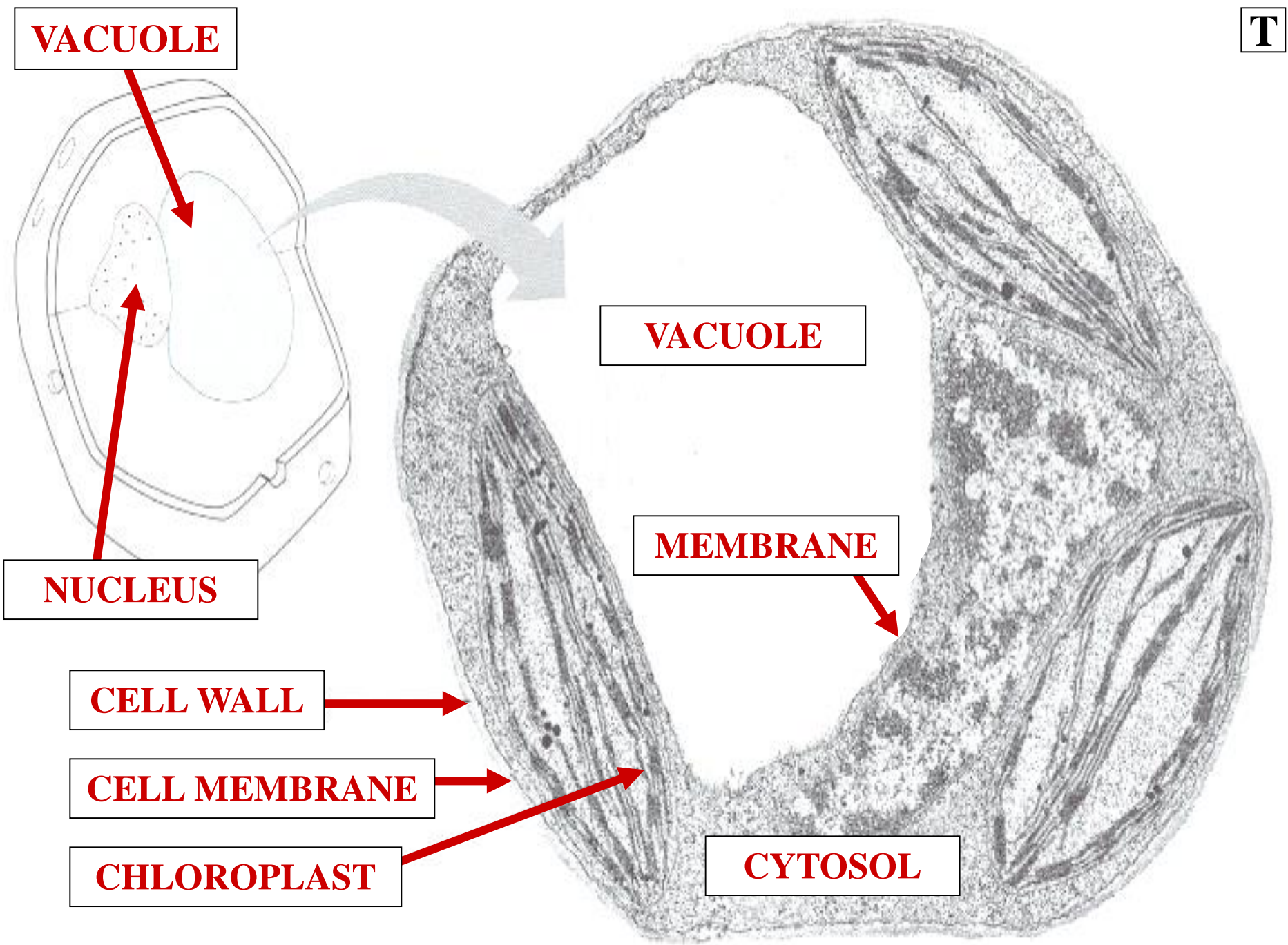


TRUE PLANT CYTOLOGY





VACUOLE ULTRASTRUCTURE



VACUOLE

VACUOLE

NUCLEUS

MEMBRANE

CELL WALL

CELL MEMBRANE

CHLOROPLAST

CYTOSOL

TONOPLAST MEMBRANE



TONOPLAST

VACUOLE MEMBRANE

TONOPLAST

TONOPLAST



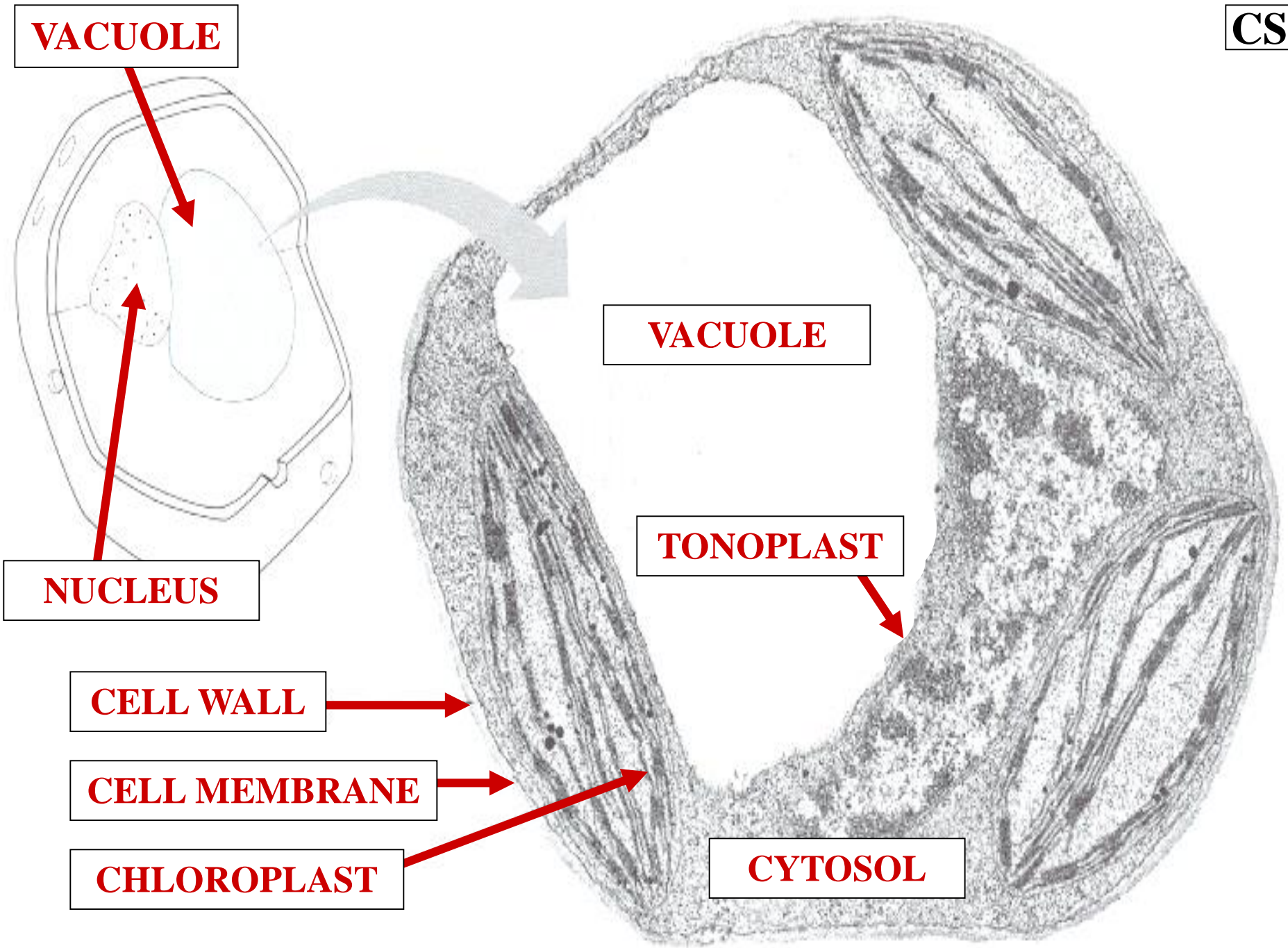
T

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VACUOLE MEMBRANE

MEDIATES TRANSPORT
INTO & OUT OF VACUOLE

TONOPLAST



