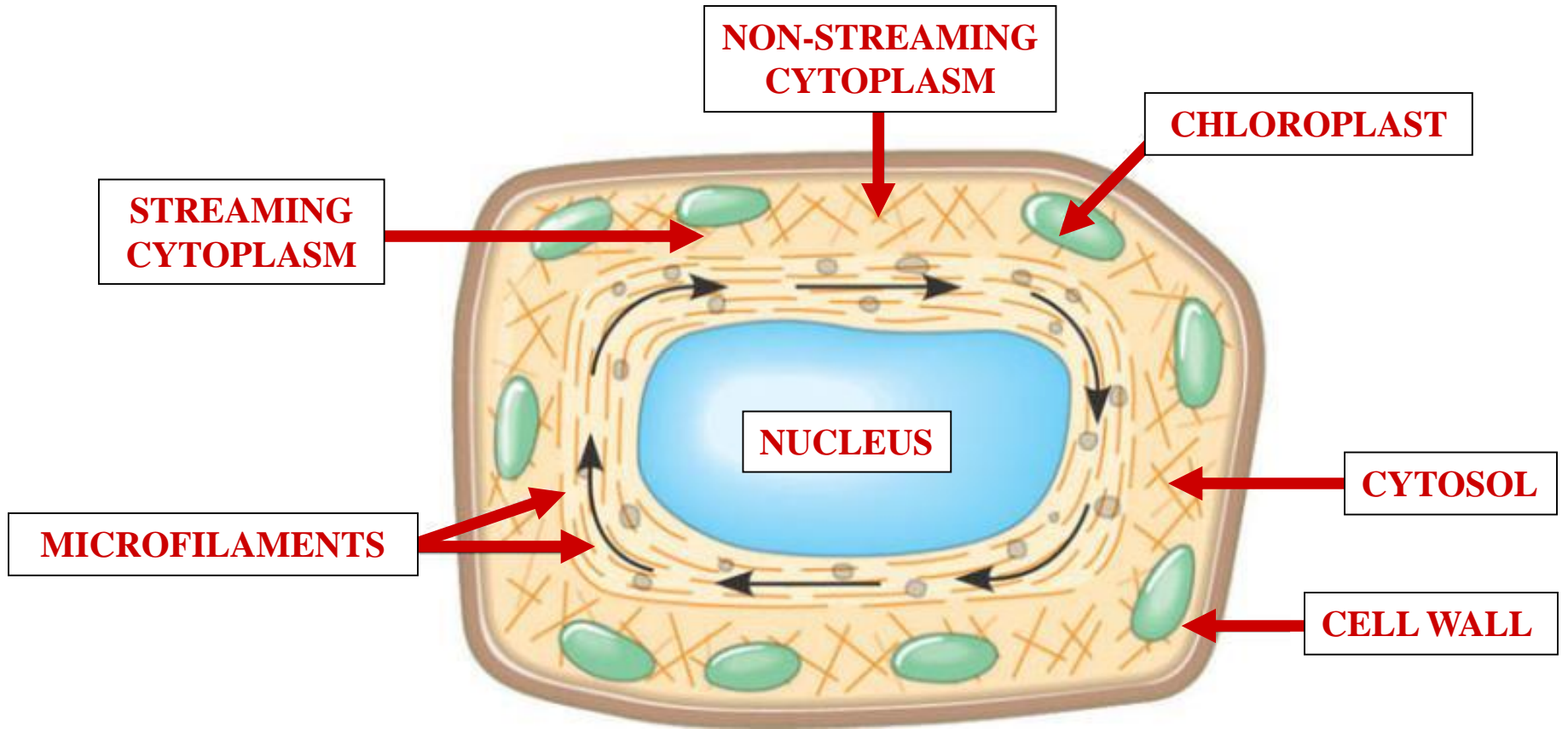


CYTOPLASMIC STREAMING



EM



CYTOPLASMIC STREAMING = CYCLOSIS

An electron micrograph showing a cross-section of a cell. The cytoplasm is filled with various organelles, including mitochondria and endoplasmic reticulum. The text is overlaid on the image in a large, bold, red, italicized font. The text reads: "CYTOPLASMIC STREAMING EQUALLY MIXES METABOLITES".