CELL SAP



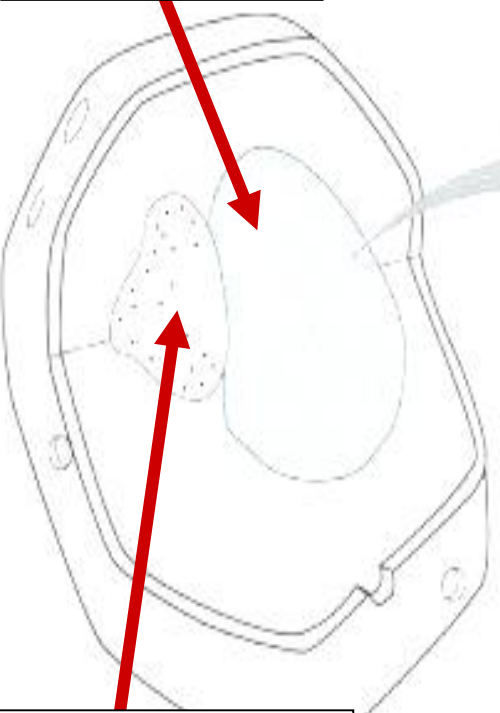
CELL SAP

VACUOLE CONTENT

CELL SAP



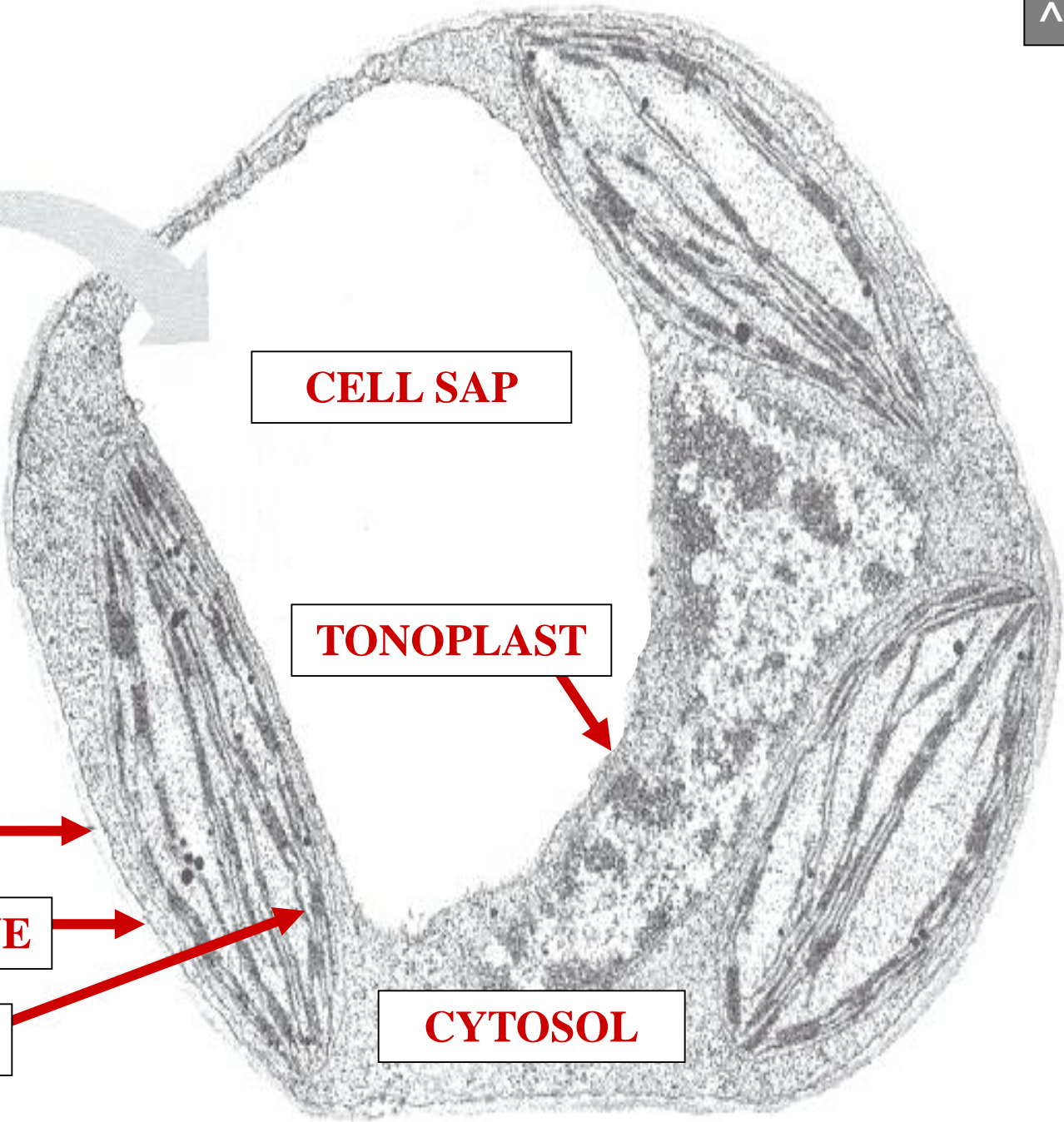
VACUOLE



NUCLEUS



CELL SAP



TONOPLAST



CELL WALL



CELL MEMBRANE



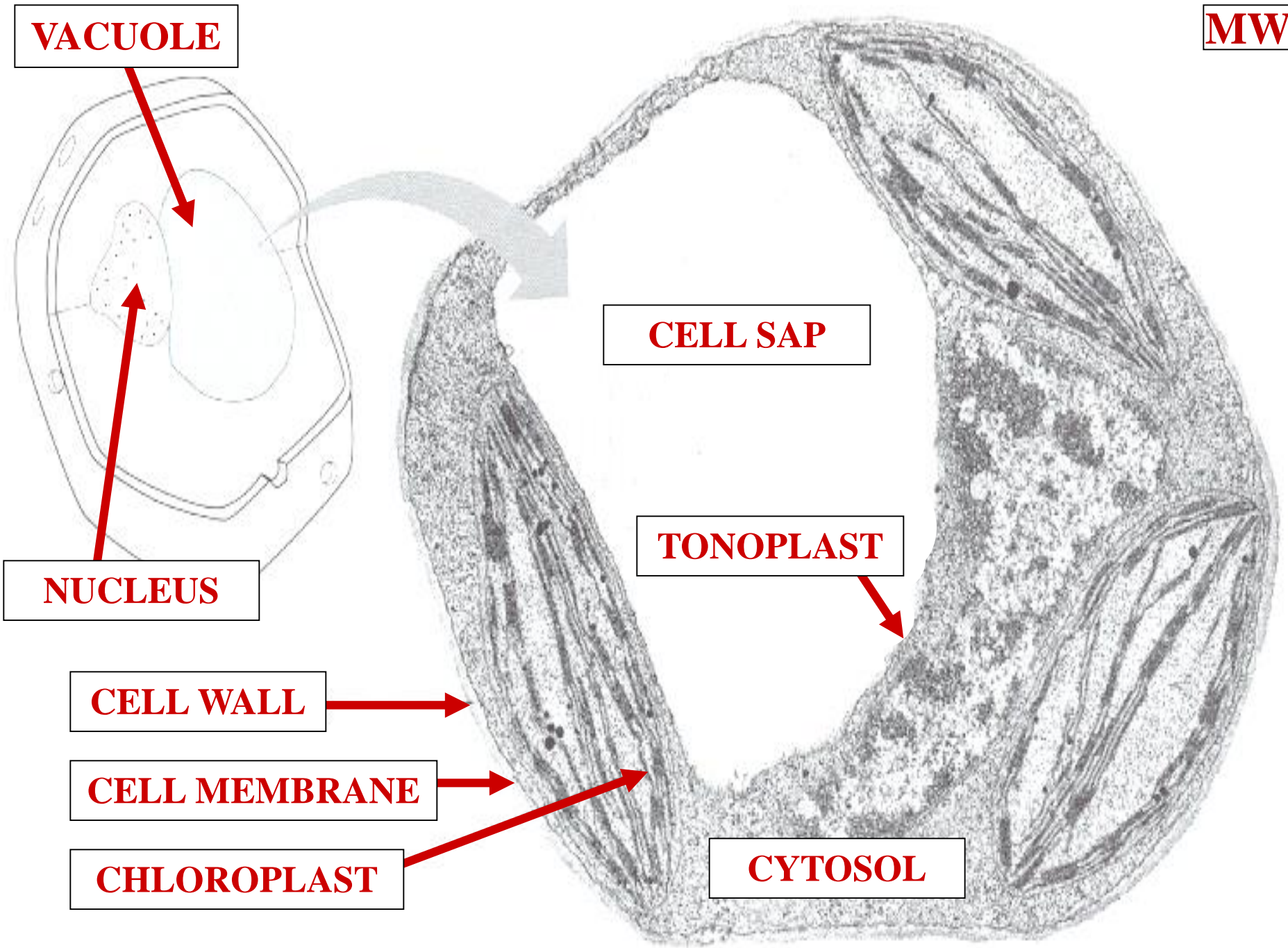
CHLOROPLAST



CYTOSOL



CELL SAP CONTENT



VACUOLE

NUCLEUS

CELL WALL

CELL MEMBRANE

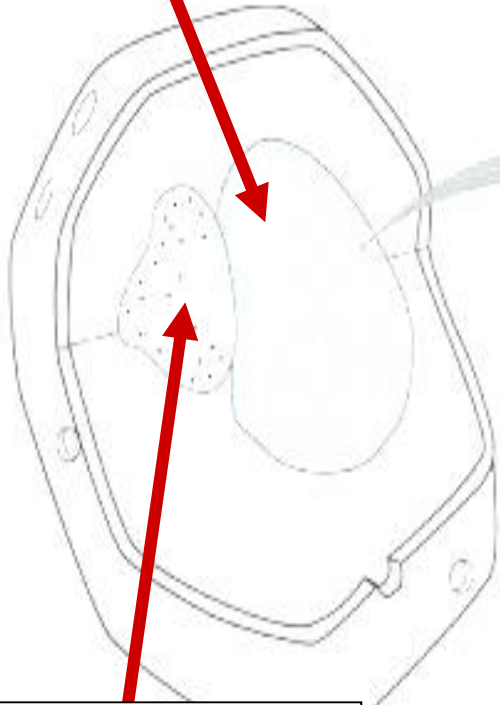
CHLOROPLAST

CELL SAP

TONOPLAST

CYTOSOL

VACUOLE



NUCLEUS

CELL WALL



CELL MEMBRANE



CHLOROPLAST

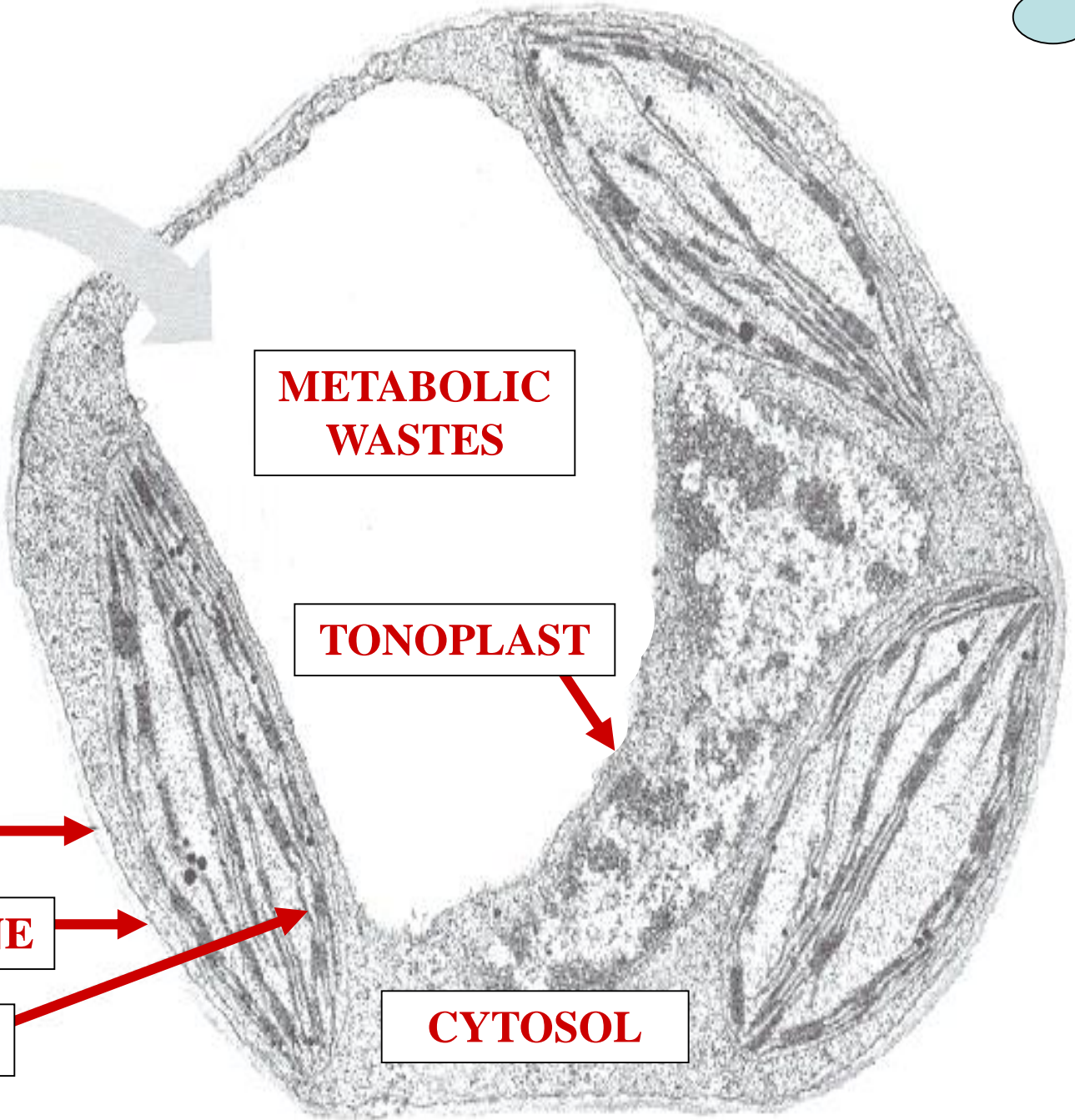


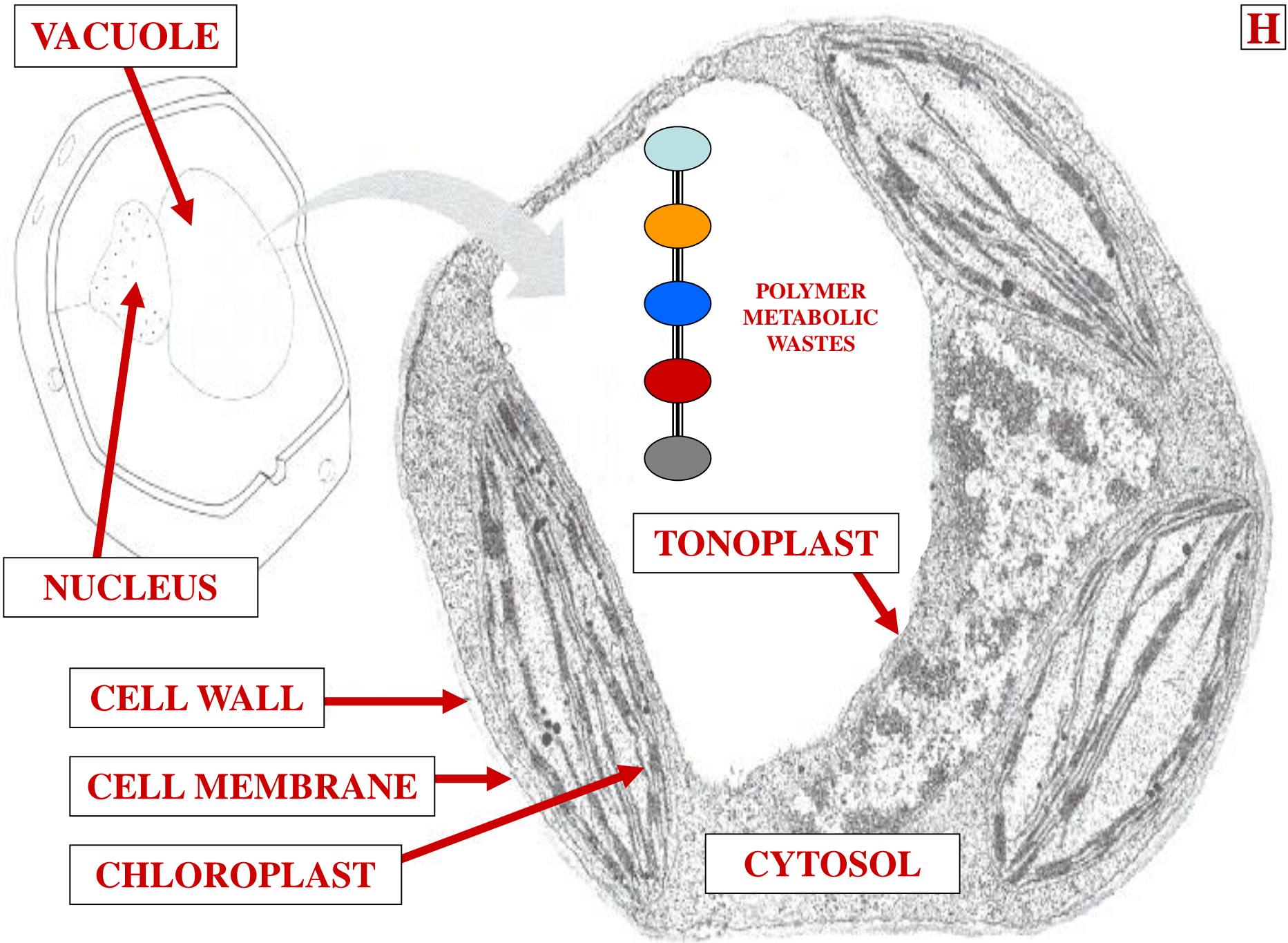
**METABOLIC
WASTES**

TONOPLAST



CYTOSOL





VACUOLE

NUCLEUS

CELL WALL

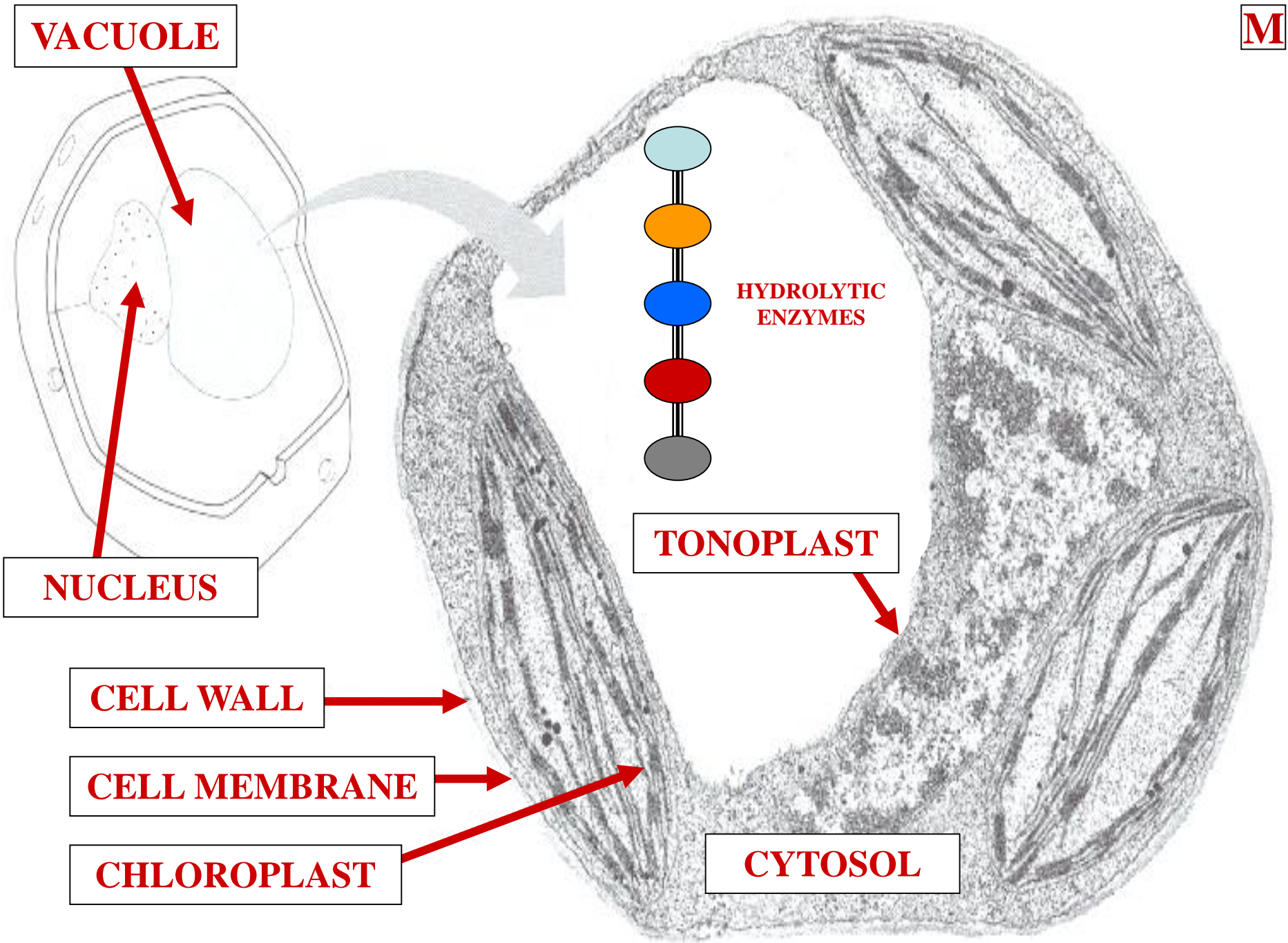
CELL MEMBRANE

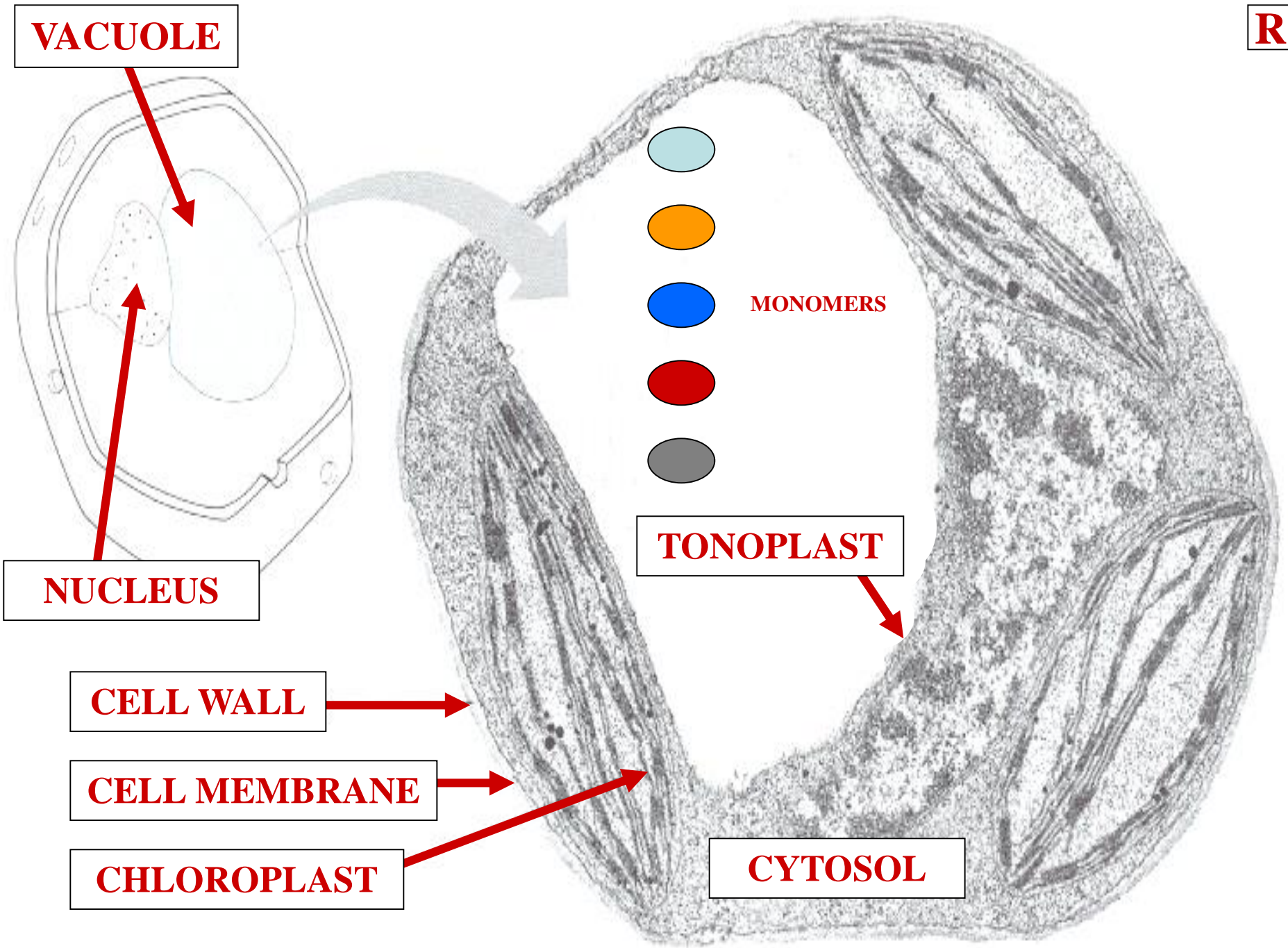
CHLOROPLAST

TONOPLAST

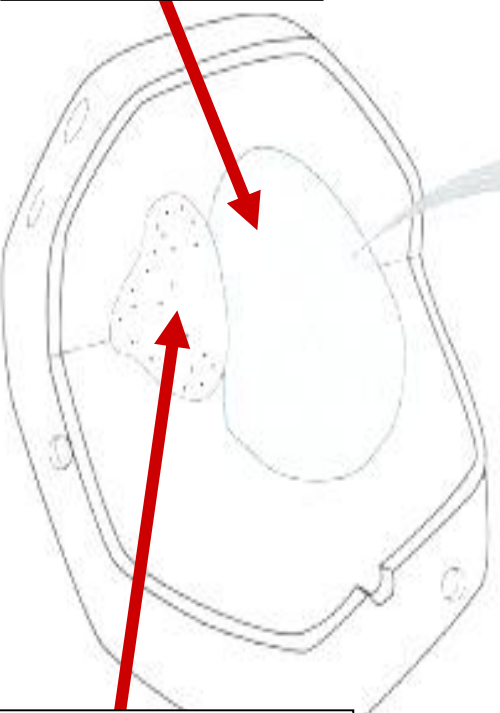
CYTOSOL

POLYMER
METABOLIC
WASTES





VACUOLE