***CYTOPLASMIC
STREAMING
EQUALLY MIXES
METABOLITES***

***EFFICIENT
CELL
METABOLISM***

HOMEOSTASIS



MICROTUBULES



MICROTUBULES

HOLLOW TUBULIN TUBULES

MICROTUBULES



MICROTUBULES

HOLLOW TUBULIN TUBULES

FOUND THROUGHOUT CYTOSOL

MICROTUBULES



MICROTUBULES

HOLLOW TUBULIN TUBULES

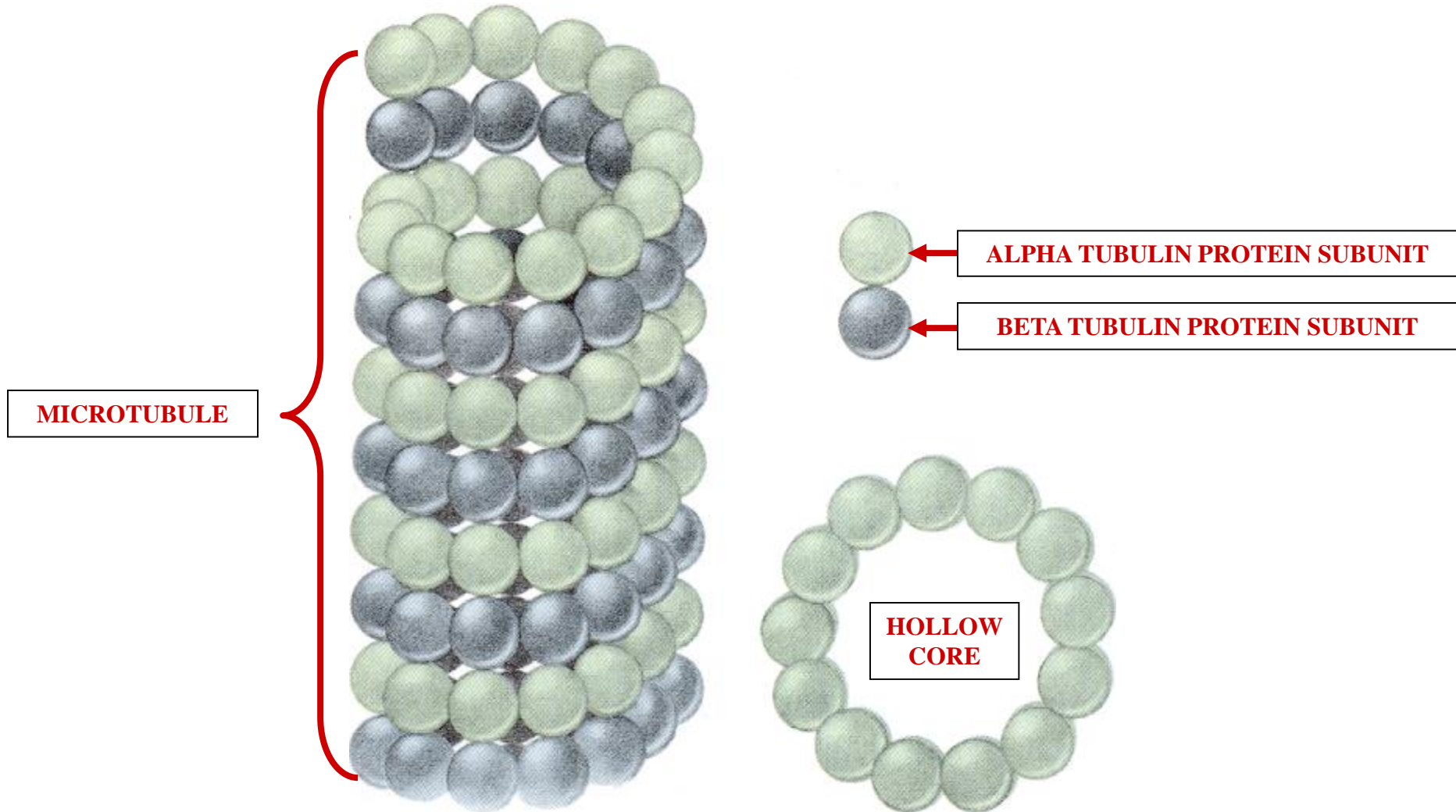
FOUND THROUGHOUT CYTOSOL

SUPPORT MICROFILAMENTS

MICROTUBULES

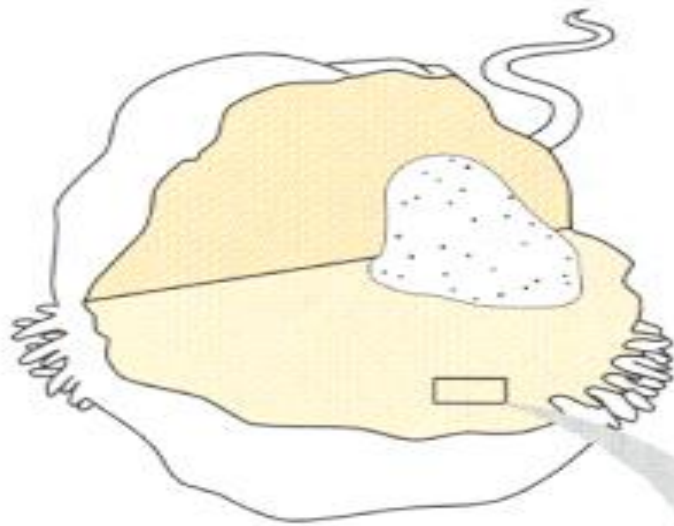


MICROTUBULE COMPOSITION



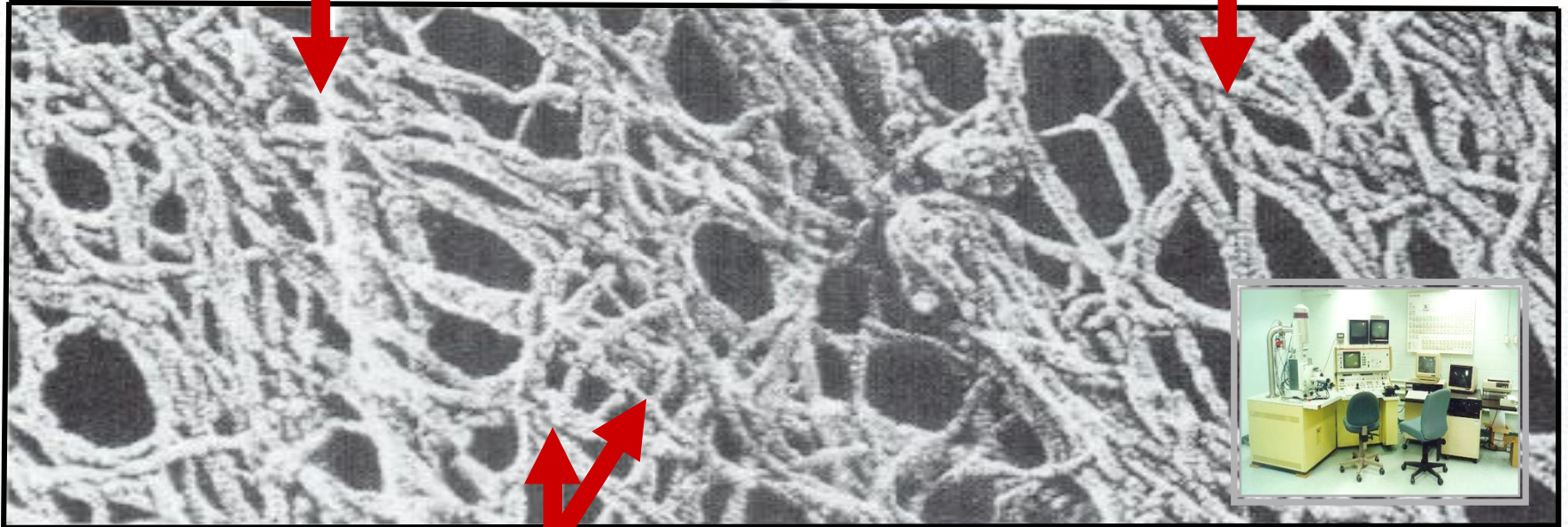


CYTOSKELETON ULTRASTRUCTURE



MICROTUBULE

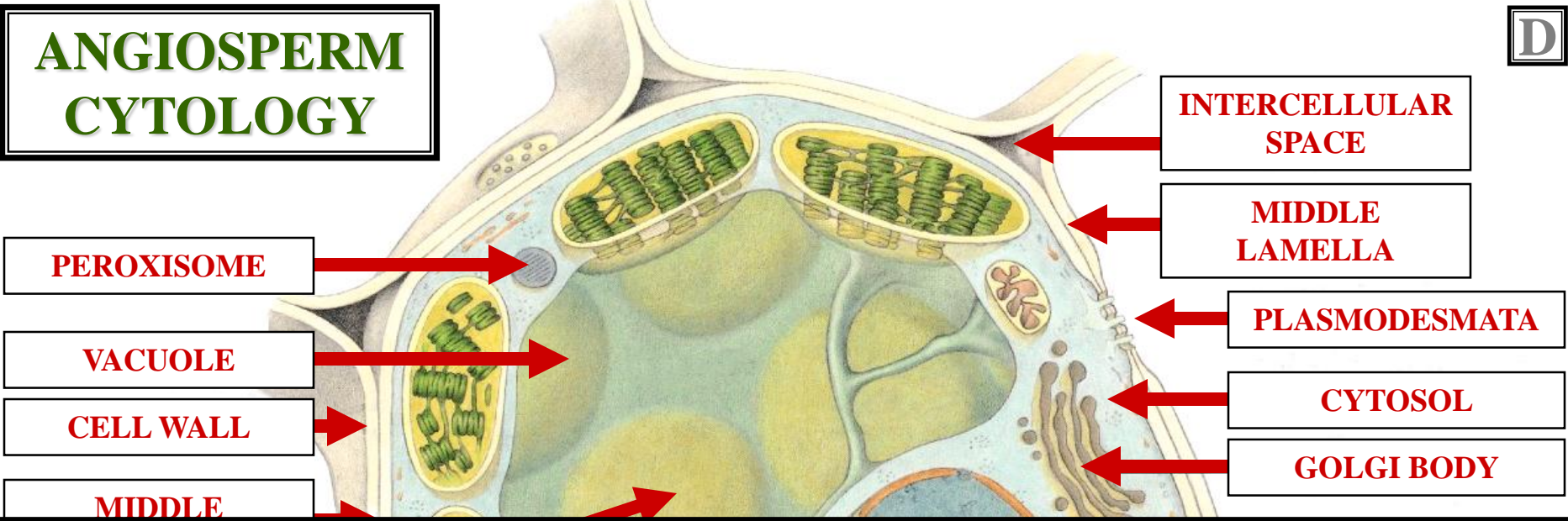
CYTOSOL



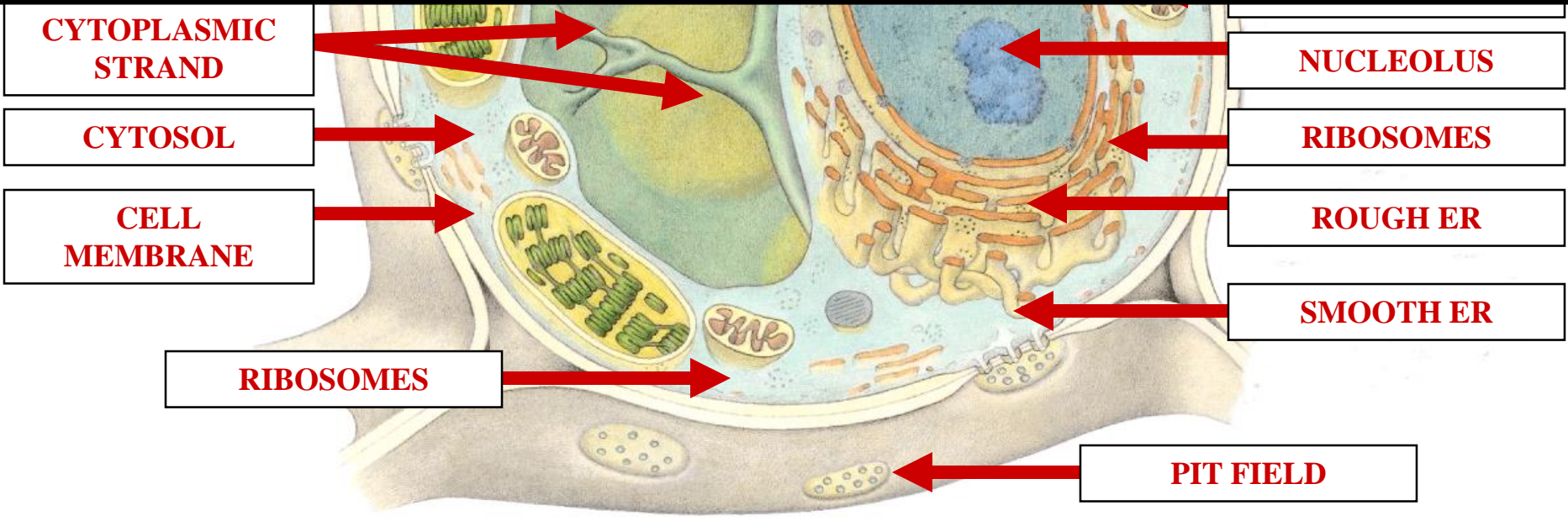
MICROFILAMENTS



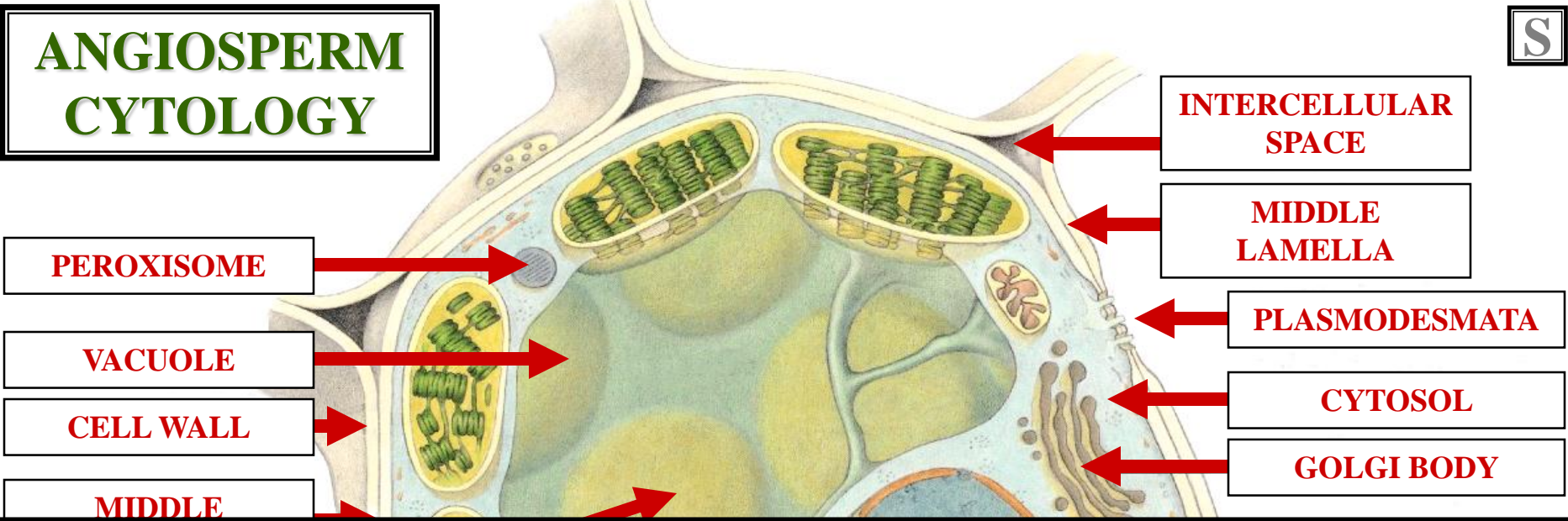
ANGIOSPERM CYTOLOGY



SUMMARY



ANGIOSPERM CYTOLOGY



PEROXISOME

VACUOLE

CELL WALL

MIDDLE

INTERCELLULAR SPACE

MIDDLE LAMELLA

PLASMODESMATA

CYTOSOL

GOLGI BODY

DOUBLE-MB ORGANELLES

CYTOPLASMIC STRAND

CYTOSOL

CELL MEMBRANE

RIBOSOMES

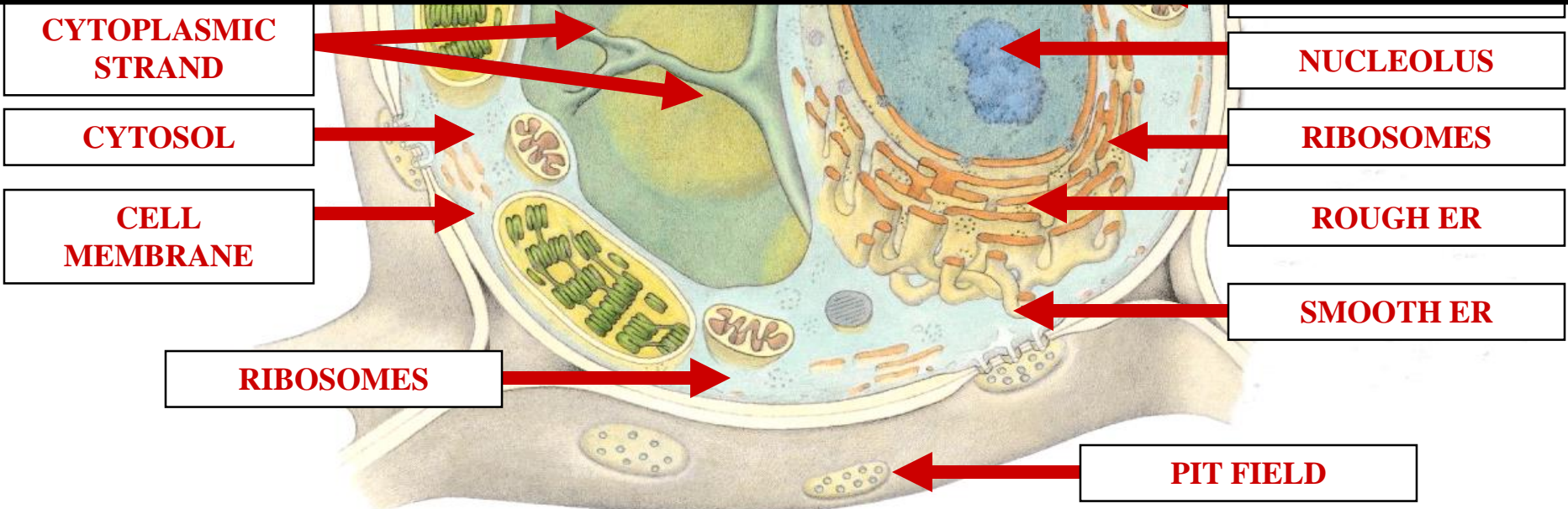
NUCLEOLUS

RIBOSOMES

ROUGH ER

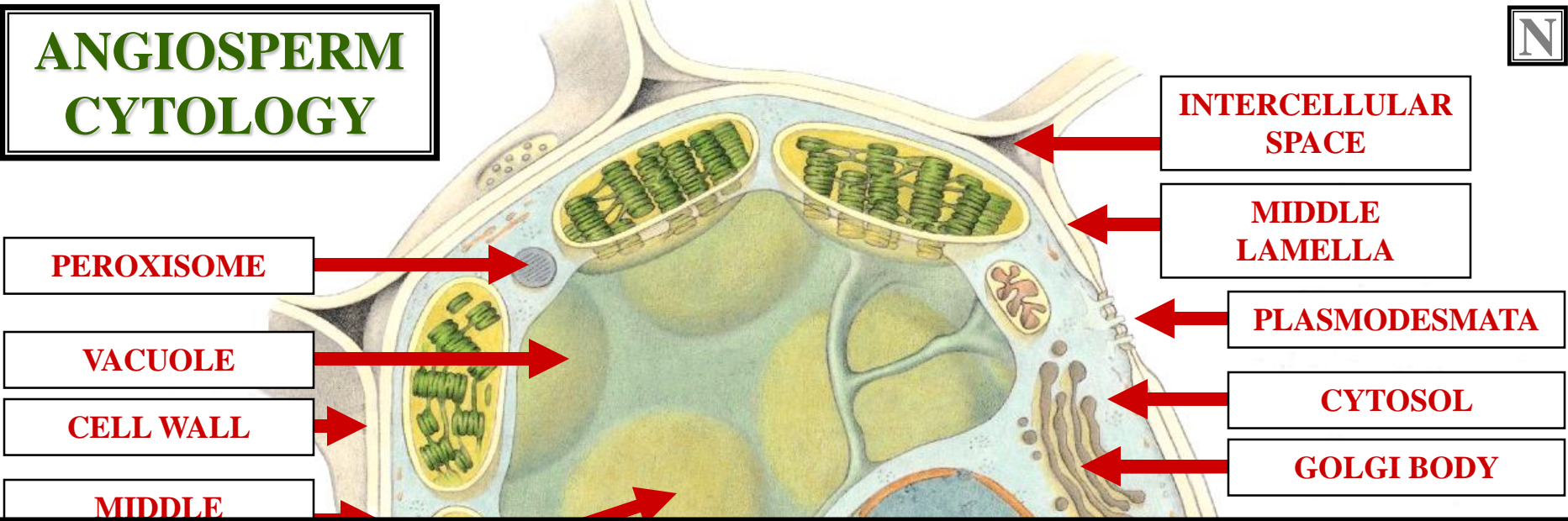
SMOOTH ER

PIT FIELD





ANGIOSPERM CYTOLOGY



PEROXISOME

VACUOLE

CELL WALL

MIDDLE

INTERCELLULAR SPACE

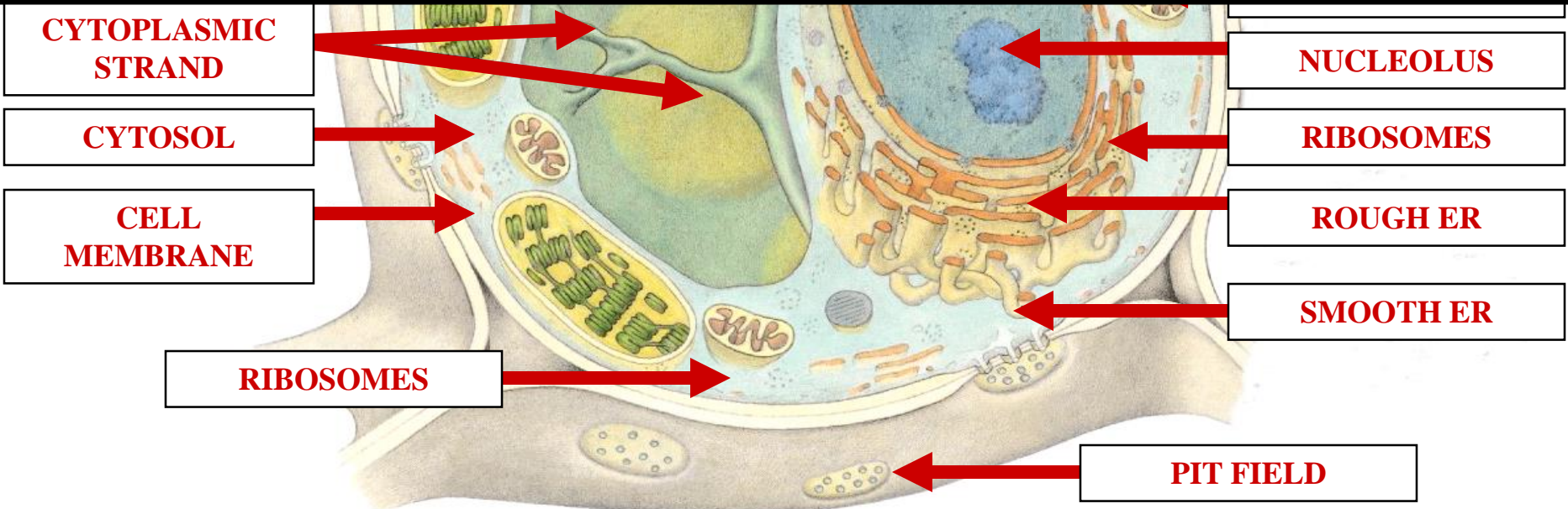
MIDDLE LAMELLA

PLASMODESMATA

CYTOSOL

GOLGI BODY

SINGLE-MB ORGANELLES



CYTOPLASMIC STRAND

CYTOSOL

CELL MEMBRANE

RIBOSOMES

NUCLEOLUS

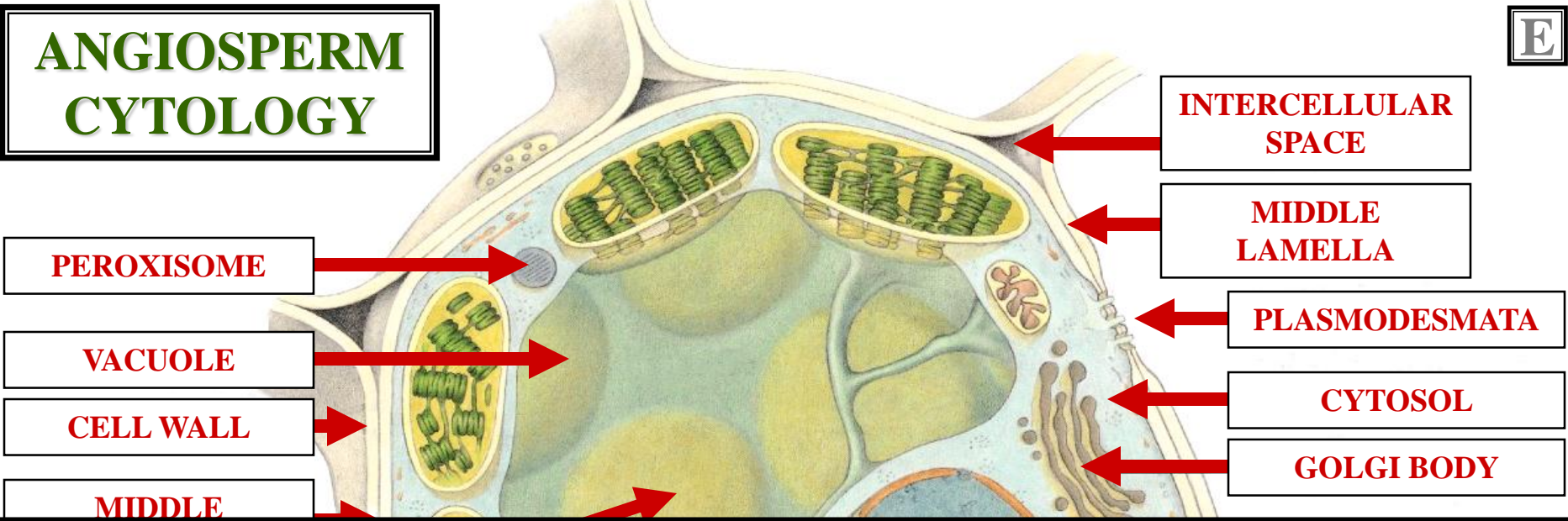
RIBOSOMES

ROUGH ER

SMOOTH ER

PIT FIELD

ANGIOSPERM CYTOLOGY



PEROXISOME

VACUOLE

CELL WALL

MIDDLE

INTERCELLULAR SPACE

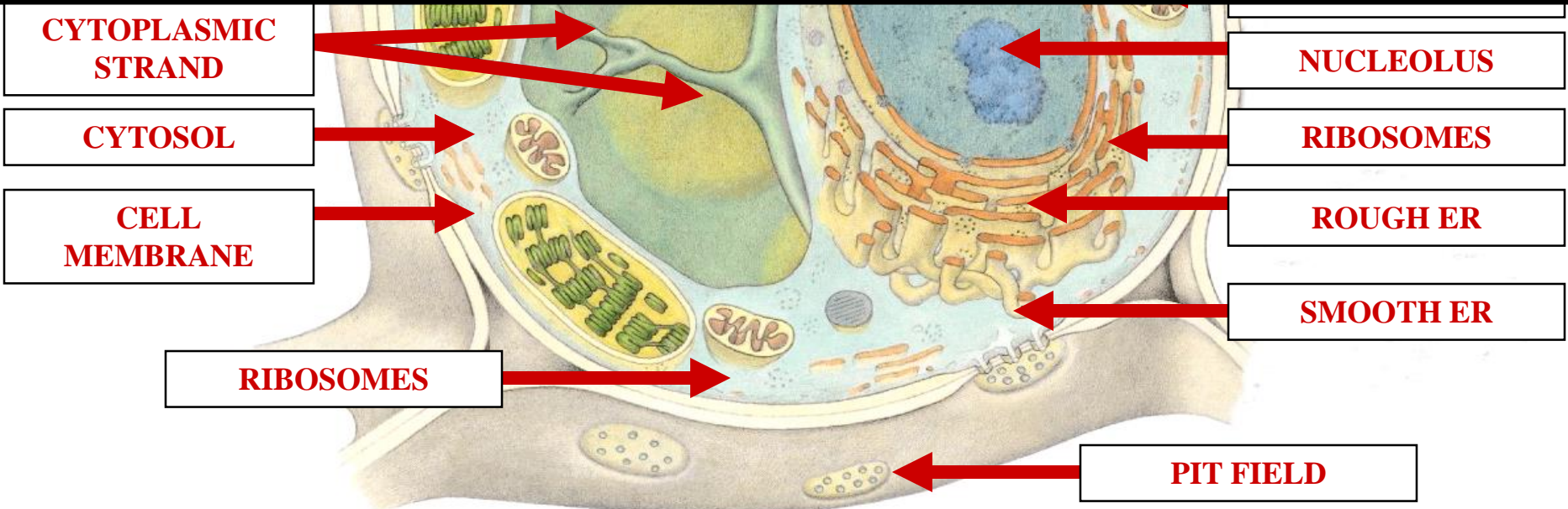
MIDDLE LAMELLA