NUCLEUS



**VACUOLE
RECYCLES
METABOLIC
WASTES**

TONOPLAST



CELL WALL



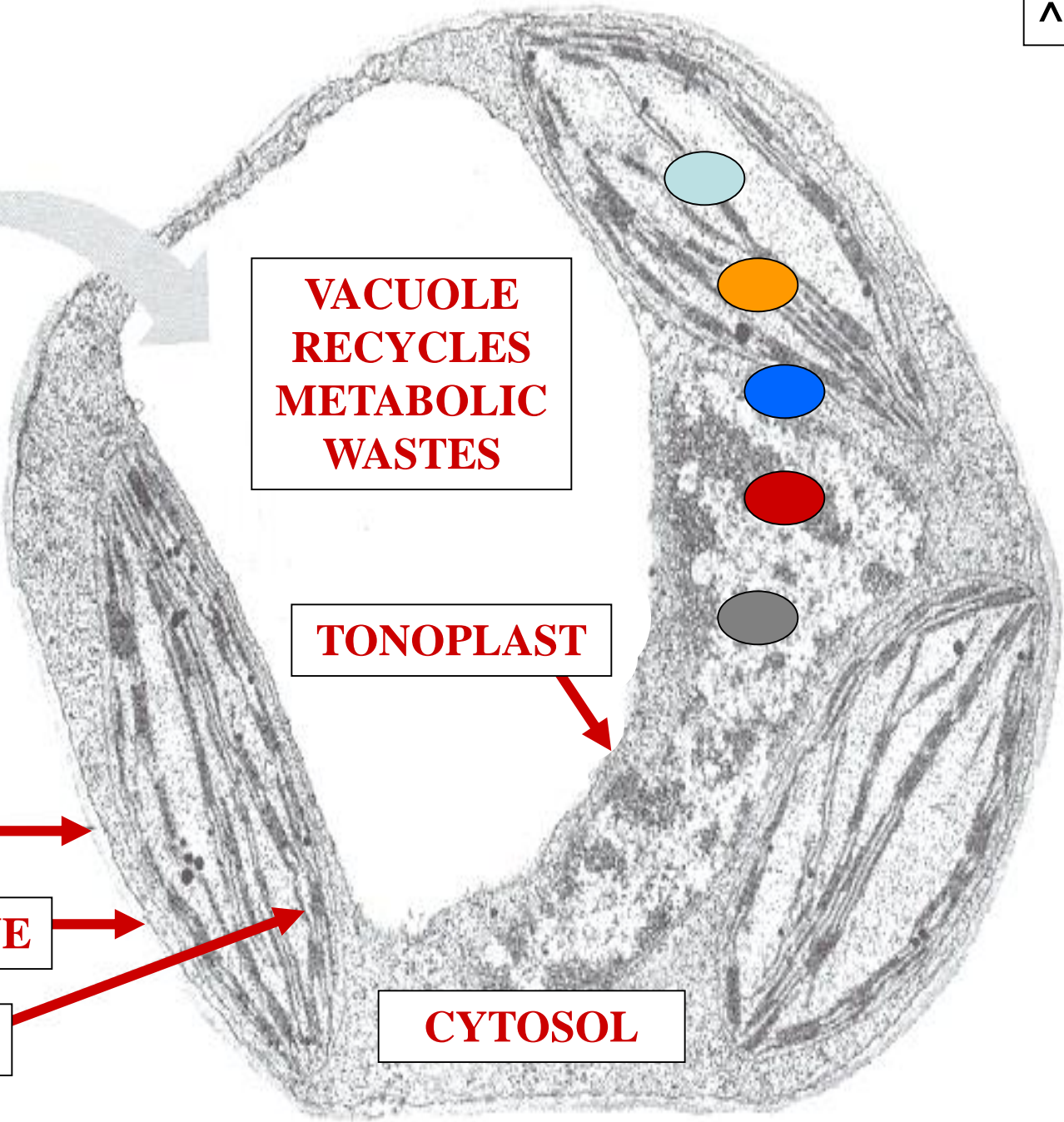
CELL MEMBRANE

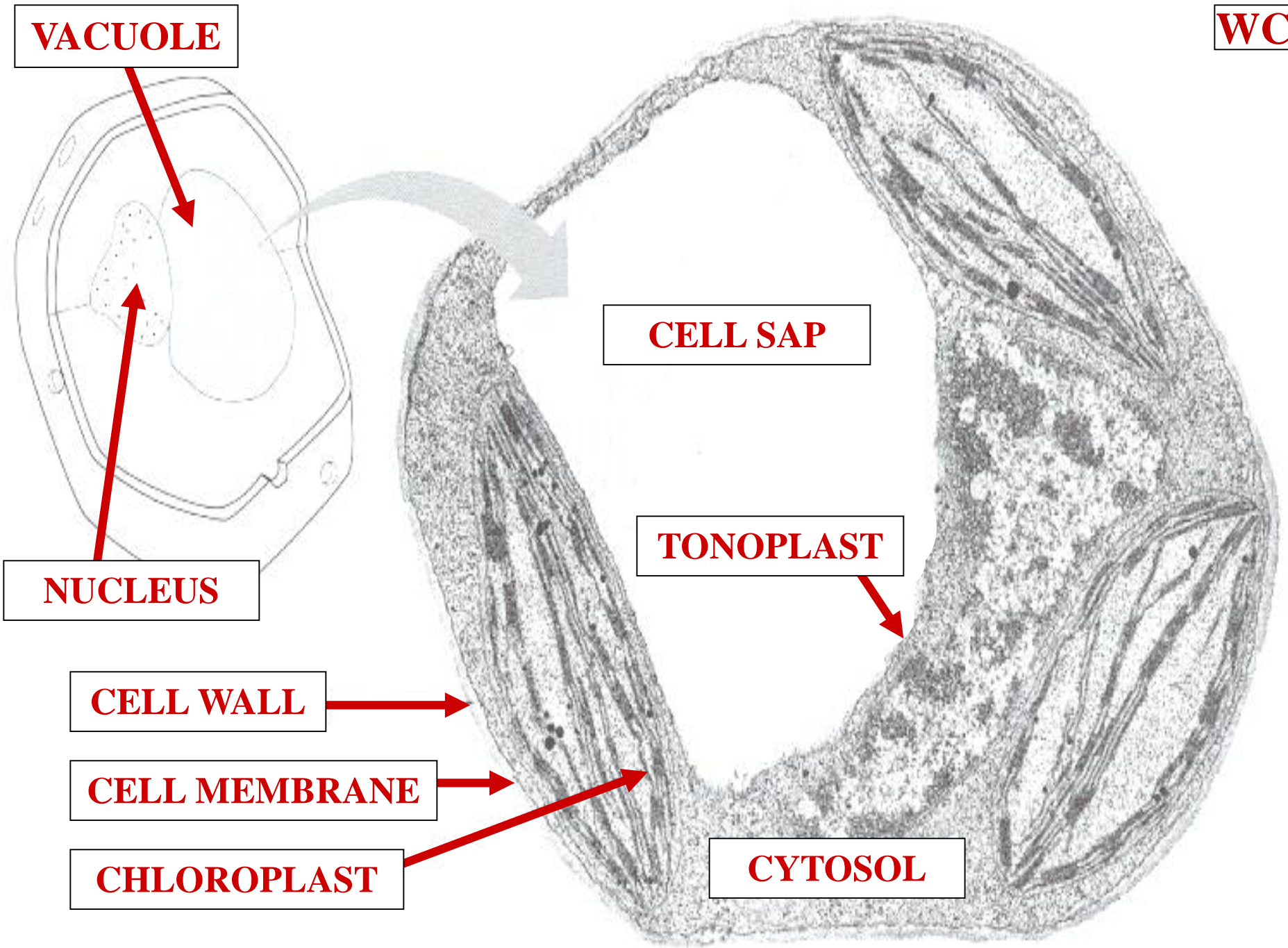


CHLOROPLAST



CYTOSOL





VACUOLE

CELL SAP

TONOPLAST

NUCLEUS

CELL WALL

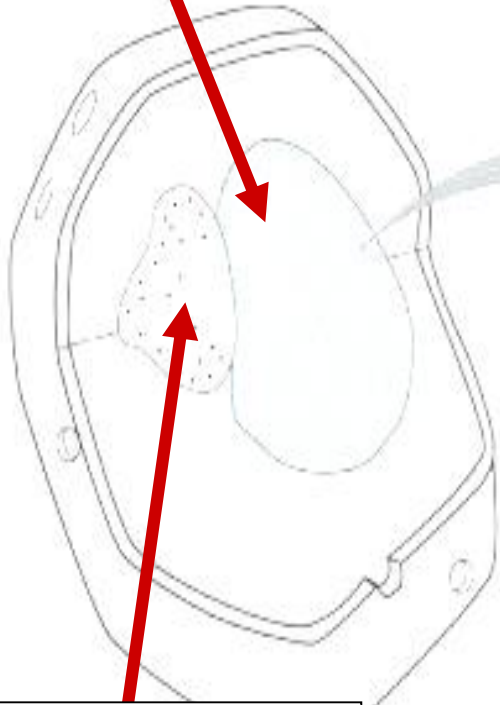
CELL MEMBRANE

CHLOROPLAST

CYTOSOL



VACUOLE



NUCLEUS

CELL WALL



CELL MEMBRANE



CHLOROPLAST

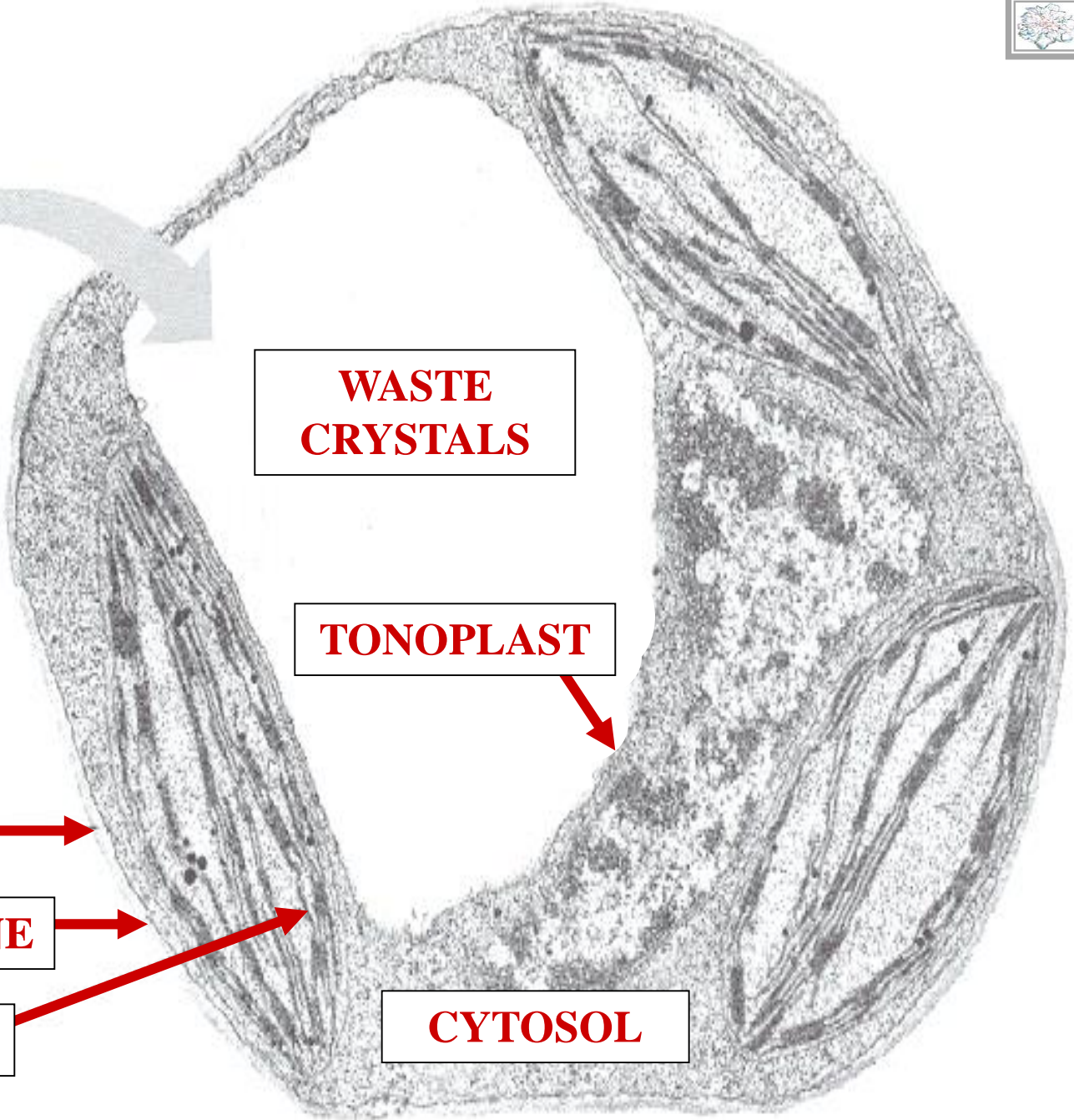


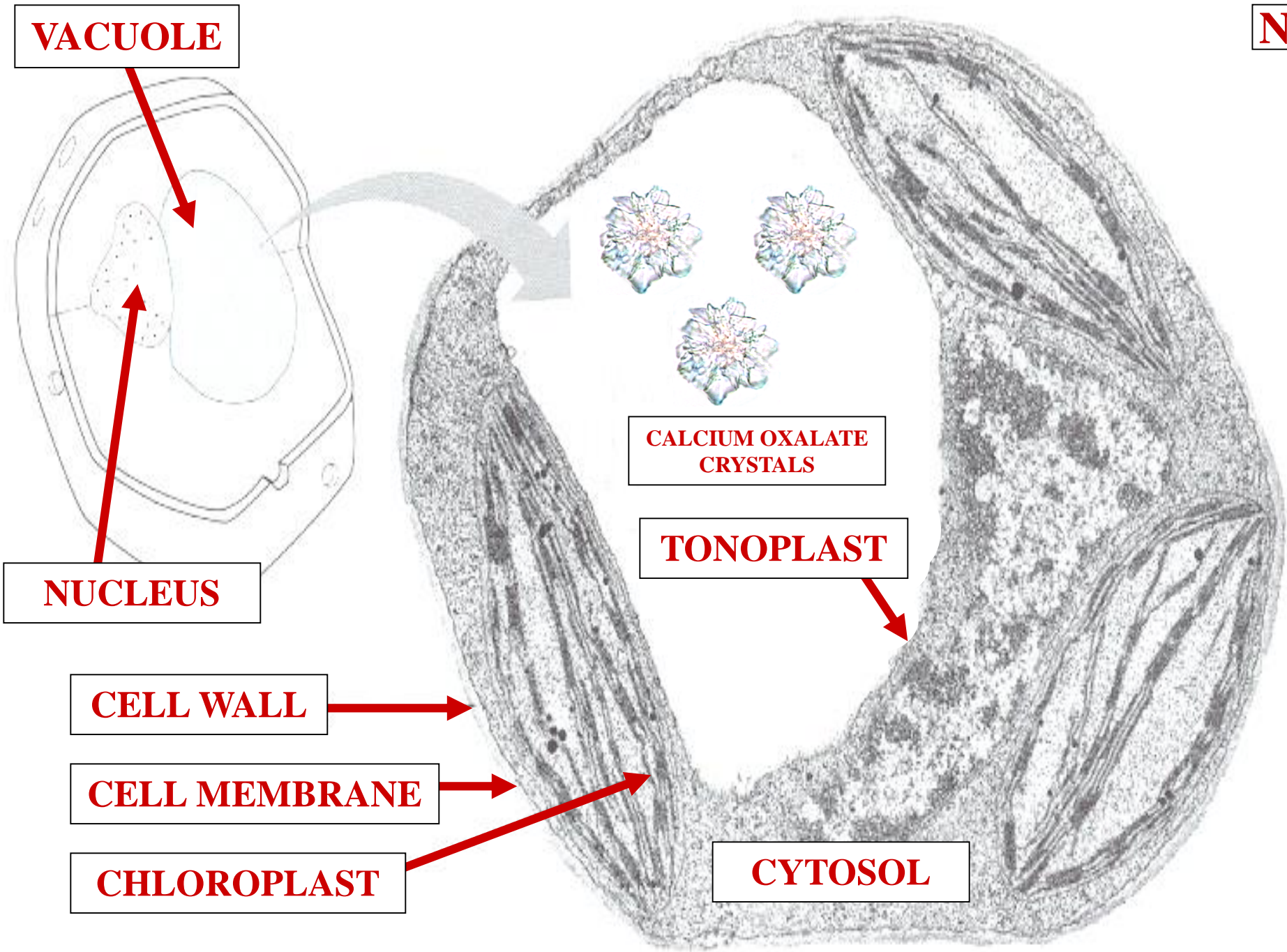
**WASTE
CRYSTALS**

TONOPLAST



CYTOSOL





VACUOLE

NUCLEUS

CELL WALL

CELL MEMBRANE

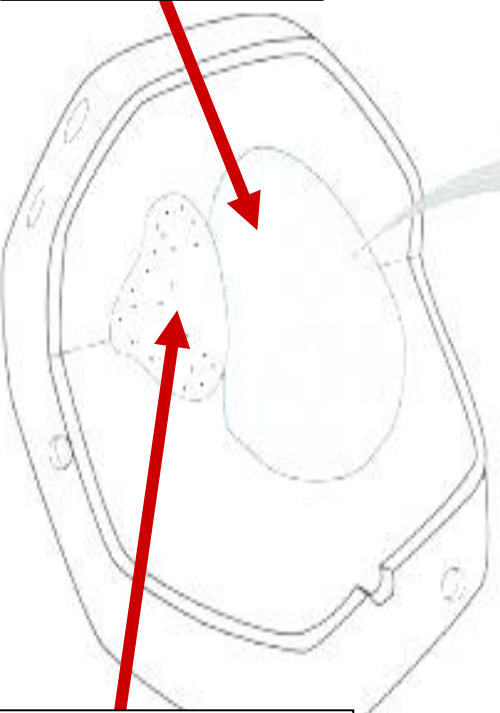
CHLOROPLAST

**CALCIUM OXALATE
CRYSTALS**

TONOPLAST

CYTOSOL

VACUOLE



NUCLEUS

CELL WALL



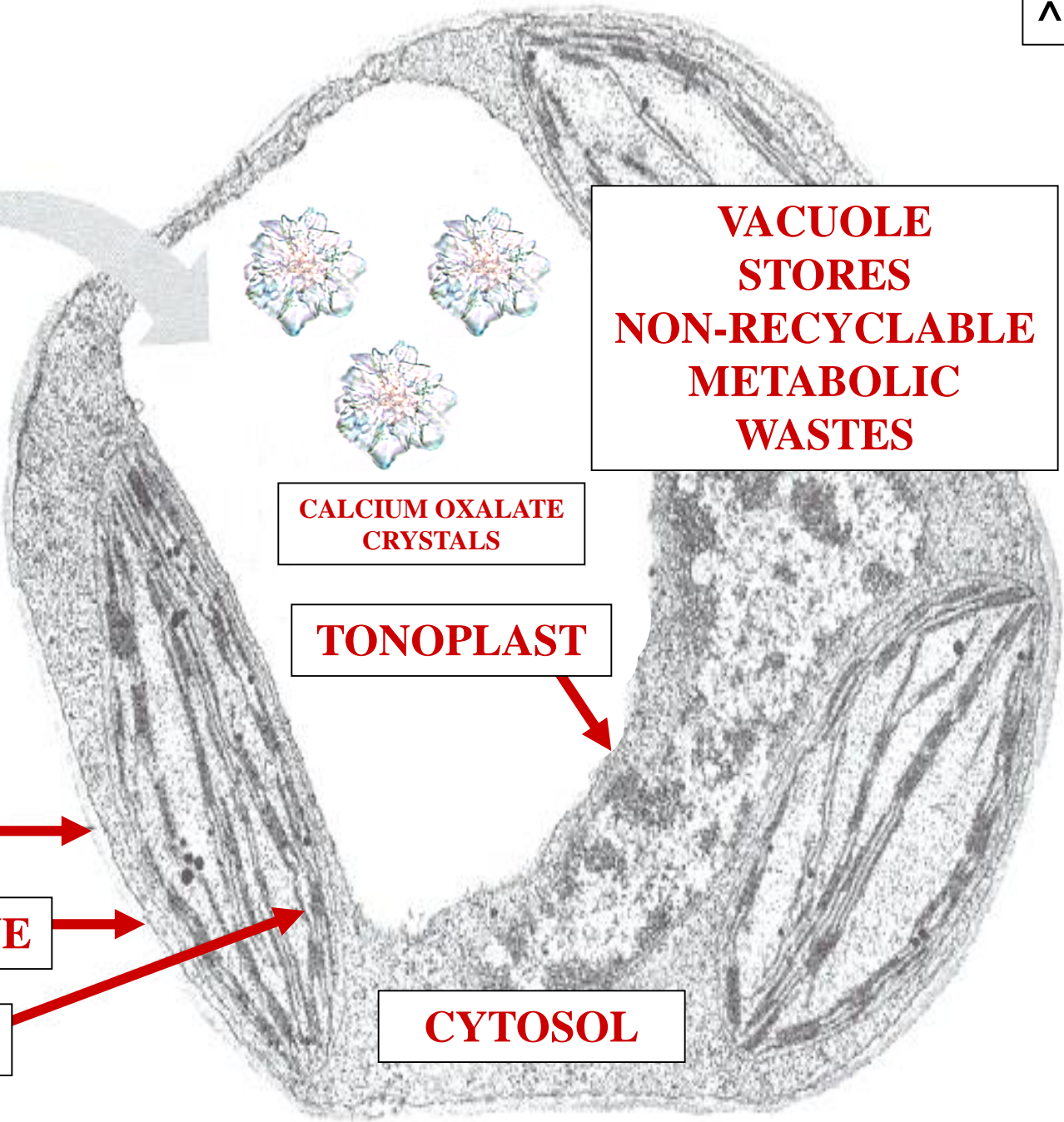
CELL MEMBRANE



CHLOROPLAST



CYTOSOL

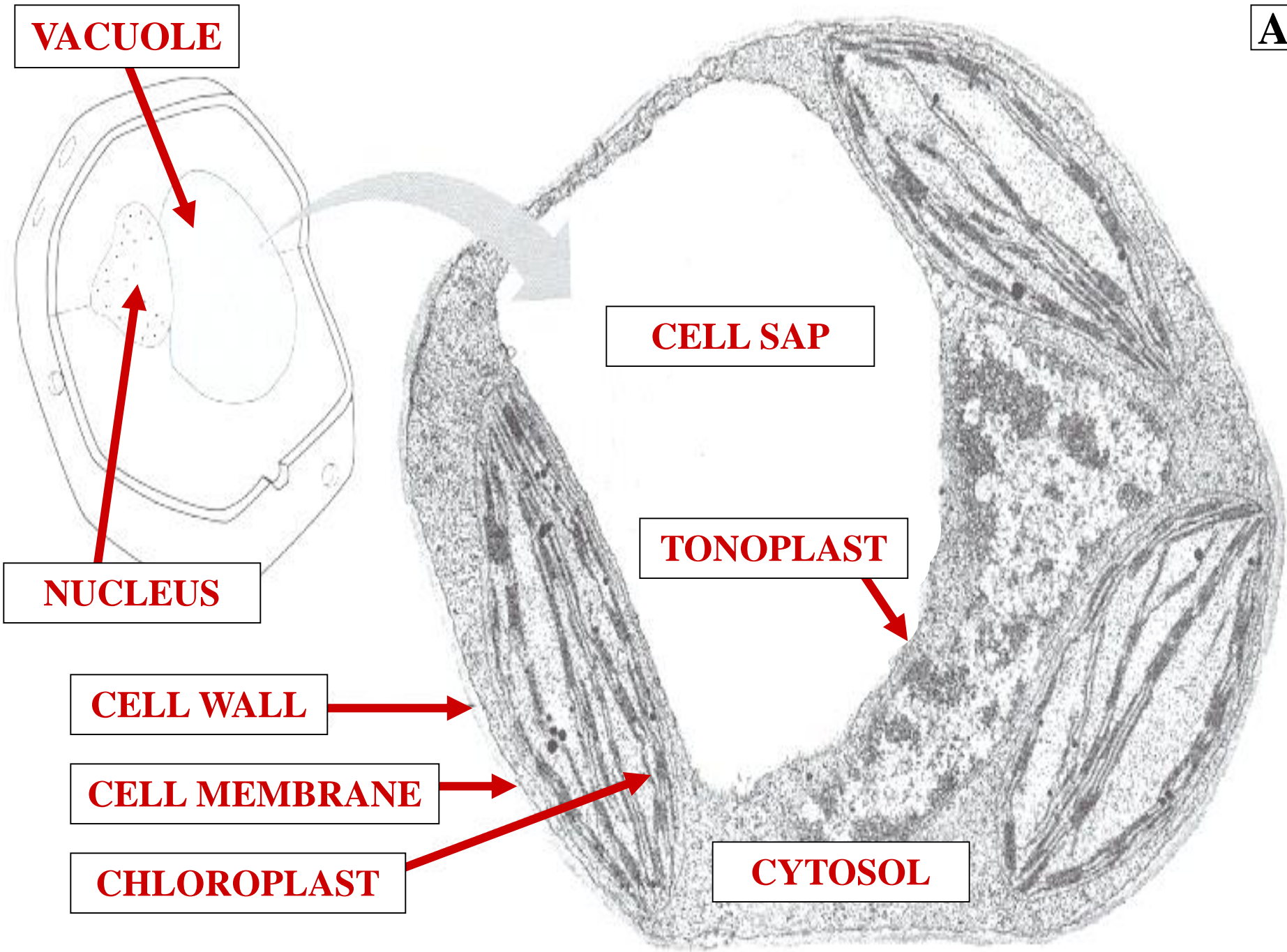


**VACUOLE
STORES
NON-RECYCLABLE