PLASMODESMATA

CYTOSOL

GOLGI BODY

NON-MB ORGANELLE



CYTOPLASMIC STRAND

CYTOSOL

CELL MEMBRANE

RIBOSOMES

NUCLEOLUS

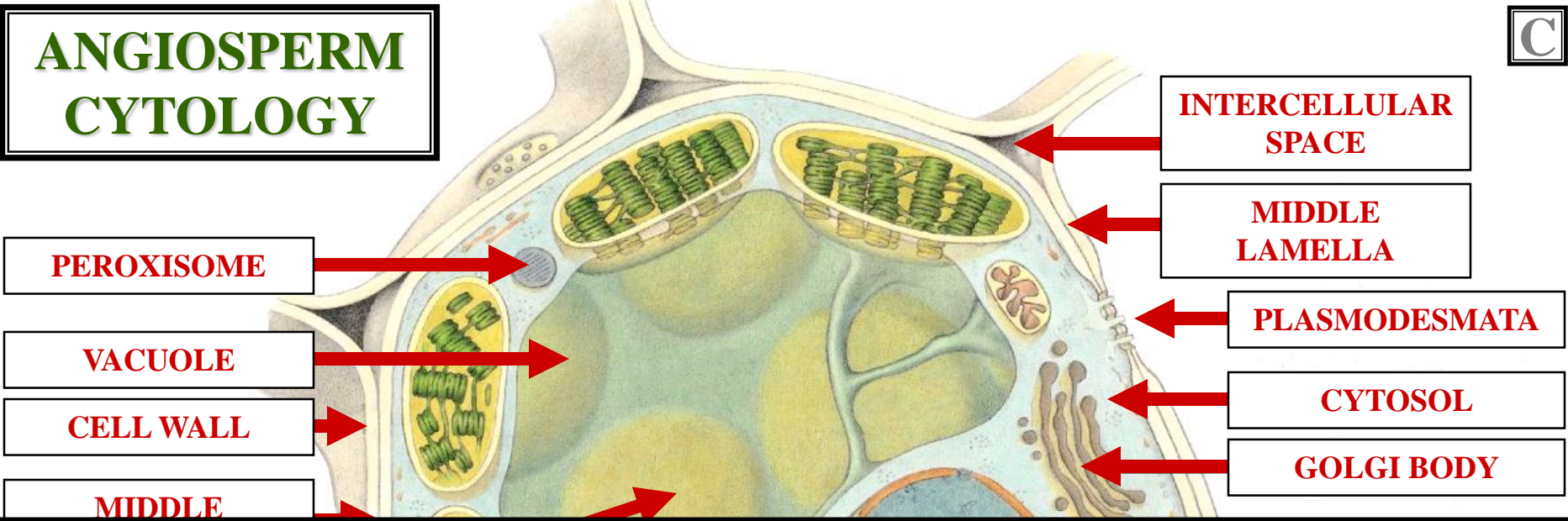
RIBOSOMES

ROUGH ER

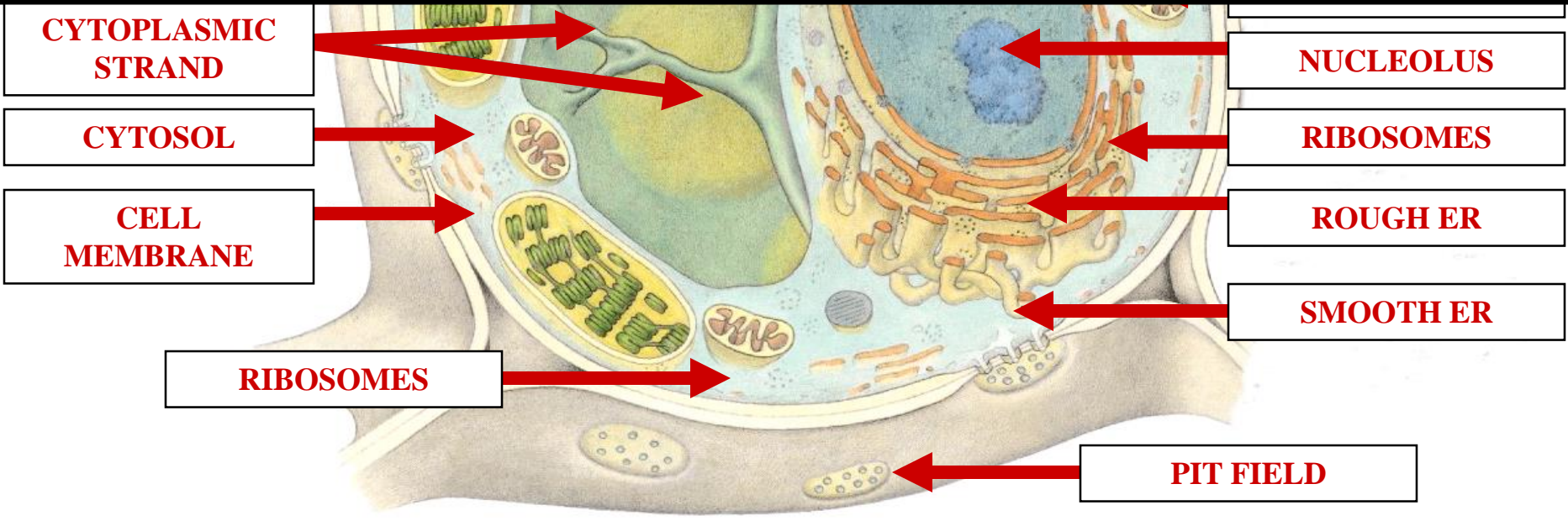
SMOOTH ER

PIT FIELD

ANGIOSPERM CYTOLOGY



ENDO-MEMBRANE SYSTEM



ANGIOSPERM CYTOLOGY

PEROXISOME

VACUOLE

CELL WALL

MIDDLE

INTERCELLULAR
SPACE

MIDDLE
LAMELLA

PLASMODESMATA

CYTOSOL

GOLGI BODY

CYTOSKELETON

CYTOPLASMIC
STRAND

CYTOSOL

CELL
MEMBRANE

NUCLEOLUS

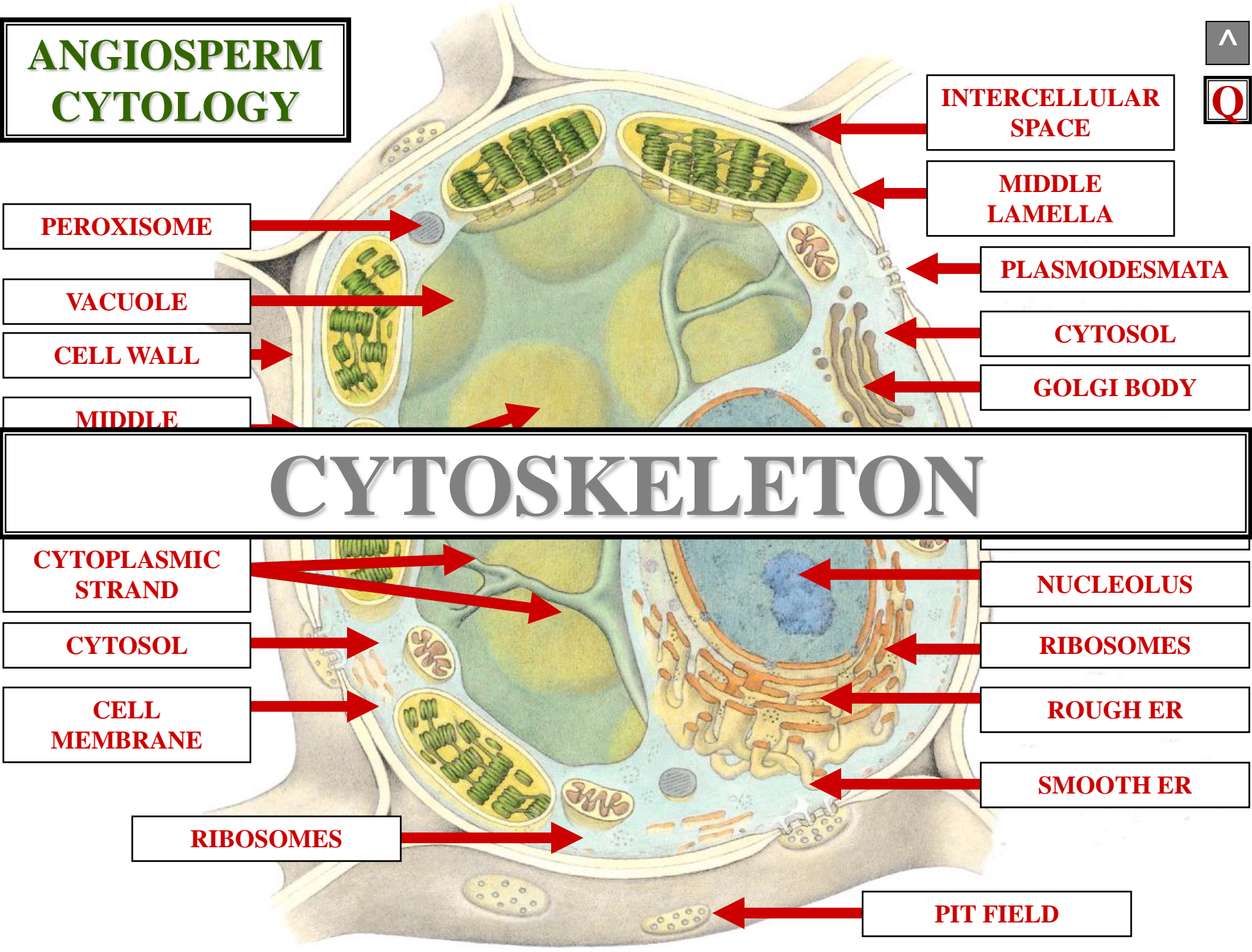
RIBOSOMES

ROUGH ER

SMOOTH ER

RIBOSOMES

PIT FIELD



LECTURE QUIZ

**LECTURE QUIZ
WEDNESDAY
16 MARCH**

LECTURE QUIZ

ANGIOSPERM CYTOLOGY QUIZ

LECTURE QUIZ

**FORMAT
FILL IN
QUESTIONS**

LECTURE QUIZ

**MUST
SPELL CORRECTLY
FOR FULL CREDIT**

**DOUBLE
MEMBRANE
BOUND
ORGANELLE
EVOLUTION**



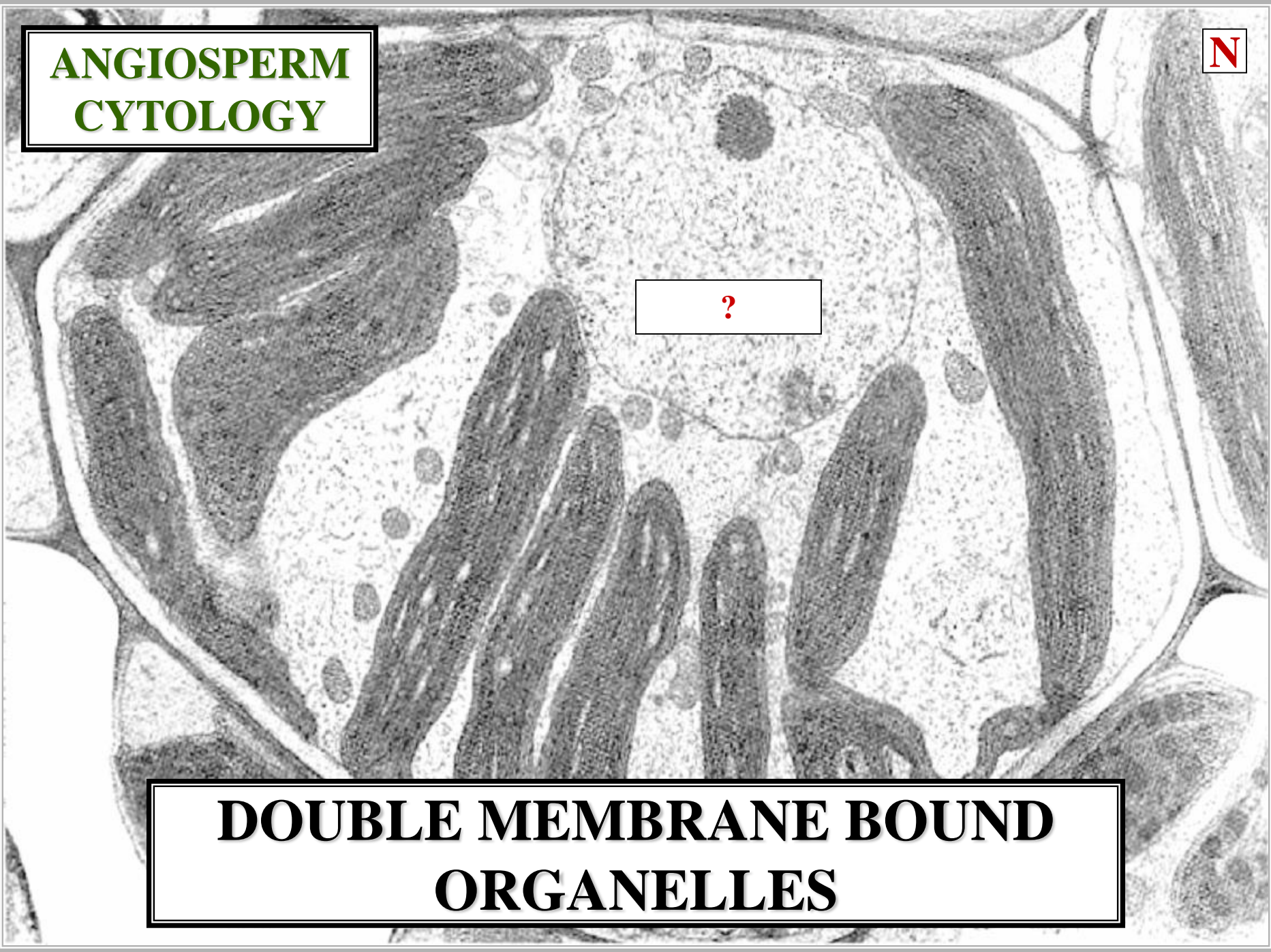
**DOUBLE
MEMBRANE
BOUND
ORGANELLE
REVIEW**

**ANGIOSPERM
CYTOLOGY**

N

?

**DOUBLE MEMBRANE BOUND
ORGANELLES**



An electron micrograph of an angiosperm cell. The image shows a large, roughly circular nucleus in the center, surrounded by several elongated, dark, and textured chloroplasts. The cytoplasm is filled with various organelles and granules. The cell wall is visible at the periphery. A small question mark icon is located in the top right corner.

**ANGIOSPERM
CYTOLOGY**

NUCLEUS

**DOUBLE MEMBRANE BOUND
ORGANELLES**

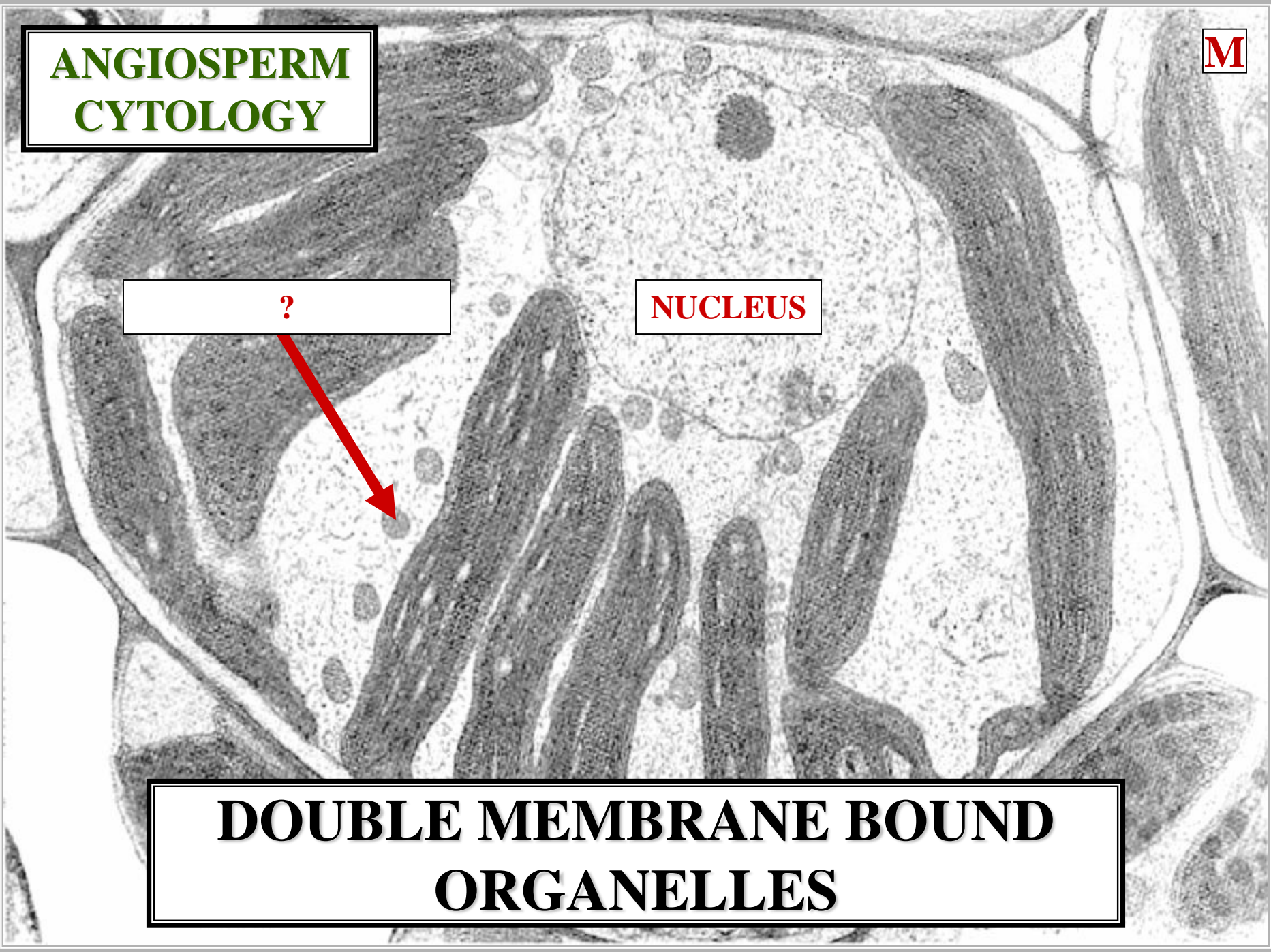
**ANGIOSPERM
CYTOLOGY**

M

?

NUCLEUS

**DOUBLE MEMBRANE BOUND
ORGANELLES**



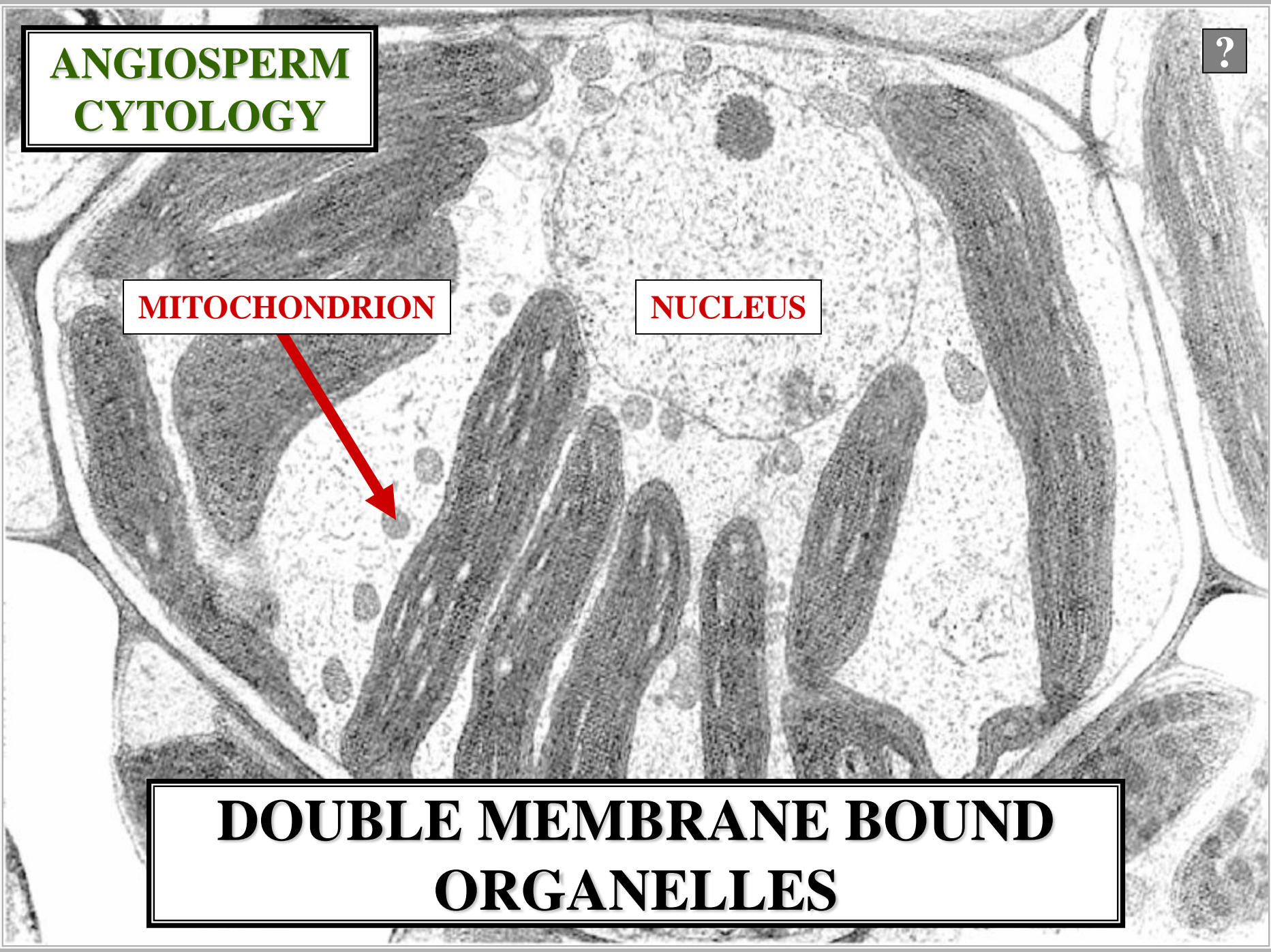
**ANGIOSPERM
CYTOLOGY**

?