METABOLIC
WASTES**

**CALCIUM OXALATE
CRYSTALS**

TONOPLAST





VACUOLE

NUCLEUS

CELL WALL

CELL MEMBRANE

CHLOROPLAST

CELL SAP

TONOPLAST

CYTOSOL

ANTHOCYANINS



ANTHOCYANINS

CELL SAP

BLUE & RED PIGMENTS

ANTHOCYANINS



ANTHOCYANINS

CELL SAP

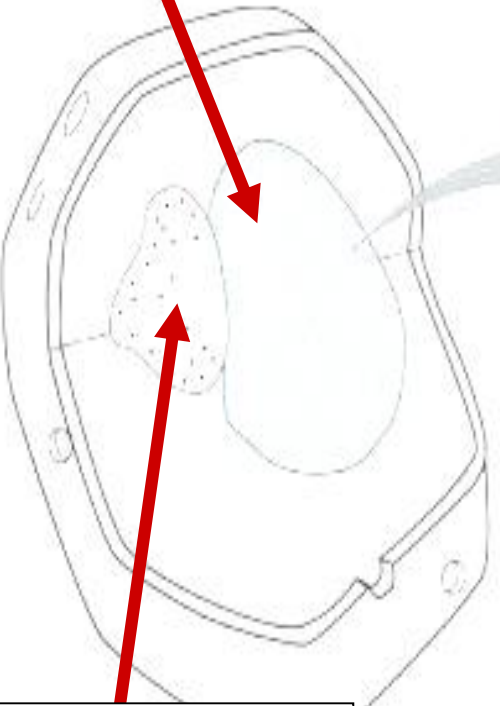
BLUE & RED PIGMENTS

ATTRACT ANIMALS

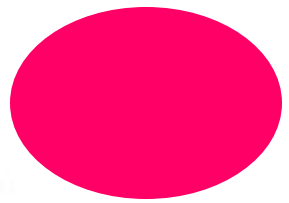
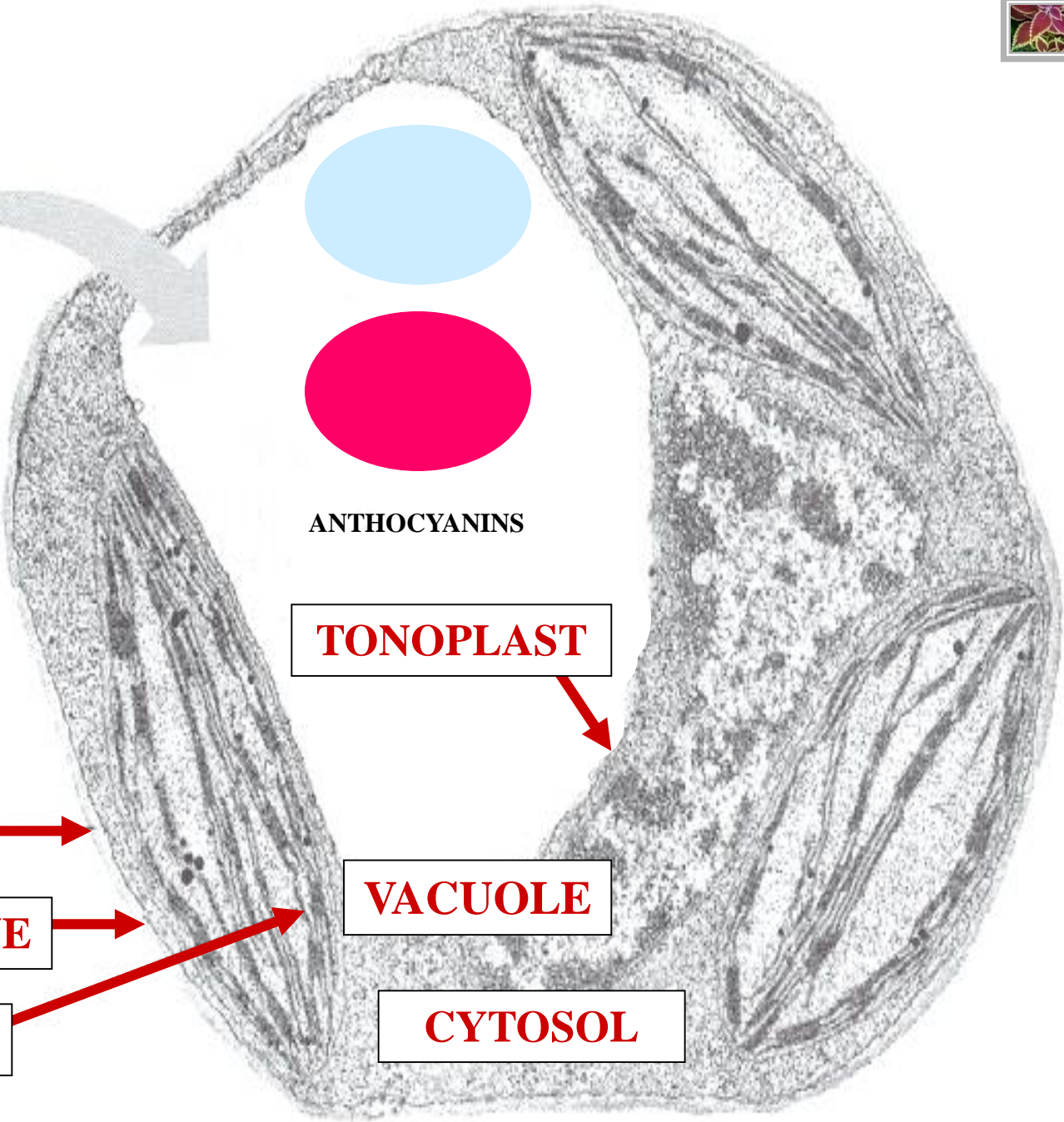
ANTHOCYANINS