MITOCHONDRION

NUCLEUS

**DOUBLE MEMBRANE BOUND
ORGANELLES**



**ANGIOSPERM
CYTOLOGY**

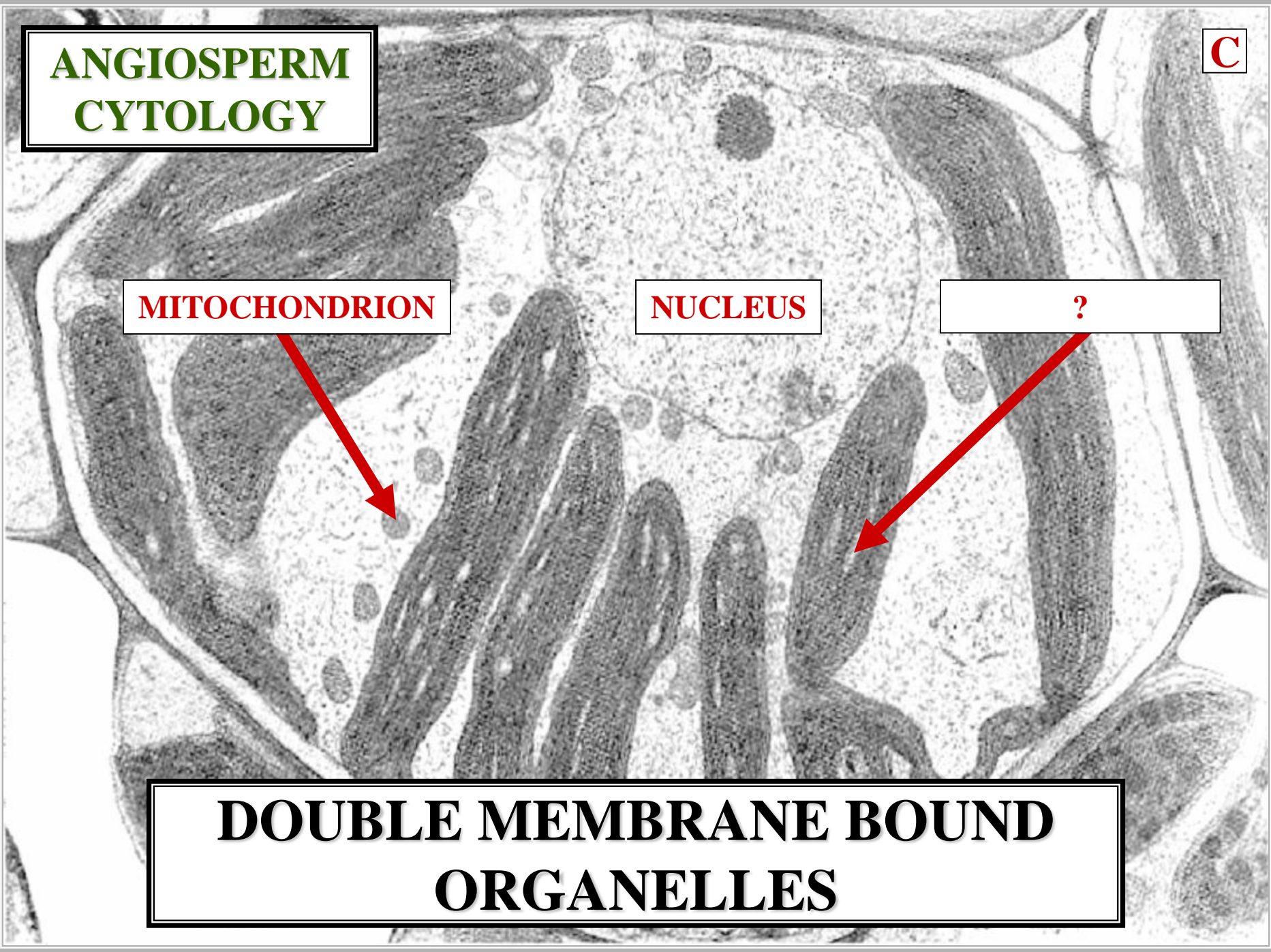
C

MITOCHONDRION

NUCLEUS

?

**DOUBLE MEMBRANE BOUND
ORGANELLES**



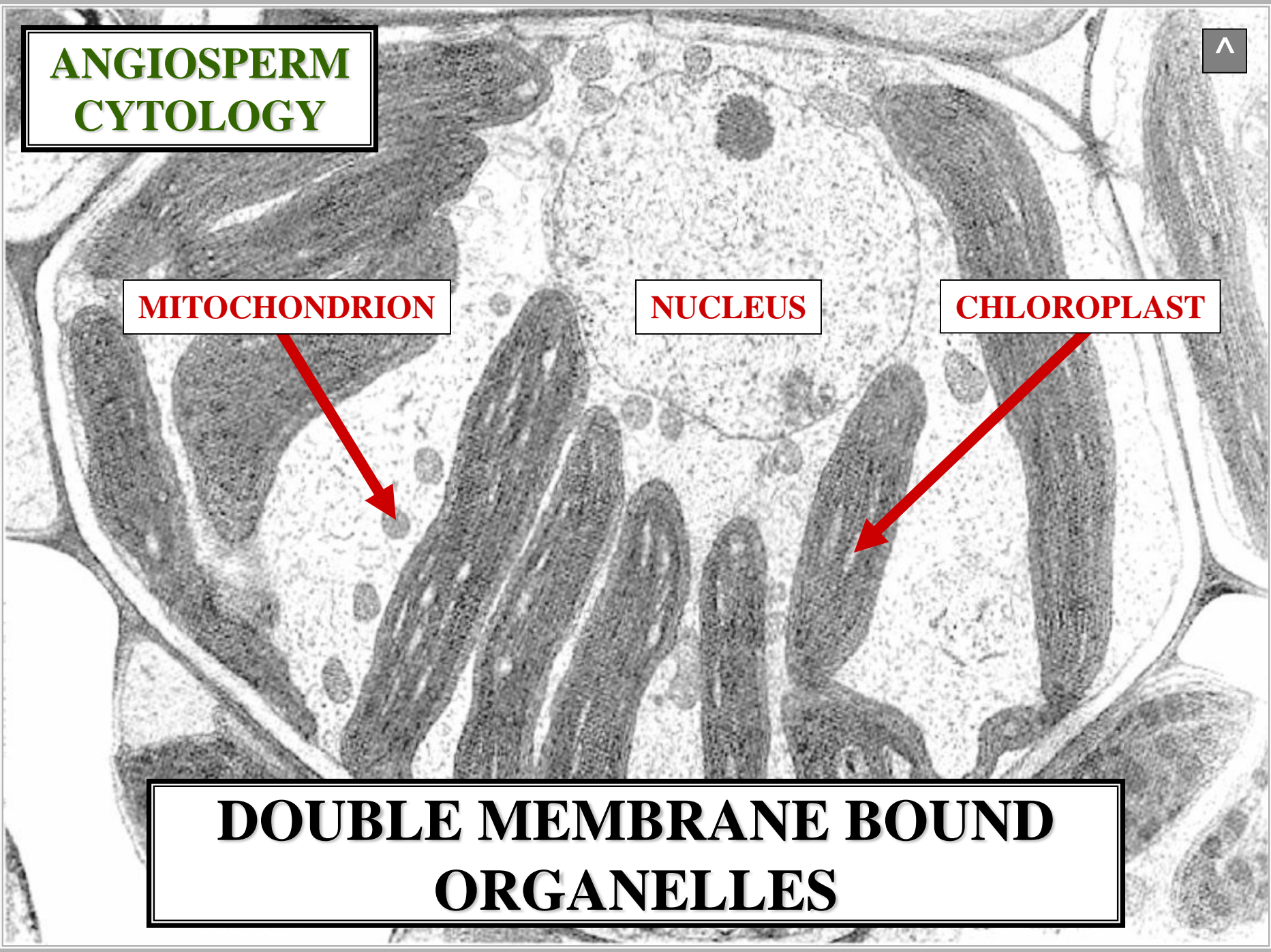
ANGIOSPERM CYTOLOGY

MITOCHONDRION

NUCLEUS

CHLOROPLAST

**DOUBLE MEMBRANE BOUND
ORGANELLES**



AUTOGENOUS THEORY

AUTOGENOUS THEORY

AUTOGENOUS THEORY



NUCLEUS EVOLUTION

AUTOGENOUS THEORY

AUTOGENOUS THEORY



VIA PROKARYOTE MEMBRANE SPECALIZATION

AUTOGENOUS THEORY

An electron micrograph of a plant cell. The image shows several large, dark, oval-shaped chloroplasts with internal membrane structures (grana). A large, light-colored nucleus is visible in the upper central region. The cytoplasm is filled with various organelles and granules. The cell wall is visible as a thin, dark line.

**ANGIOSPERM
CYTOLOGY**

NUCLEUS

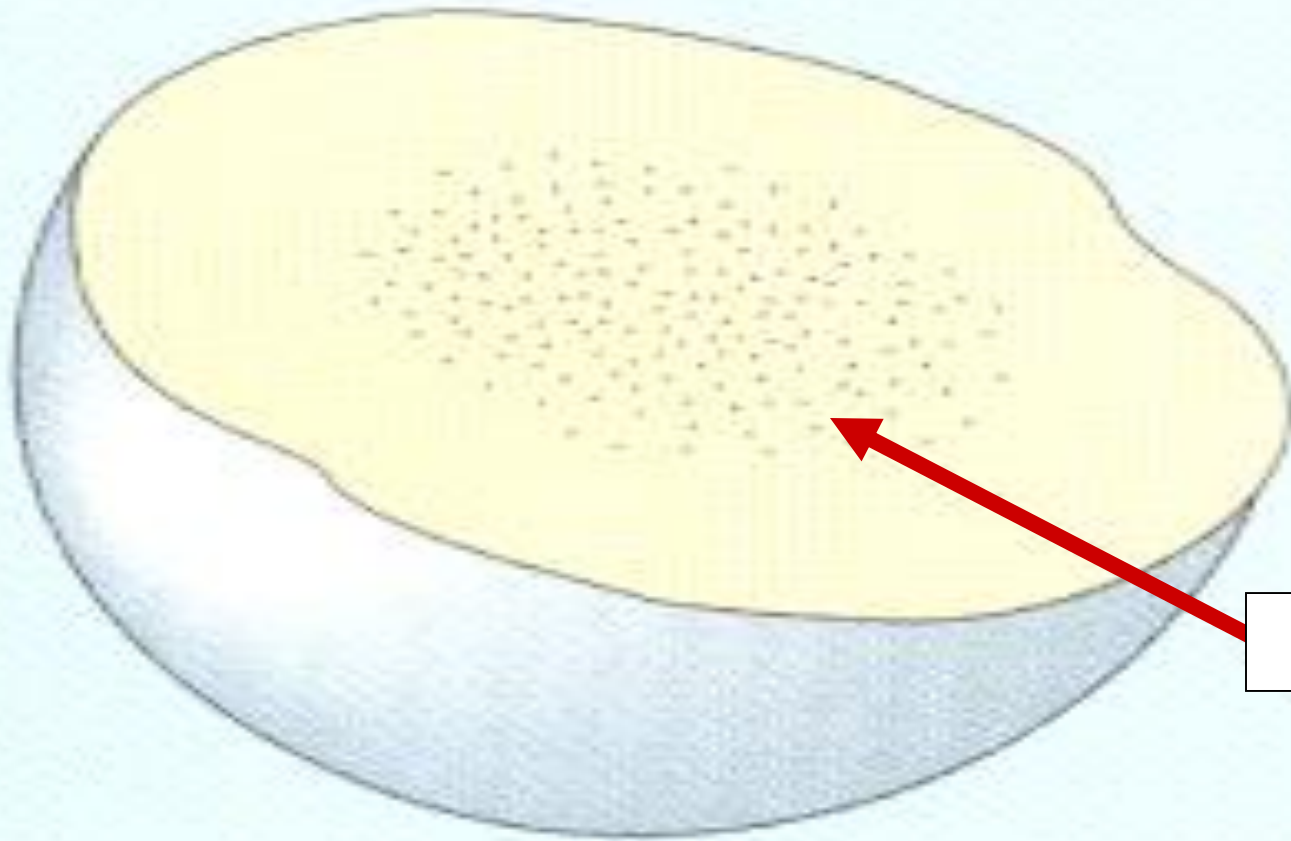
**AUTOGENOUS
THEORY**



NUCLEUS EVOLUTION



NUCLEUS EVOLUTION SCENARIO



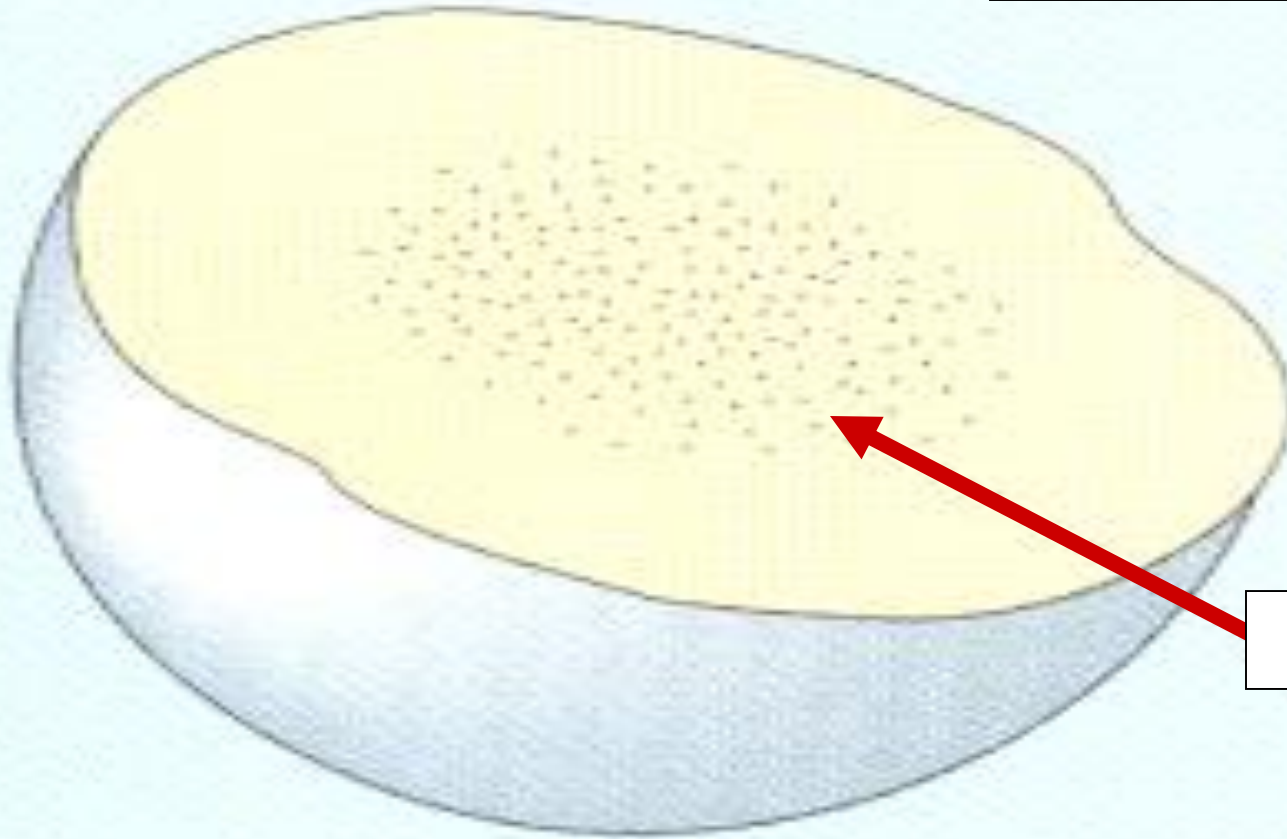
DNA

ANCESTRAL PROKARYOTE

NU

AB

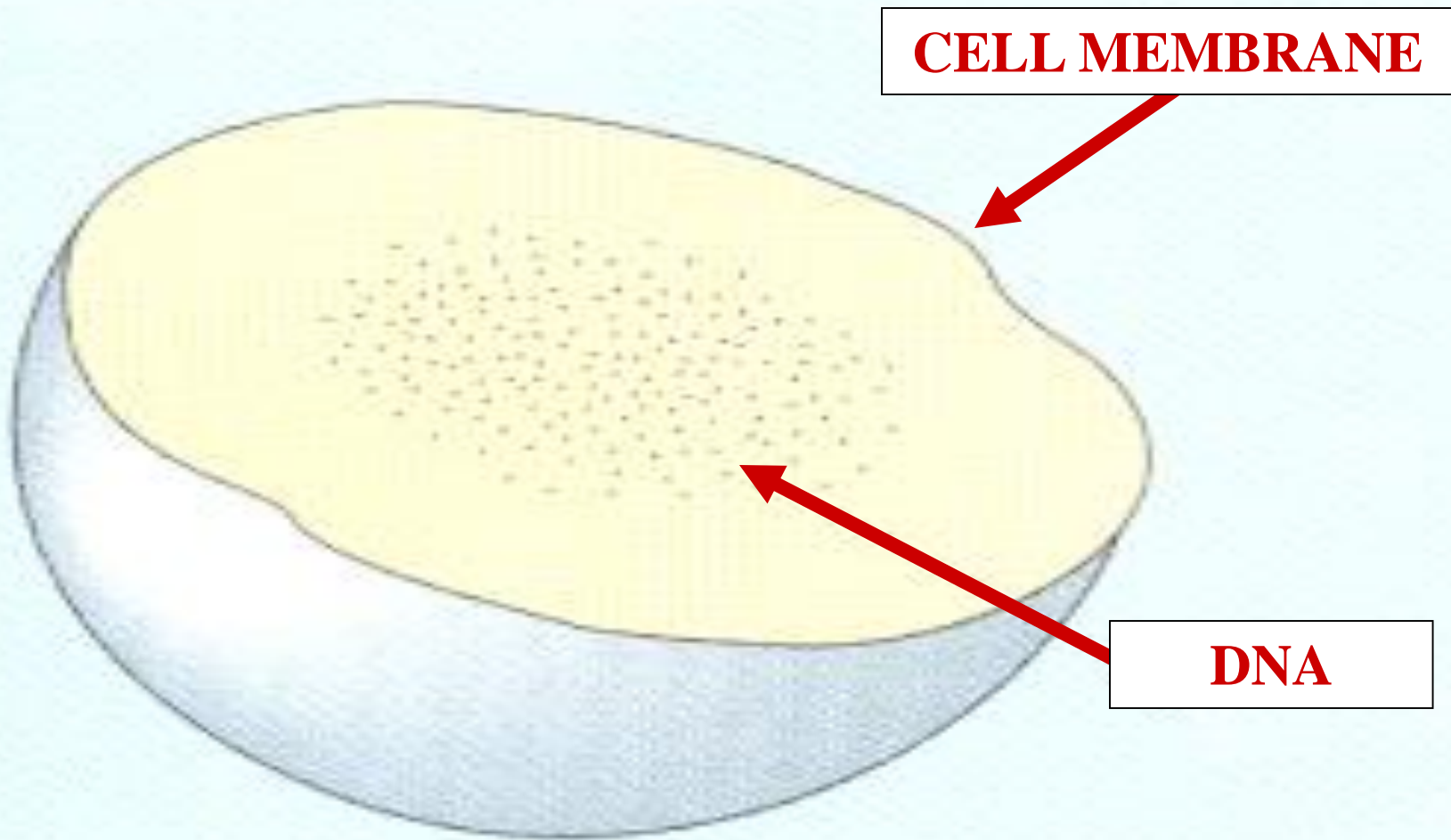
NUCLEUS: ABSENT



DNA

ANCESTRAL PROKARYOTE

CM



CELL MEMBRANE

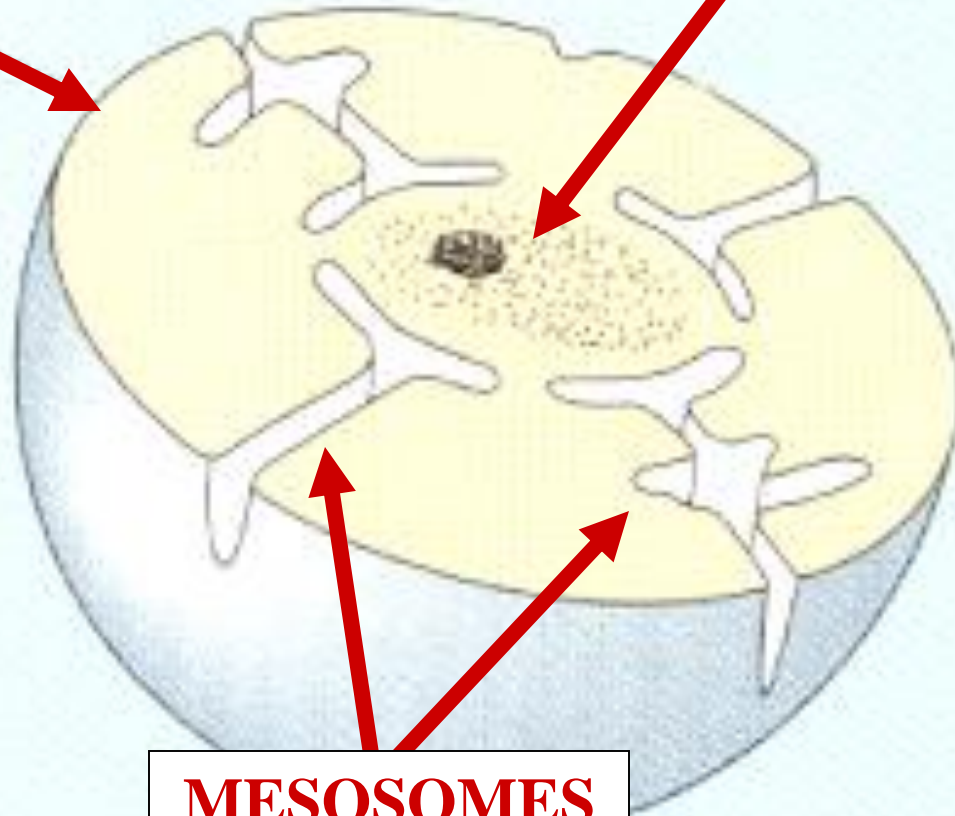
DNA

ANCESTRAL PROKARYOTE

M

CELL MEMBRANE

DNA



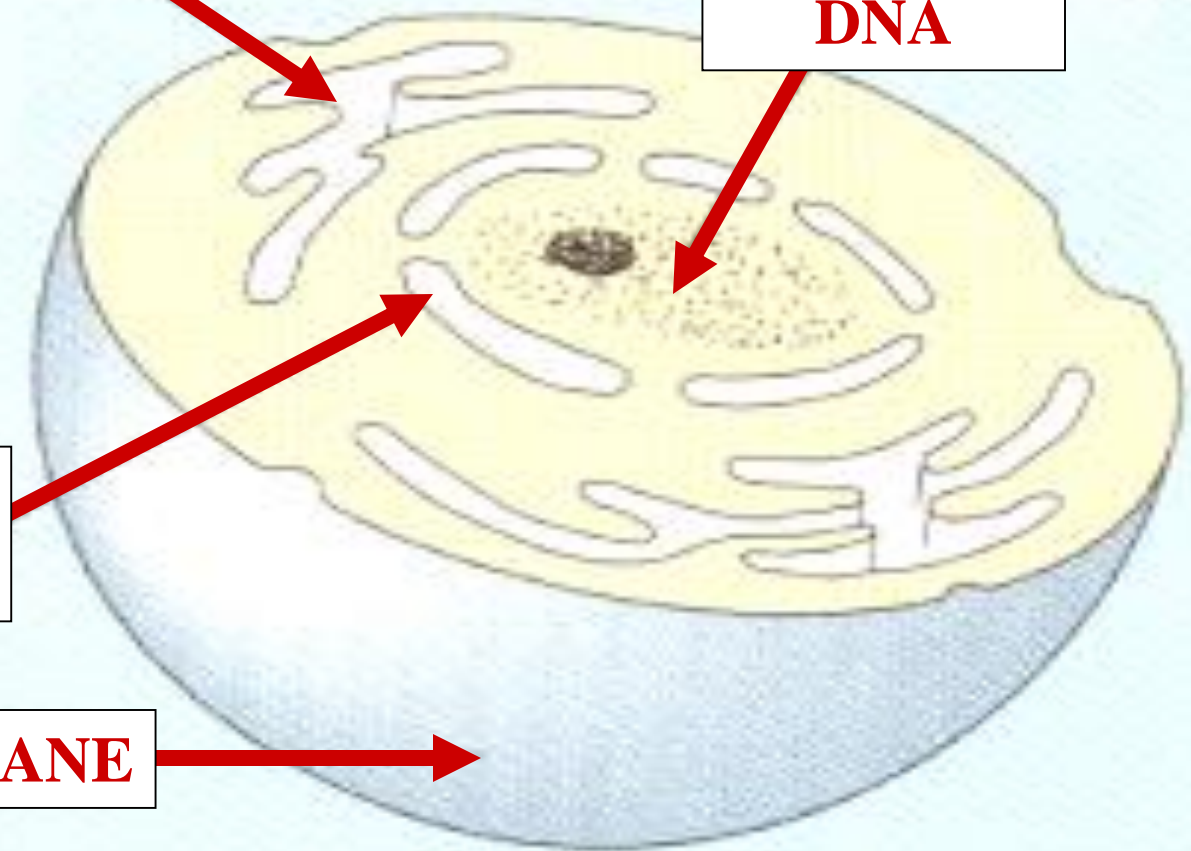
MESOSOMES

ANCESTRAL PROKARYOTE

IM

INTERNAL MEMBRANE

DNA



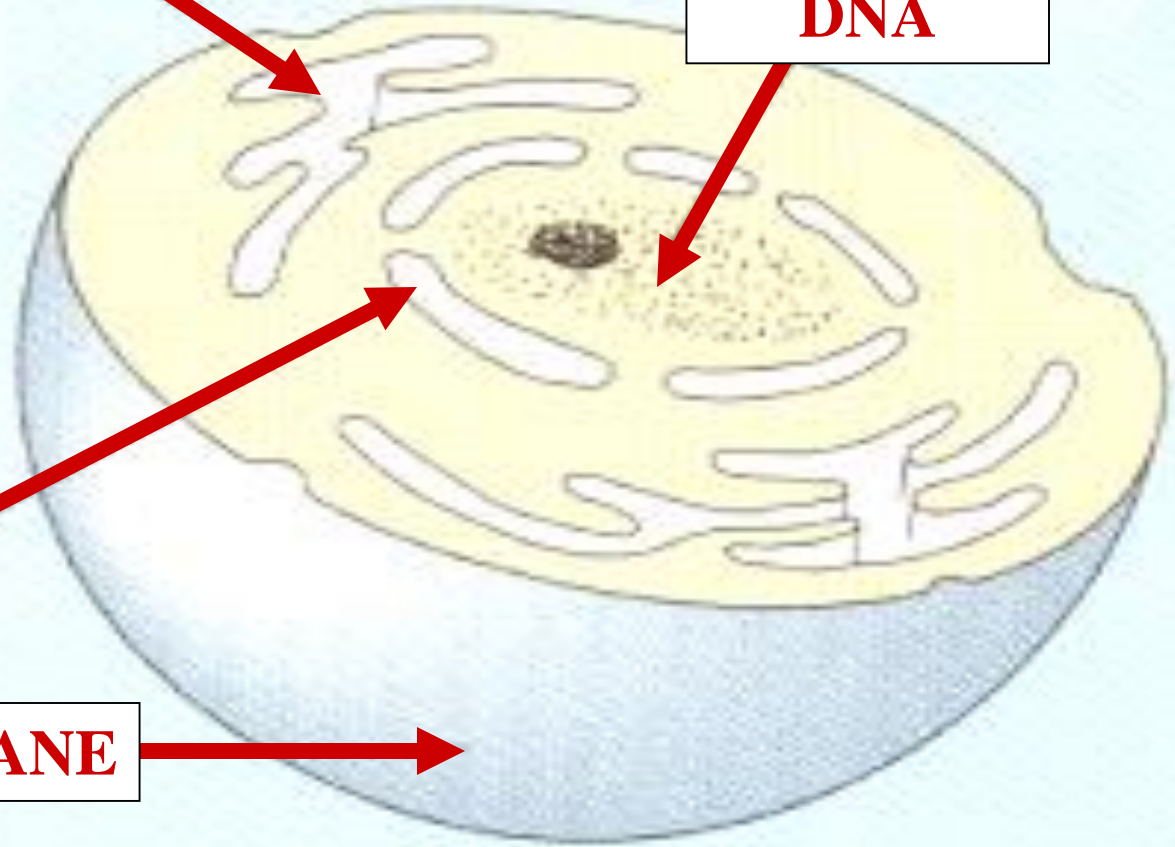
CELL MEMBRANE

ANCESTRAL PROKARYOTE

ER

ENDOPLASMIC RETICULUM

DNA



CELL MEMBRANE

ANCESTRAL PROKARYOTE

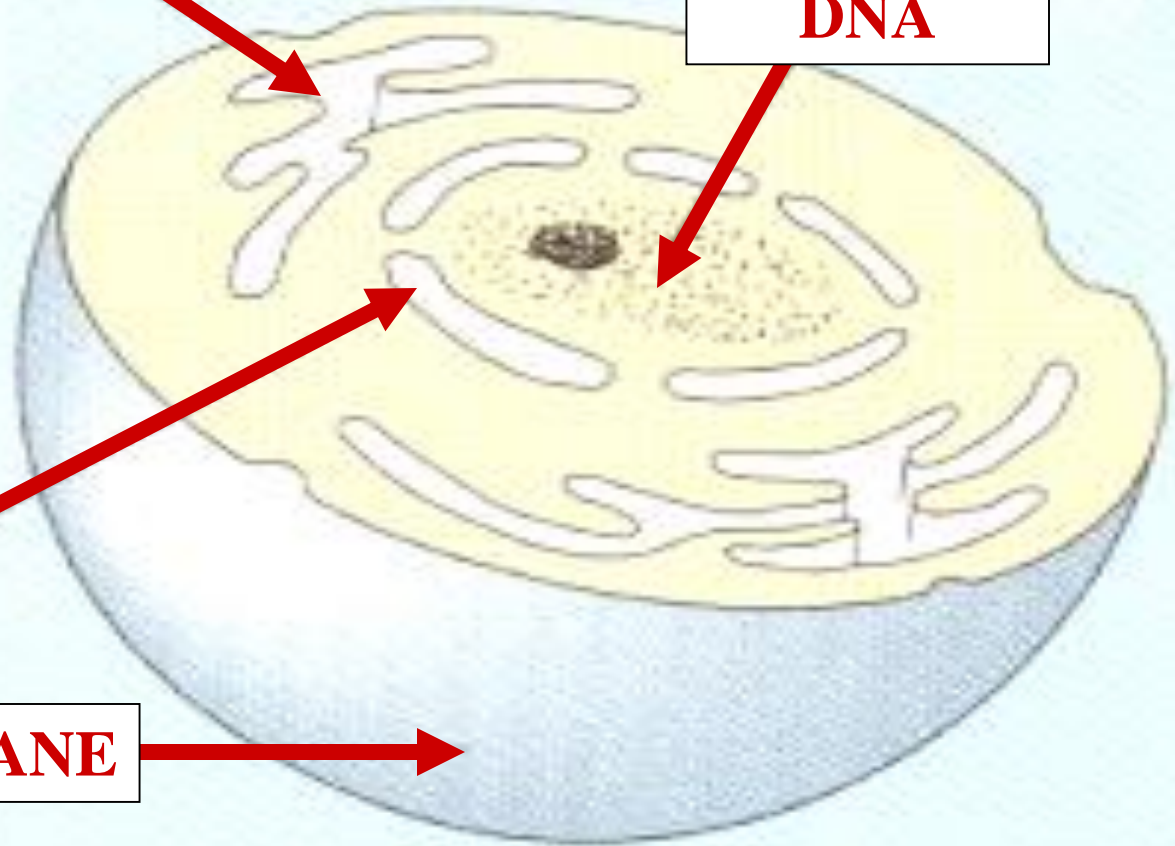
NM

ENDOPLASMIC RETICULUM

DNA

**NUCLEAR
MEMBRANE**

CELL MEMBRANE



ANCESTRAL PROKARYOTE

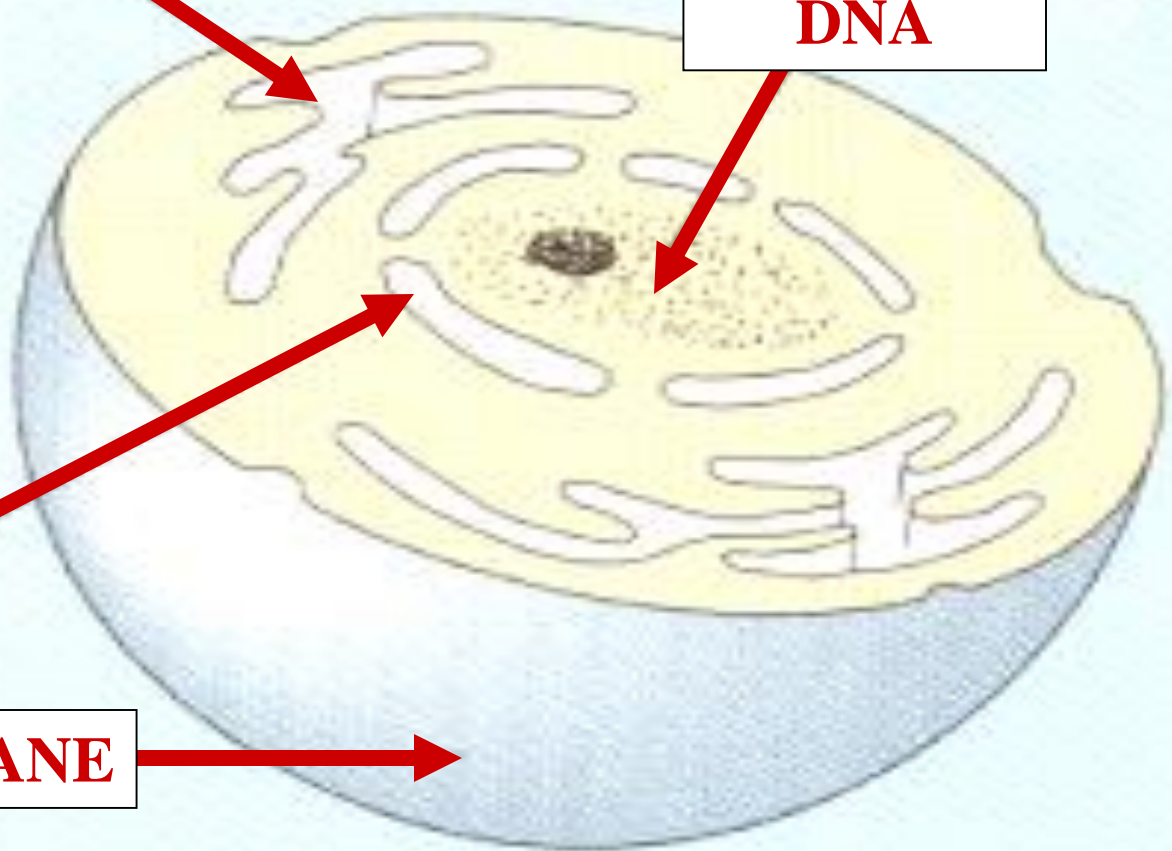
AT

ENDOPLASMIC RETICULUM

DNA

NUCLEAR MEMBRANE

CELL MEMBRANE



AUTOGENOUS THEORY