VACUOLE



NUCLEUS



ANTHOCYANINS

TONOPLAST



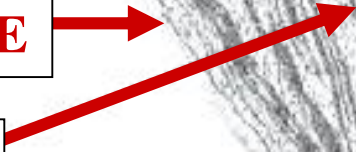
CELL WALL



CELL MEMBRANE



CHLOROPLAST



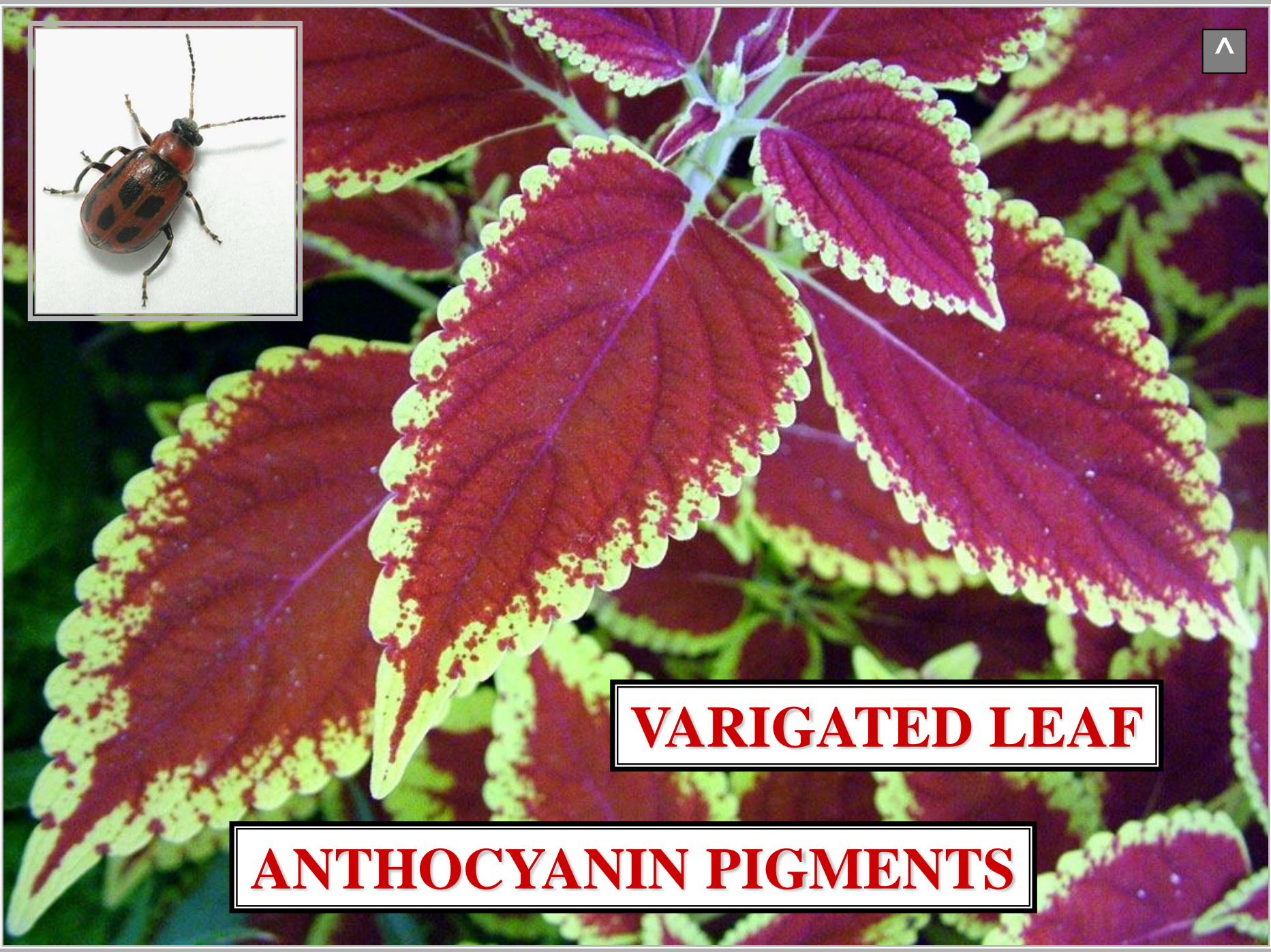
VACUOLE

CYTOSOL



VARIGATED LEAF

ANTHOCYANIN PIGMENTS



VARIGATED LEAF

ANTHOCYANIN PIGMENTS

PEROXISOME

PEROXISOMES



PEROXISOMES

PLANT CELLS ONLY

PEROXISOMES



PEROXISOMES

PLANT CELLS ONLY

PHOTOSYNTHESIS CELLS ONLY

PEROXISOMES

PEROXISOMES



PLANT CELLS ONLY

PHOTOSYNTHESIS CELLS ONLY

SITE: PHOTO-RESPIRATION

PEROXISOMES



PLANT CELLS ONLY





PR

PSYN CELLS ONLY





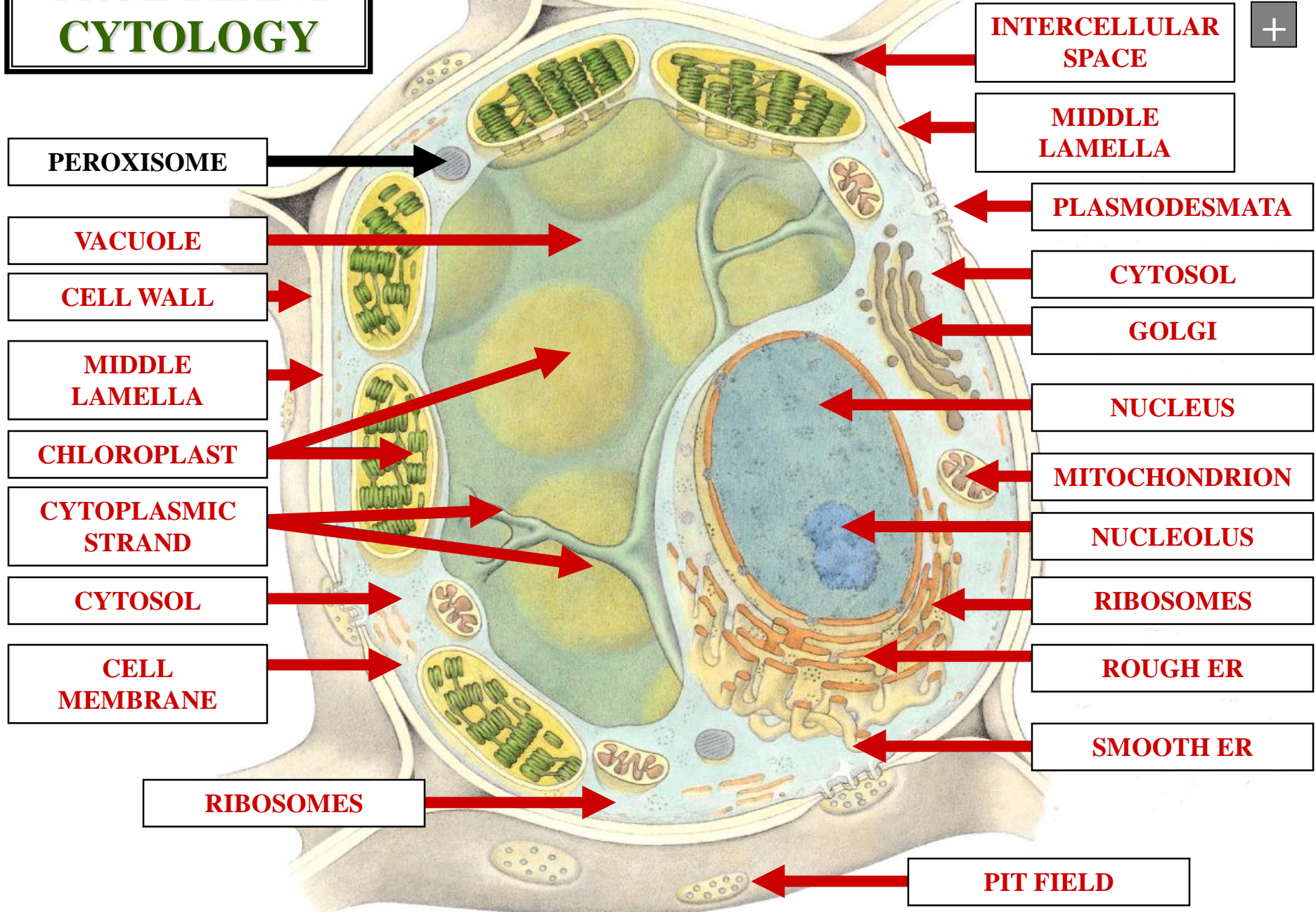
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TRUE PLANT CYTOLOGY