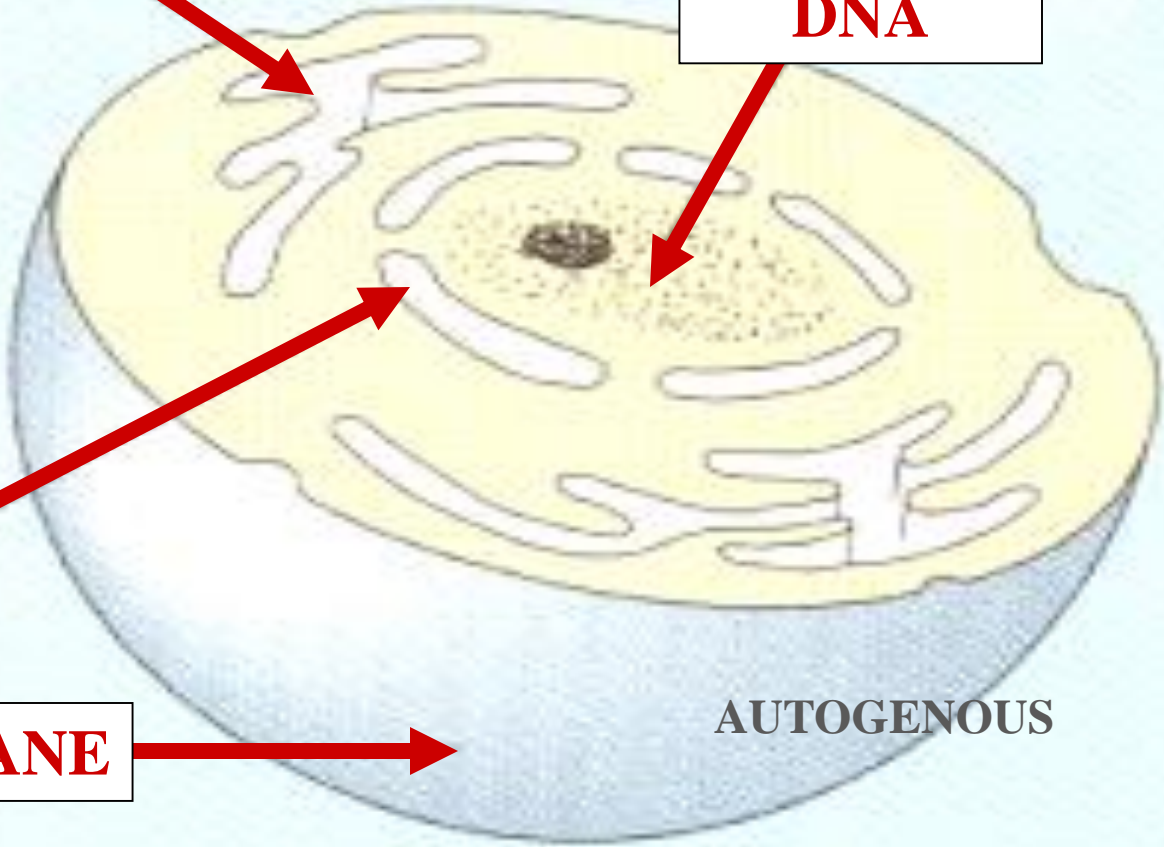


ENDOPLASMIC RETICULUM

DNA

NUCLEAR MEMBRANE

CELL MEMBRANE



AUTOGENOUS

AUTOGENOUS THEORY

ENDOPLASMIC RETICULUM



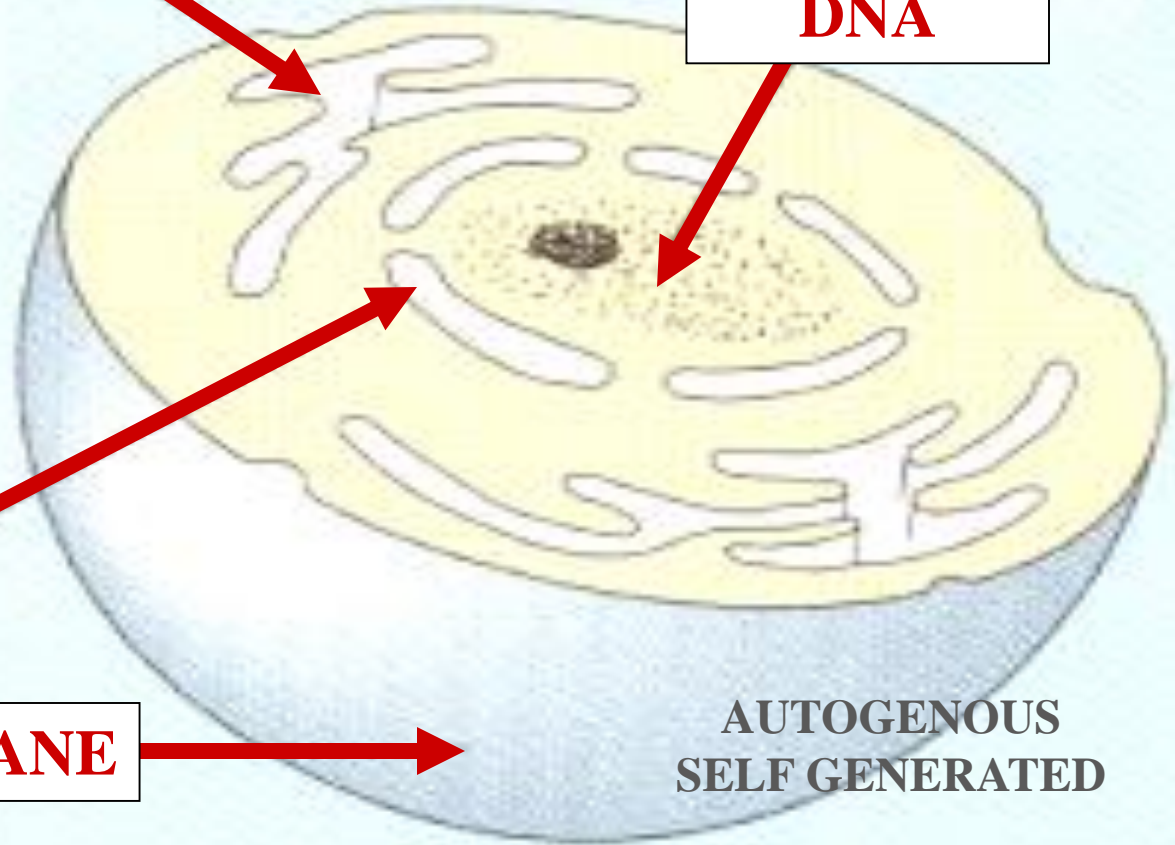
DNA

**NUCLEAR
MEMBRANE**

CELL MEMBRANE

**AUTOGENOUS
SELF GENERATED**

AUTOGENOUS THEORY



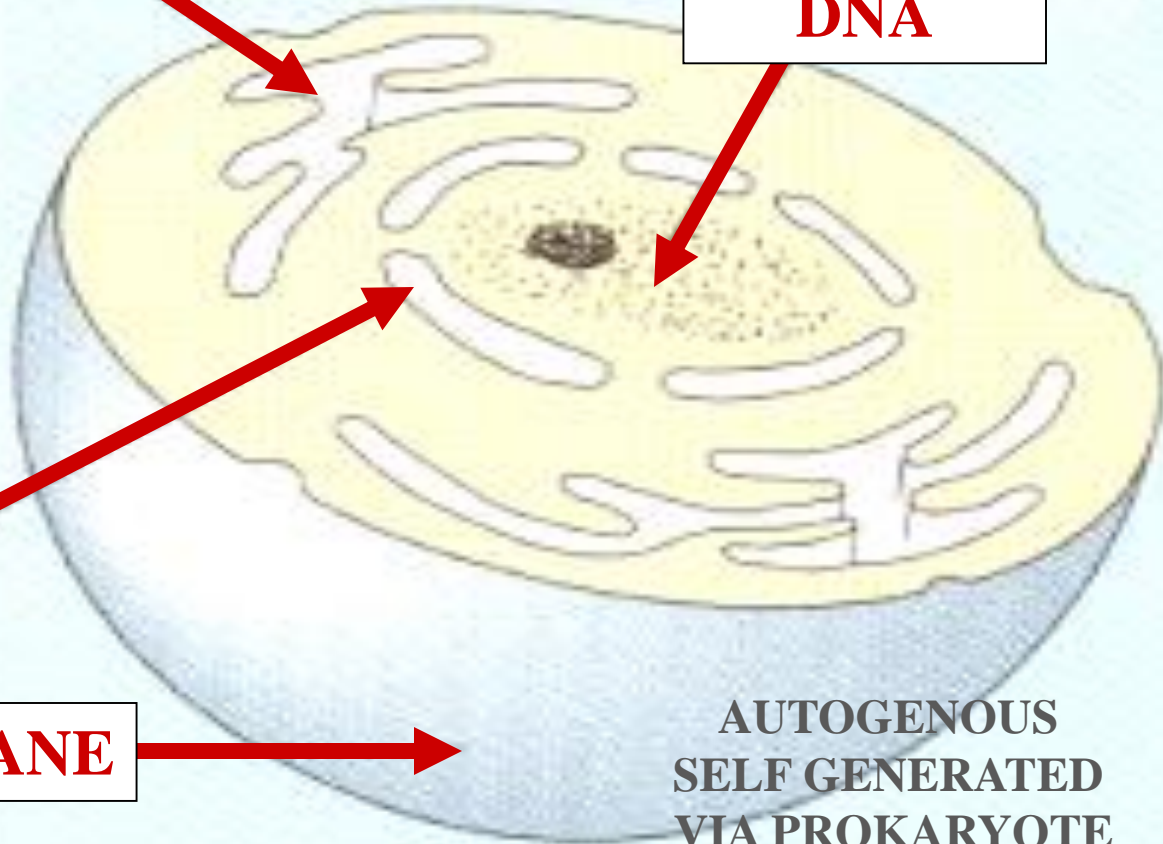


ENDOPLASMIC RETICULUM

DNA

NUCLEAR MEMBRANE

CELL MEMBRANE



**AUTOGENOUS
SELF GENERATED
VIA PROKARYOTE**

MEMBRANE SPECIALIZATION

AUTOGENOUS THEORY

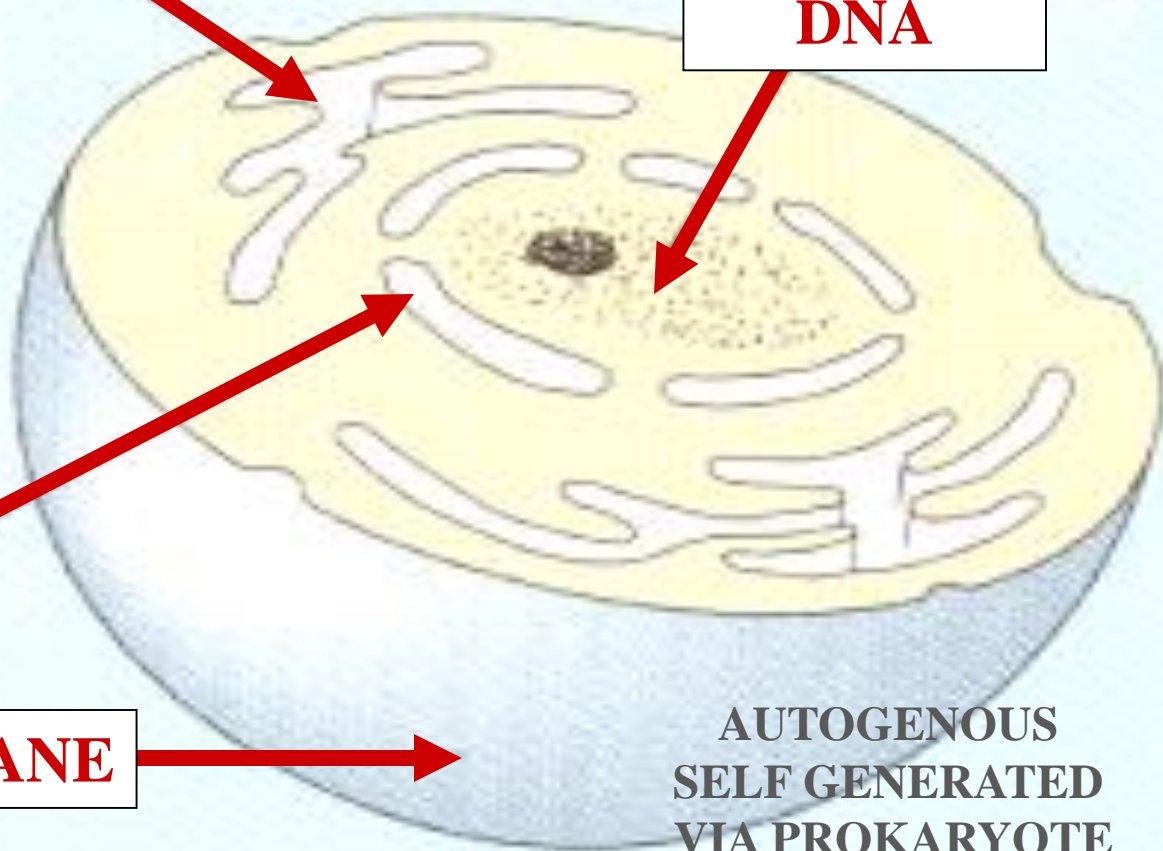


ENDOPLASMIC RETICULUM

DNA

NUCLEAR MEMBRANE

CELL MEMBRANE



**AUTOGENOUS
SELF GENERATED
VIA PROKARYOTE
MEMBRANE SPECIALIZATION**

AUTOGENOUS THEORY



**AUTOGENOUS
THEORY
SUPPORTING
EVIDENCE**

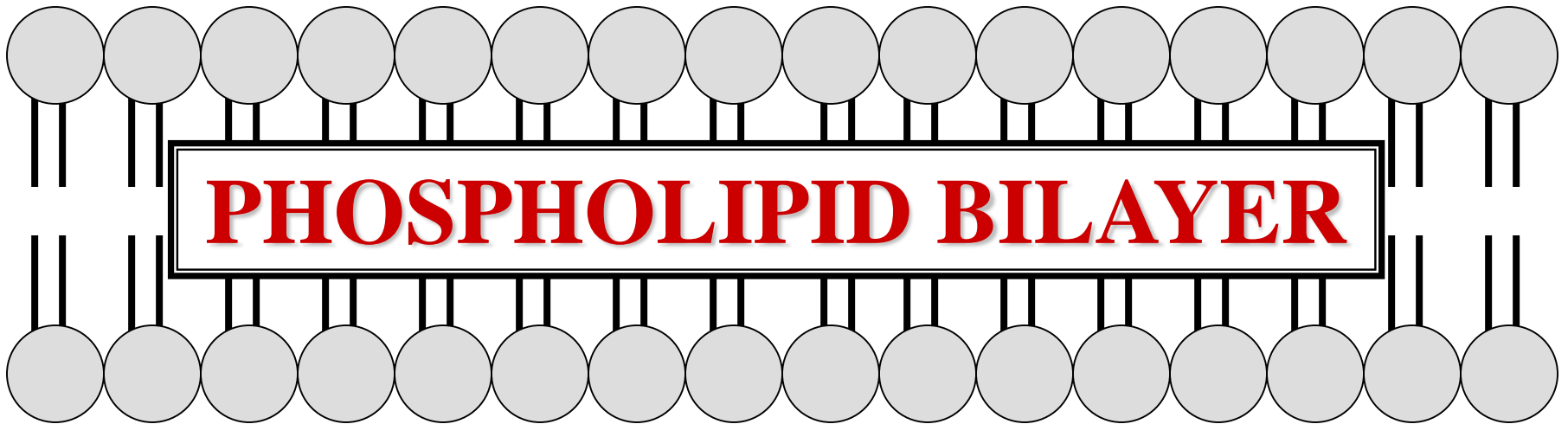


CELL MEMBRANE, ER & NUCLEAR MEMBRANE

WATER

WATER

WATER



WATER

WATER

WATER

CELL MEMBRANE, ER & NUCLEAR MEMBRANE

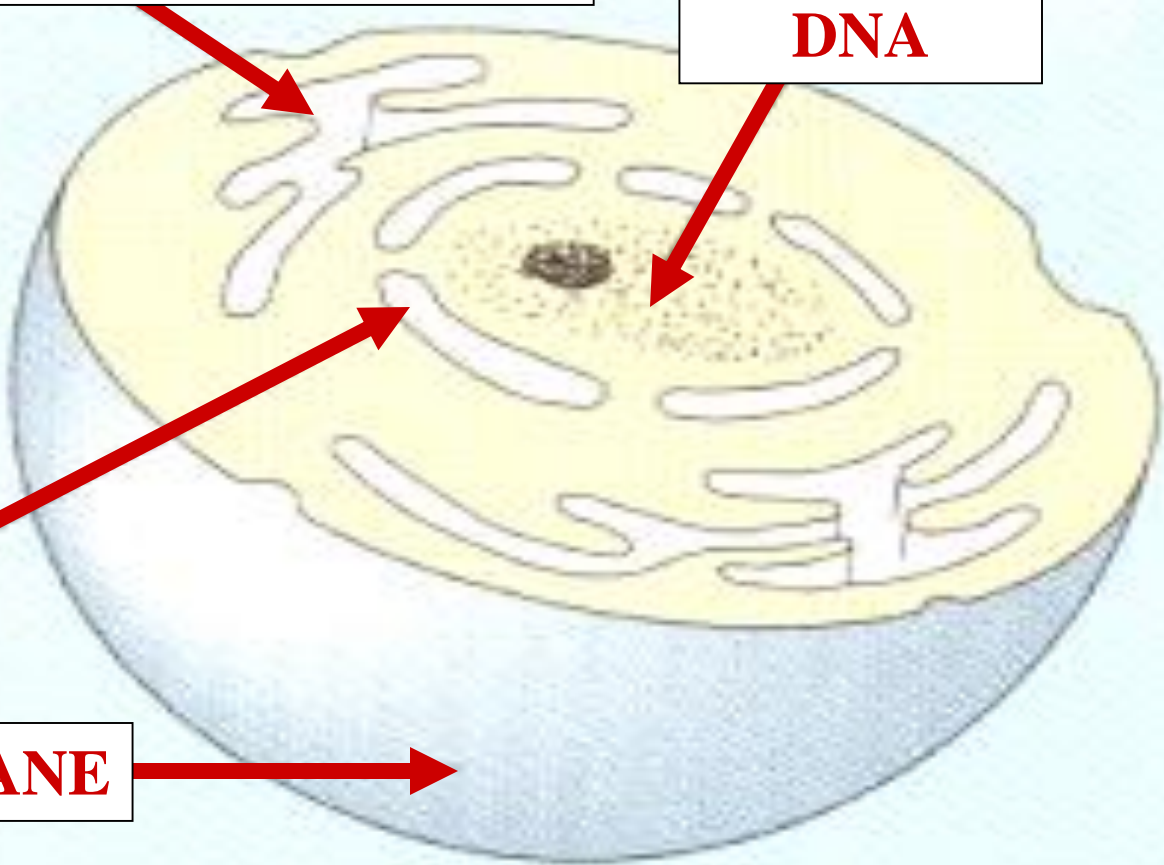
ER

DNA

[Empty box]

[Empty box]

CELL MEMBRANE

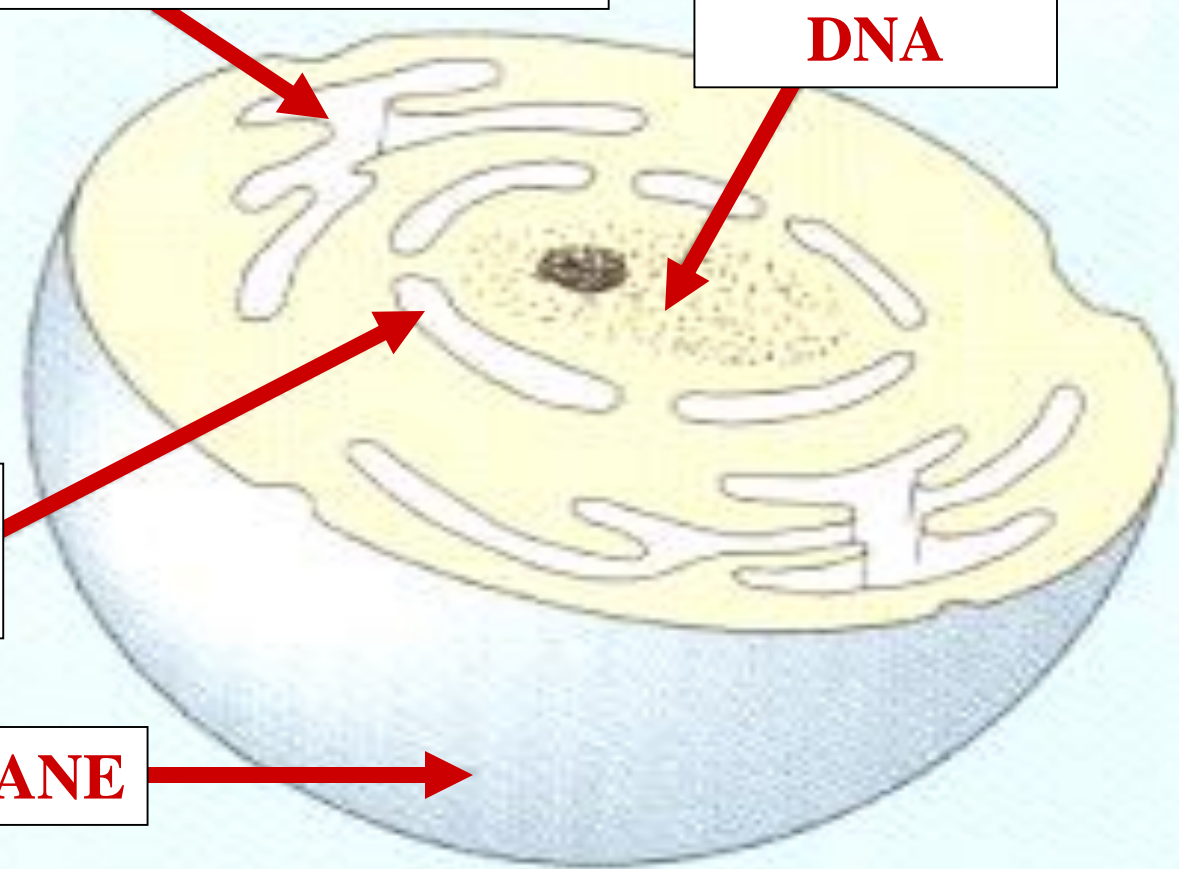


EUKARYOYTE CELL

ENDOPLASMIC RETICULUM

DNA

CELL MEMBRANE



EUKARYOYTE CELL

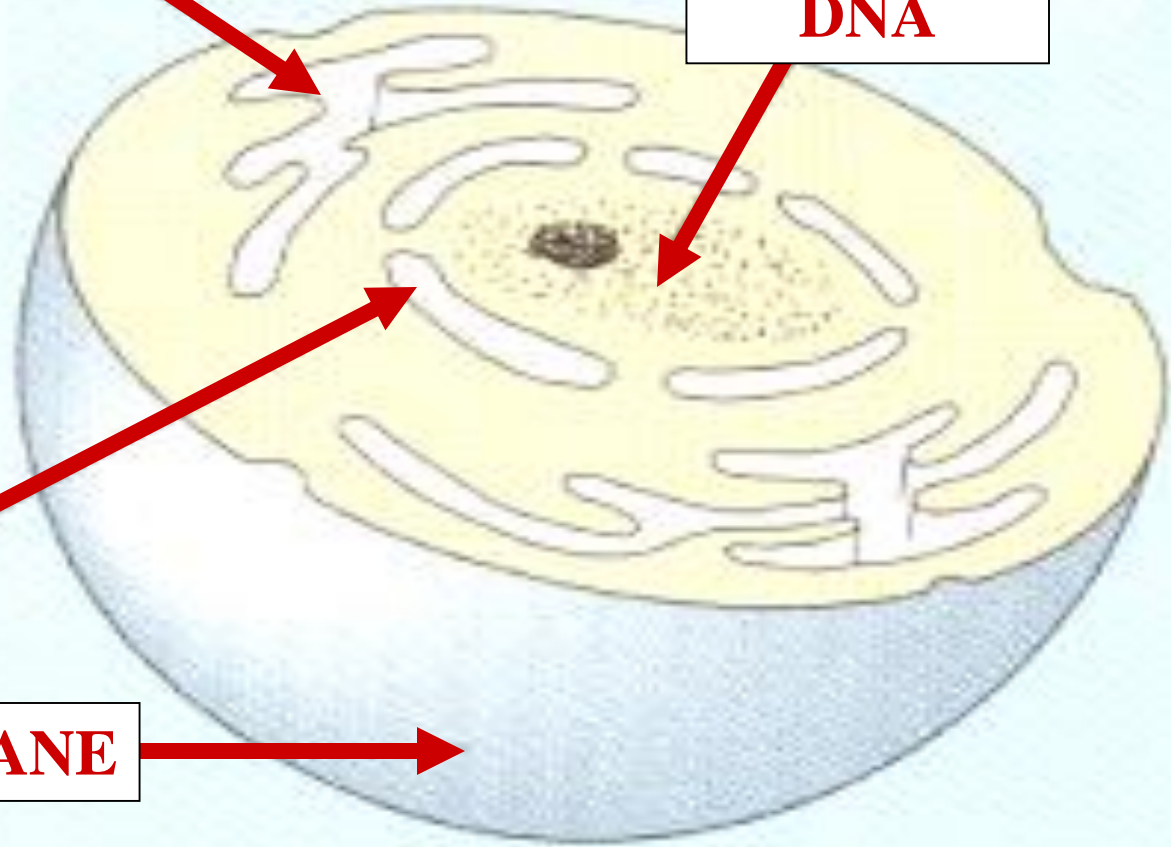


ENDOPLASMIC RETICULUM

DNA

**NUCLEAR
MEMBRANE**

CELL MEMBRANE



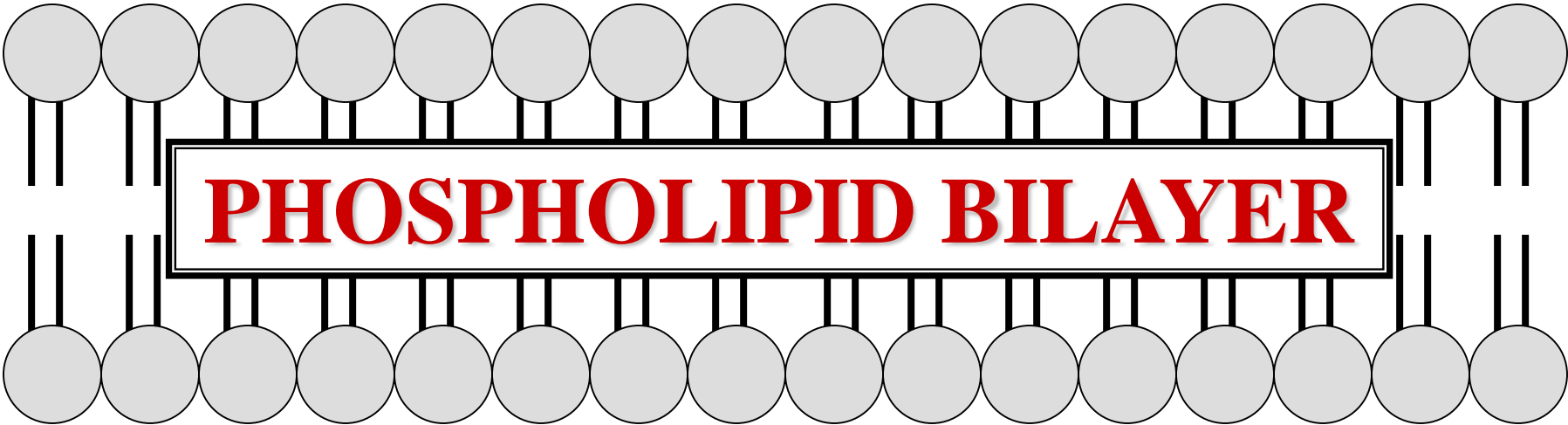
EUKARYOYTE CELL

CELL MEMBRANE, ER & NUCLEAR MEMBRANE

WATER

WATER

WATER



WATER

WATER

WATER

CELL MEMBRANE, ER & NUCLEAR MEMBRANE

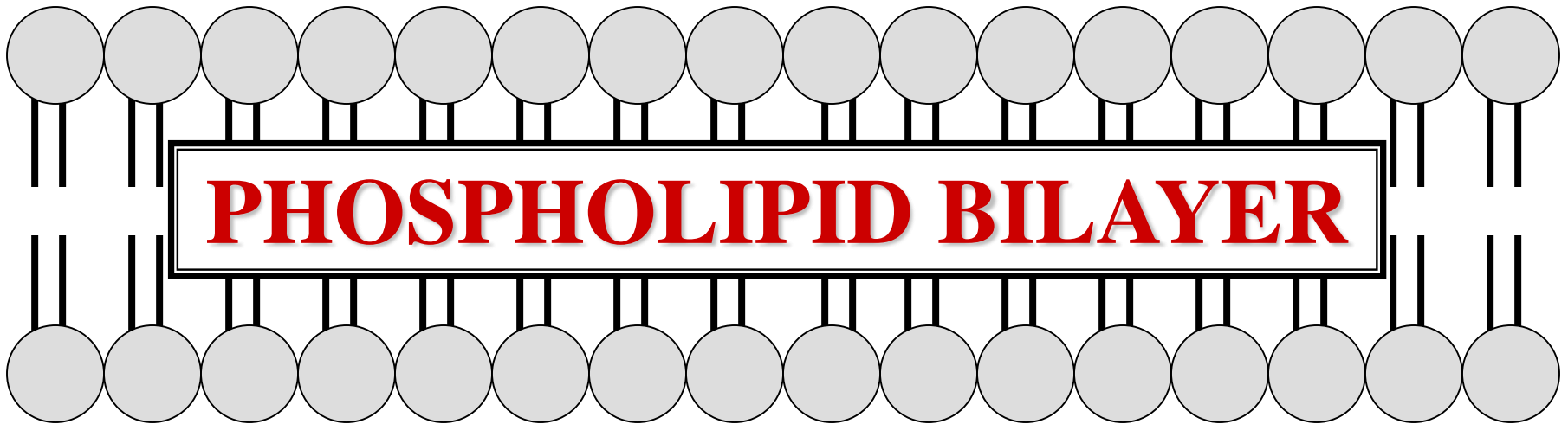


CELL MEMBRANE, ER & NUCLEAR MEMBRANE

WATER

WATER

WATER



PHOSPHOLIPID BILAYER

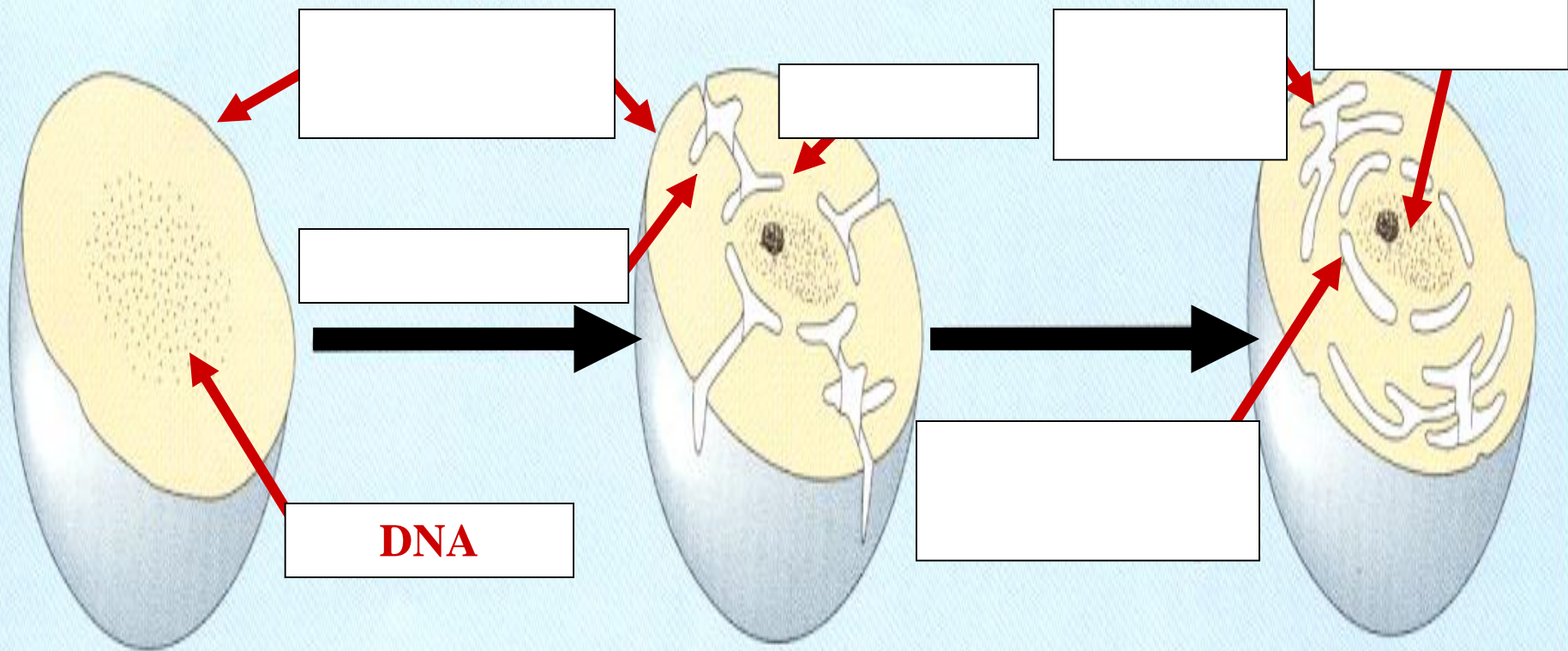
WATER

WATER

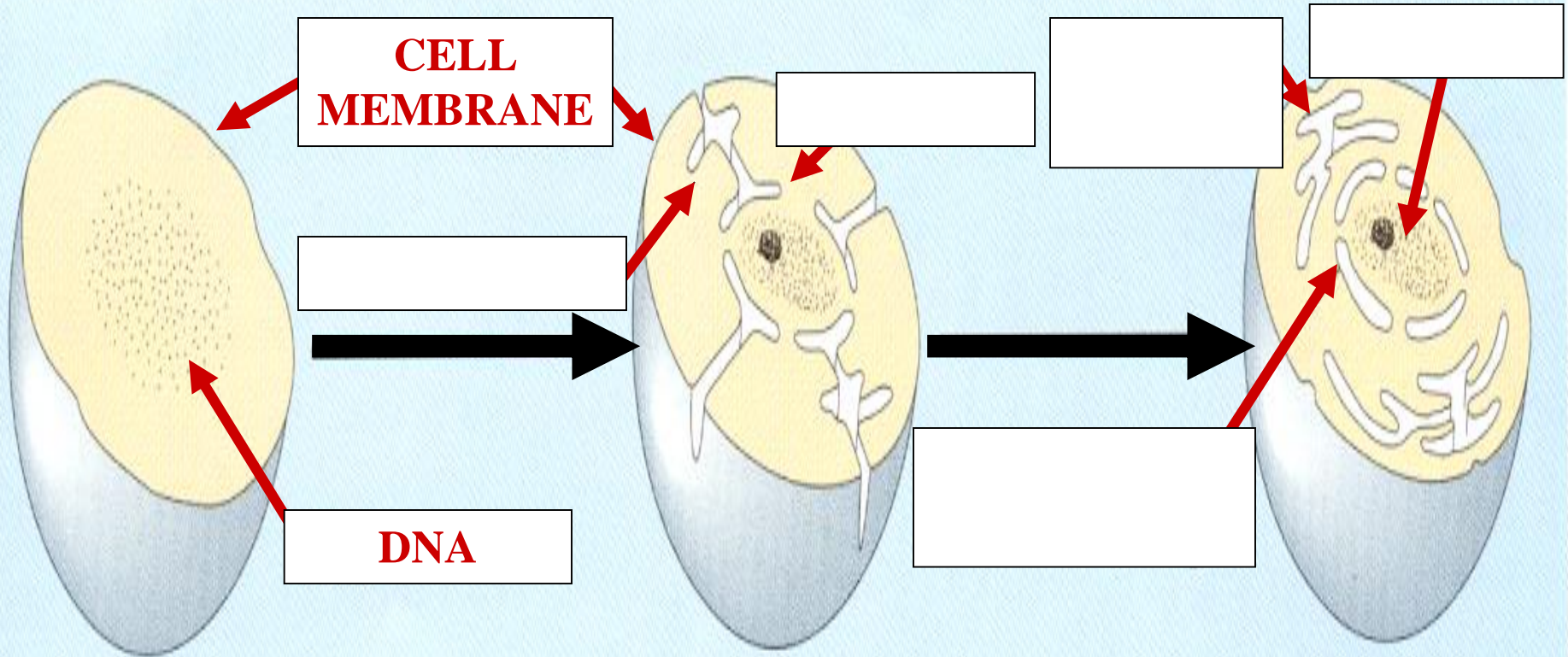
WATER

**PHOSPHOLIPIDS
IDENTICAL**

AUTOGENOUS THEORY



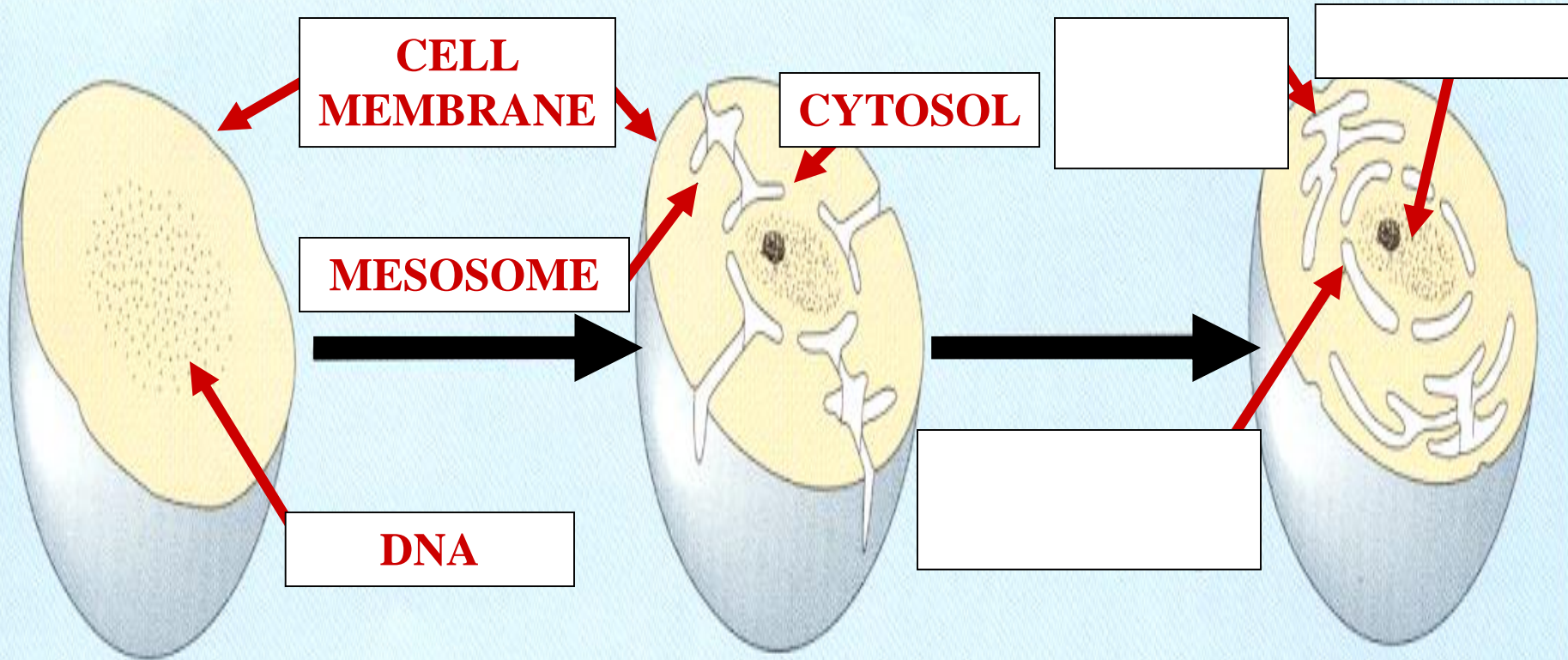
AUTOGENOUS THEORY



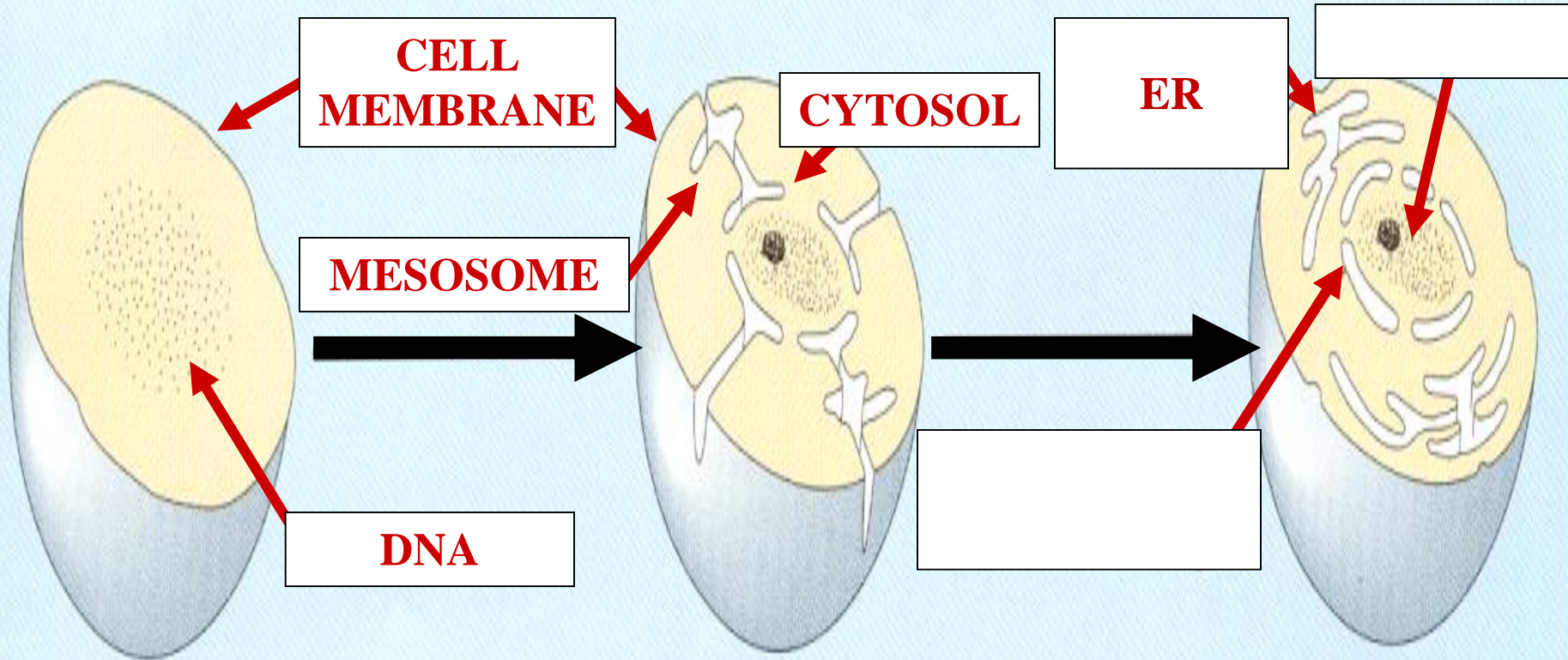
**ANCESTRAL
PROKARYOTE**

**NUCLEATED
EUKARYOTE**

AUTOGENOUS THEORY



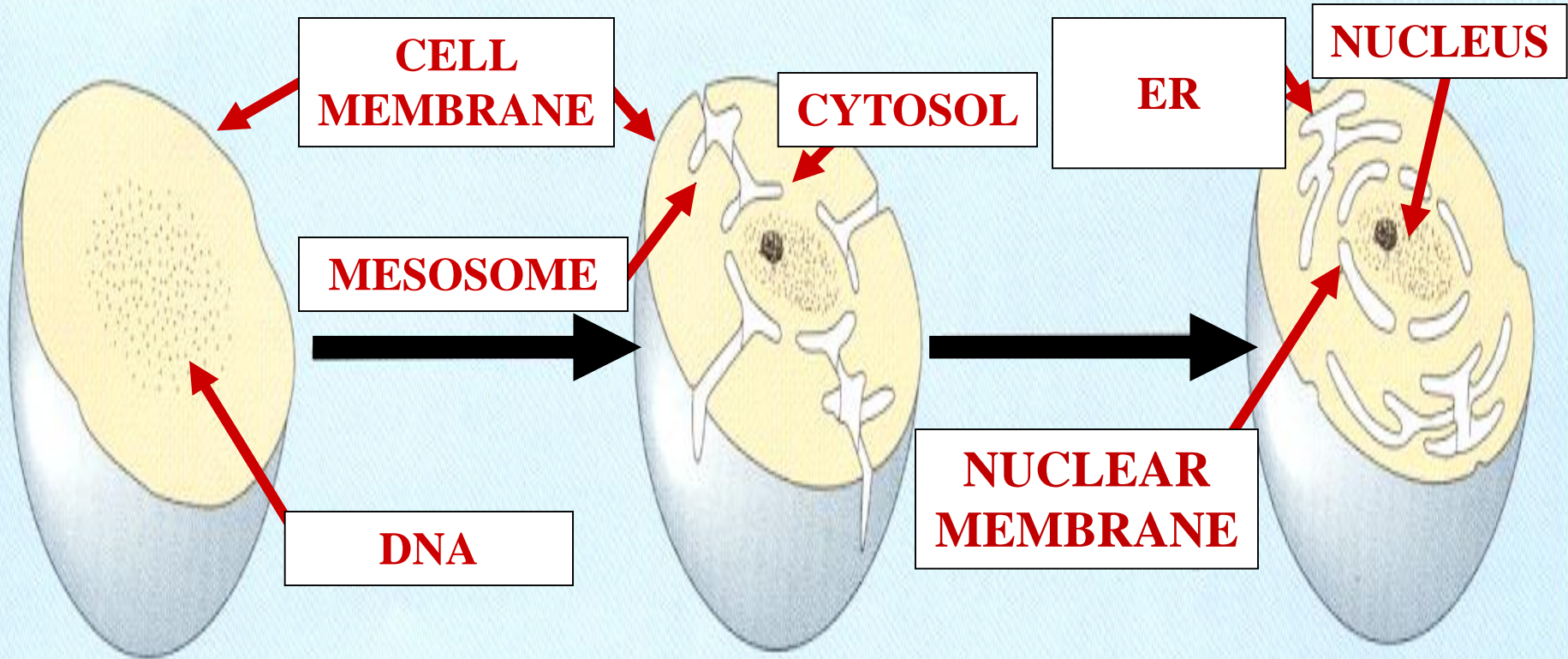
AUTOGENOUS THEORY



**ANCESTRAL
PROKARYOTE**

**NUCLEATED
EUKARYOTE**

AUTOGENOUS THEORY



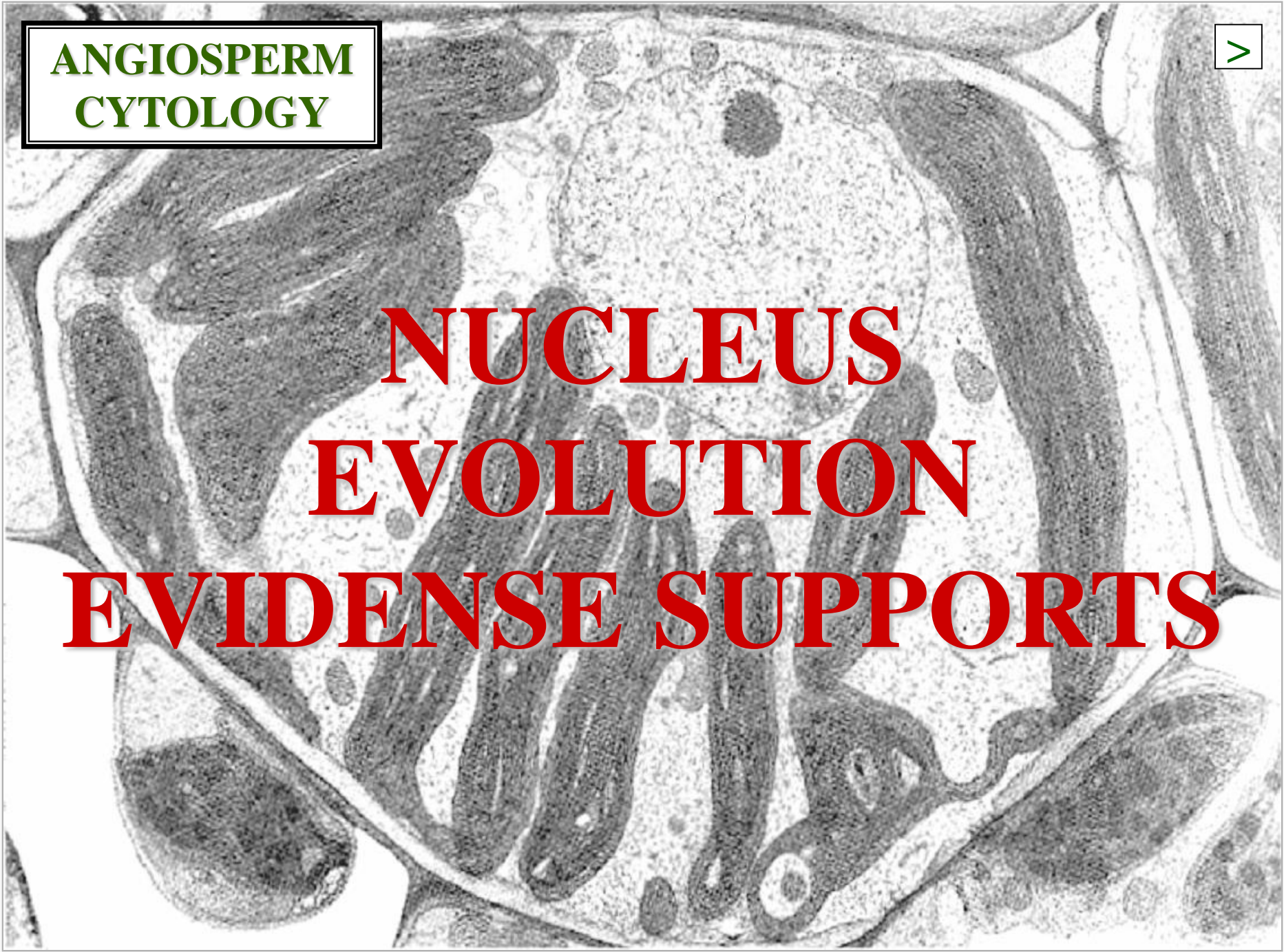
**ANCESTRAL
PROKARYOTE**

**NUCLEATED
EUKARYOTE**

**ANGIOSPERM
CYTOLOGY**



**NUCLEUS
EVOLUTION
EVIDENSE SUPPORTS**