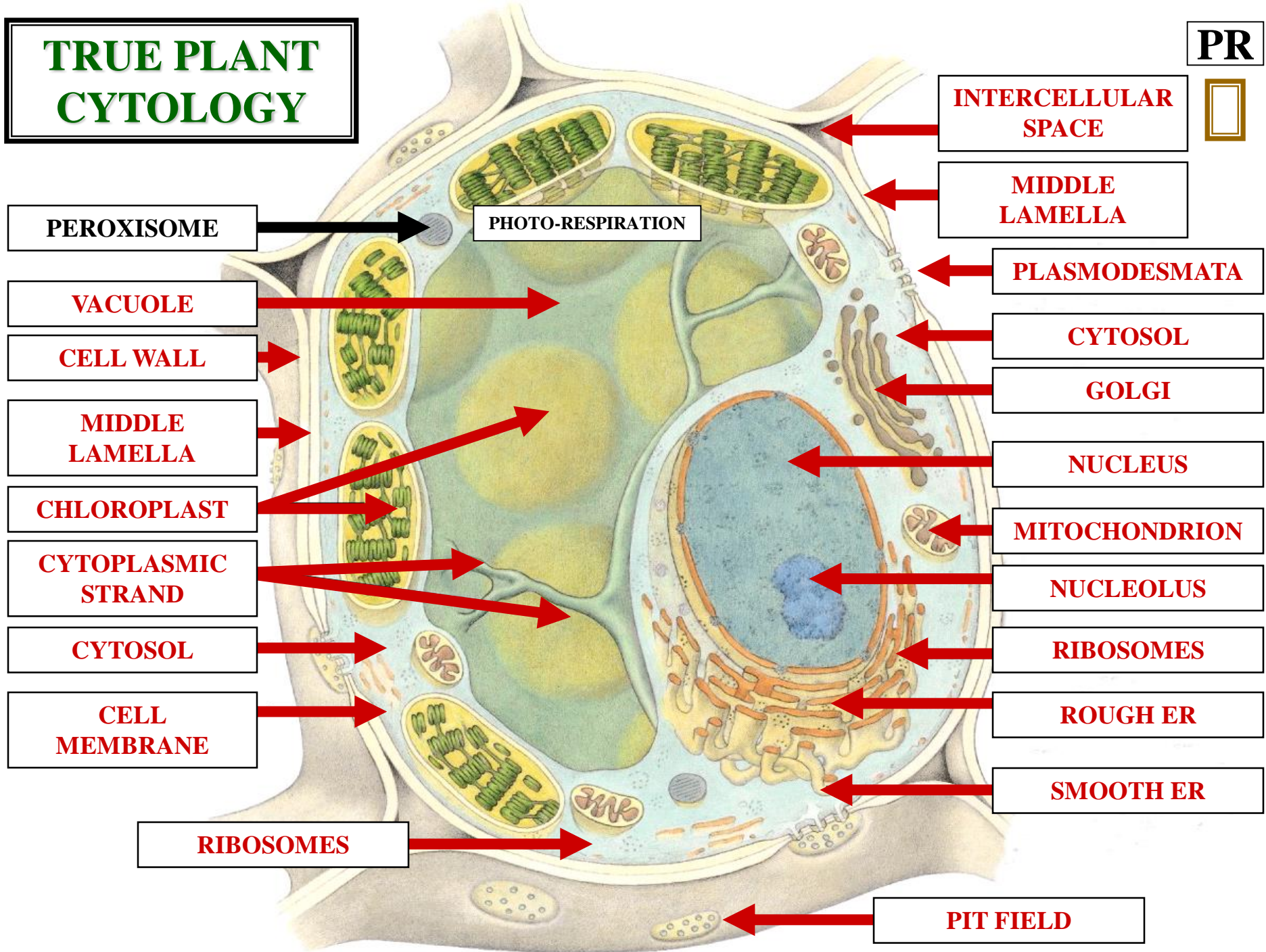
PR

+



TRUE PLANT CYTOLOGY

PR



PEROXISOME

PHOTO-RESPIRATION

INTERCELLULAR
SPACE



VACUOLE

MIDDLE
LAMELLA

CELL WALL

PLASMODESMATA

MIDDLE
LAMELLA

CYTOSOL

CHLOROPLAST

GOLGI

CYTOPLASMIC
STRAND

NUCLEUS

CYTOSOL

MITOCHONDRION

CELL
MEMBRANE

NUCLEOLUS

RIBOSOMES

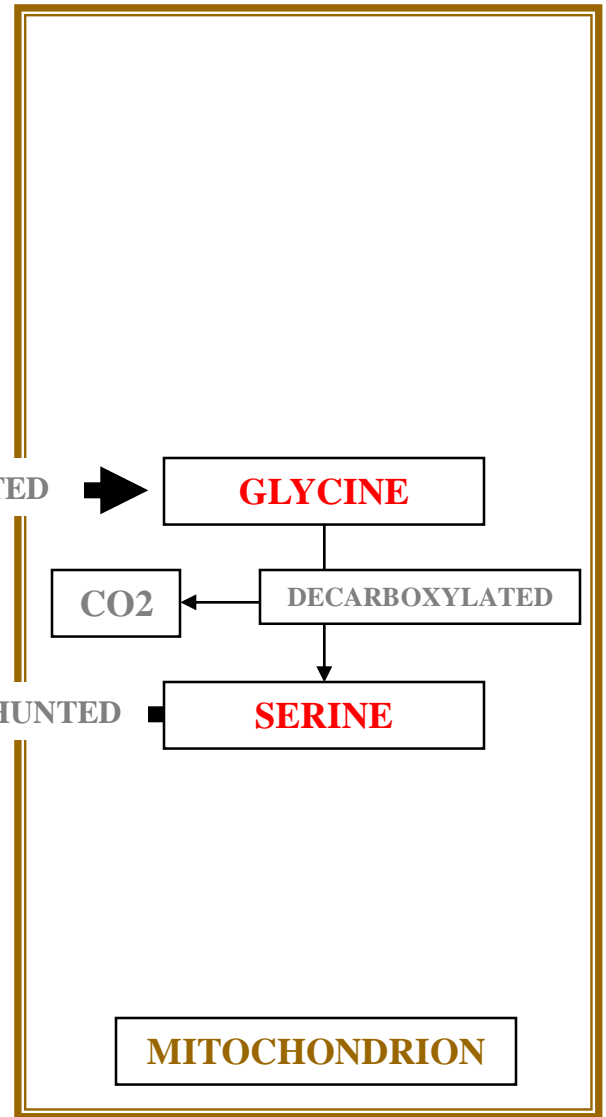
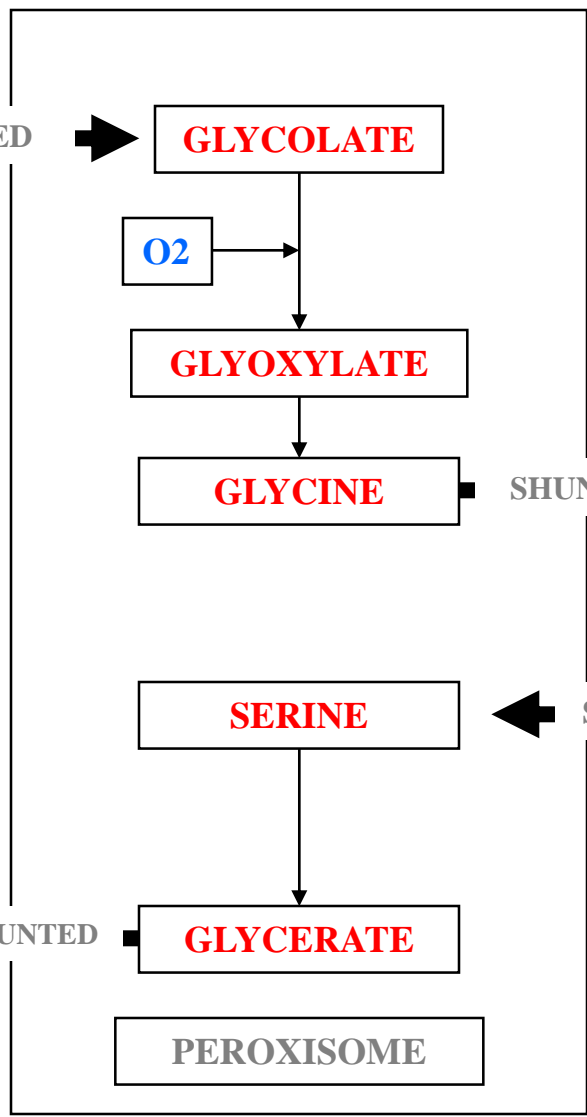
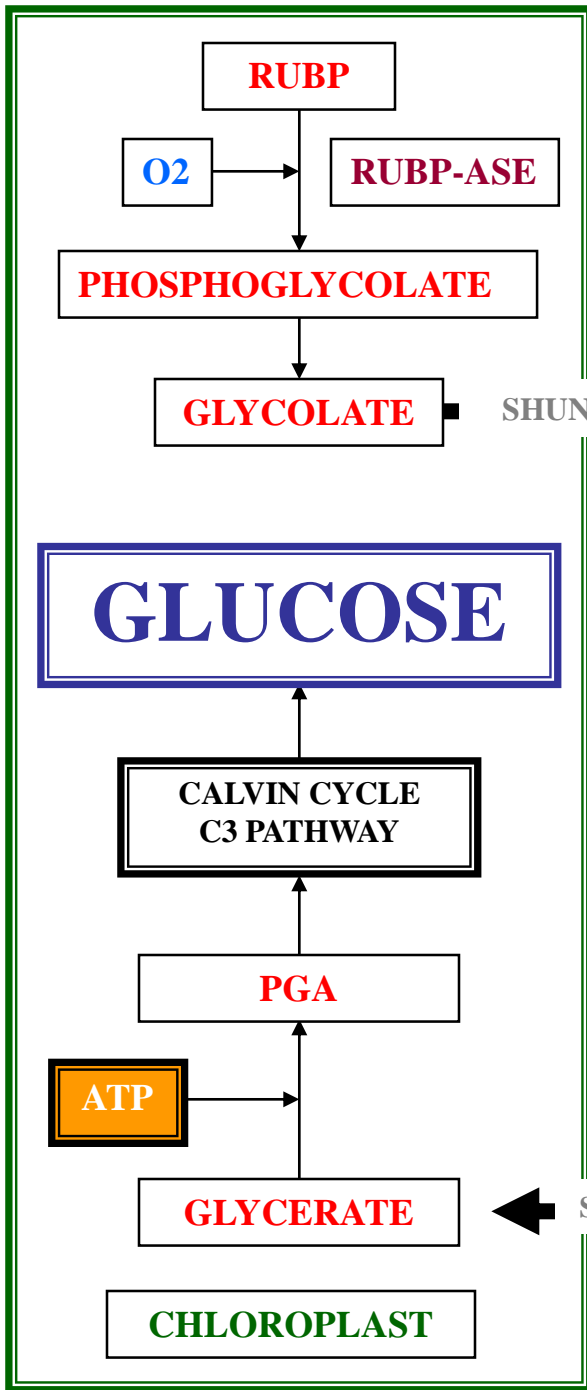
ROUGH ER

RIBOSOMES

SMOOTH ER

PIT FIELD

PHOTO-RESPIRATION



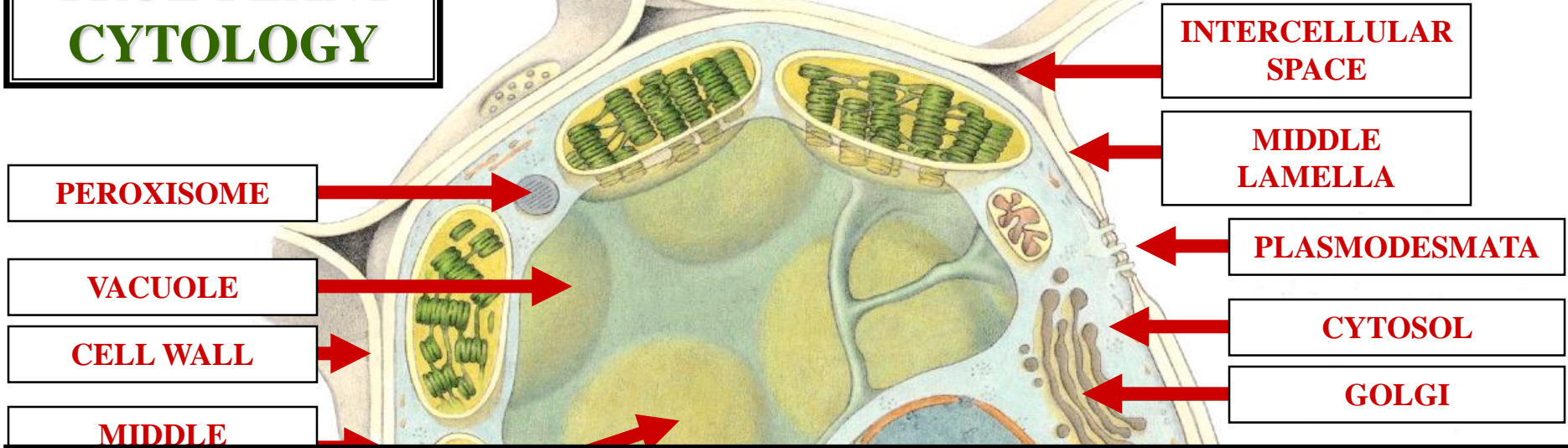
SHUNTED →

SHUNTED →

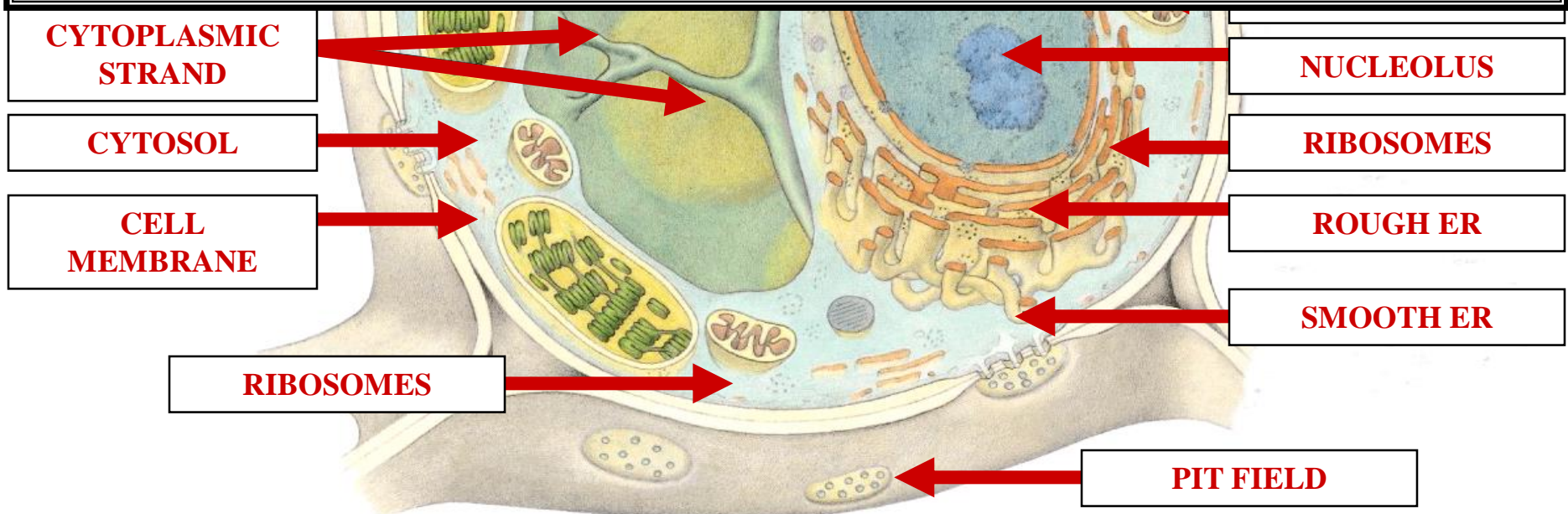
SHUNTED ←

← SHUNTED

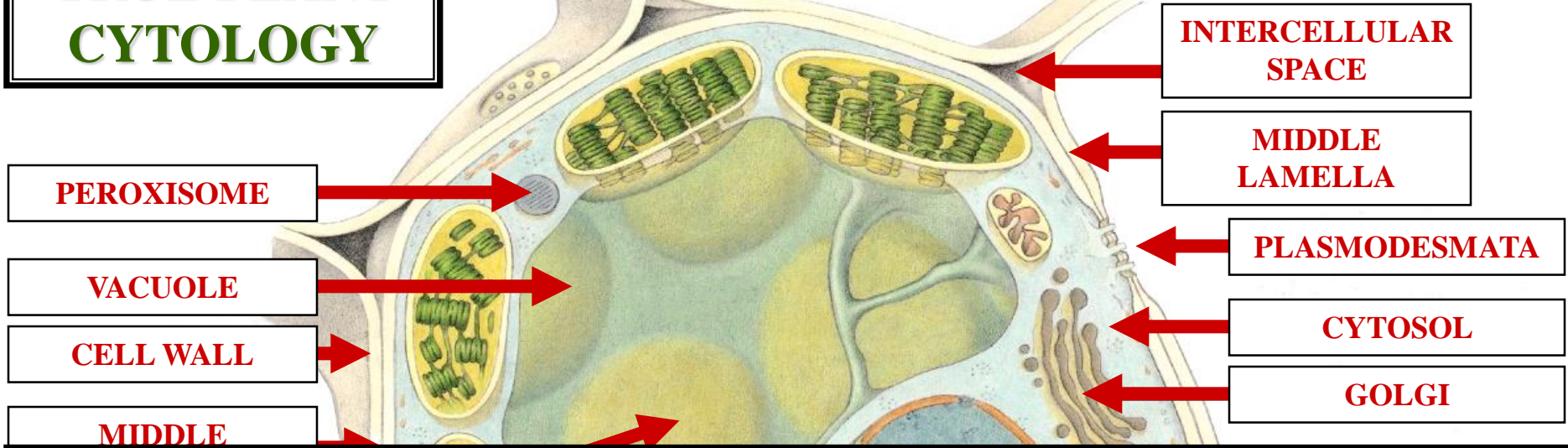
TRUE PLANT CYTOLOGY



SUMMARY



TRUE PLANT CYTOLOGY



DOUBLE-MB ORGANELLES