An electron micrograph of a plant cell. The image shows several large, dark, oval-shaped chloroplasts with internal membrane structures (grana) visible. A large, light-colored nucleus is located in the upper central region. 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 grey square containing a white upward-pointing arrow.

**ANGIOSPERM
CYTOLOGY**

NUCLEUS

**AUTOGENOUS
THEORY**

ENDOSYMBIOTIC THEORY

ENDOSYMBIOTIC THEORY



**ENDOSYMBIOTIC
THEORY**

PLASTID

&

MITOCHONDRION

EVOLUTION

**ENDOSYMBIOTIC
THEORY**

ENDOSYMBIOTIC THEORY



VIA PROKARYOTE SYMBIOSIS

ENDOSYMBIOTIC THEORY

An electron micrograph showing a cross-section of a cell. In the center, there is a large, roughly circular nucleus with a dense nucleolus. To the left, a mitochondrion is visible, characterized by its dark, folded membrane structure (cristae). To the right, a plastid is visible, showing a similar dark, layered structure. Two red arrows point from text labels to these organelles. The overall image is in grayscale, typical of electron microscopy.

MITOCHONDRION

PLASTID

ENDOSYMBIOTIC THEORY

SYMBIOSIS

SYMBIOSIS

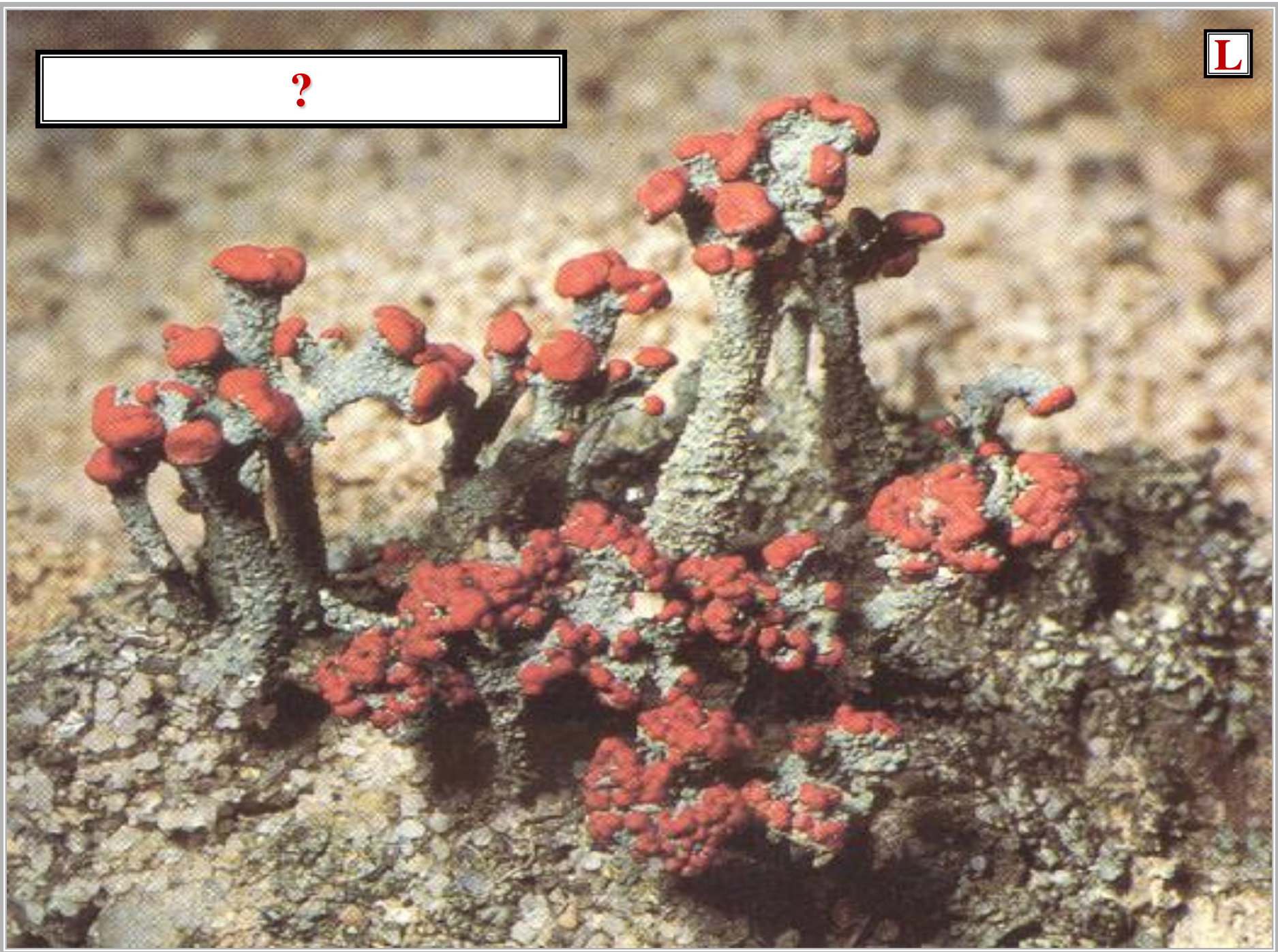


SYMBIOSIS

**TWO DIFFERENT SPECIES
EXIST IN AN
INTRICATE ASSOCIATION**

SYMBIOSIS

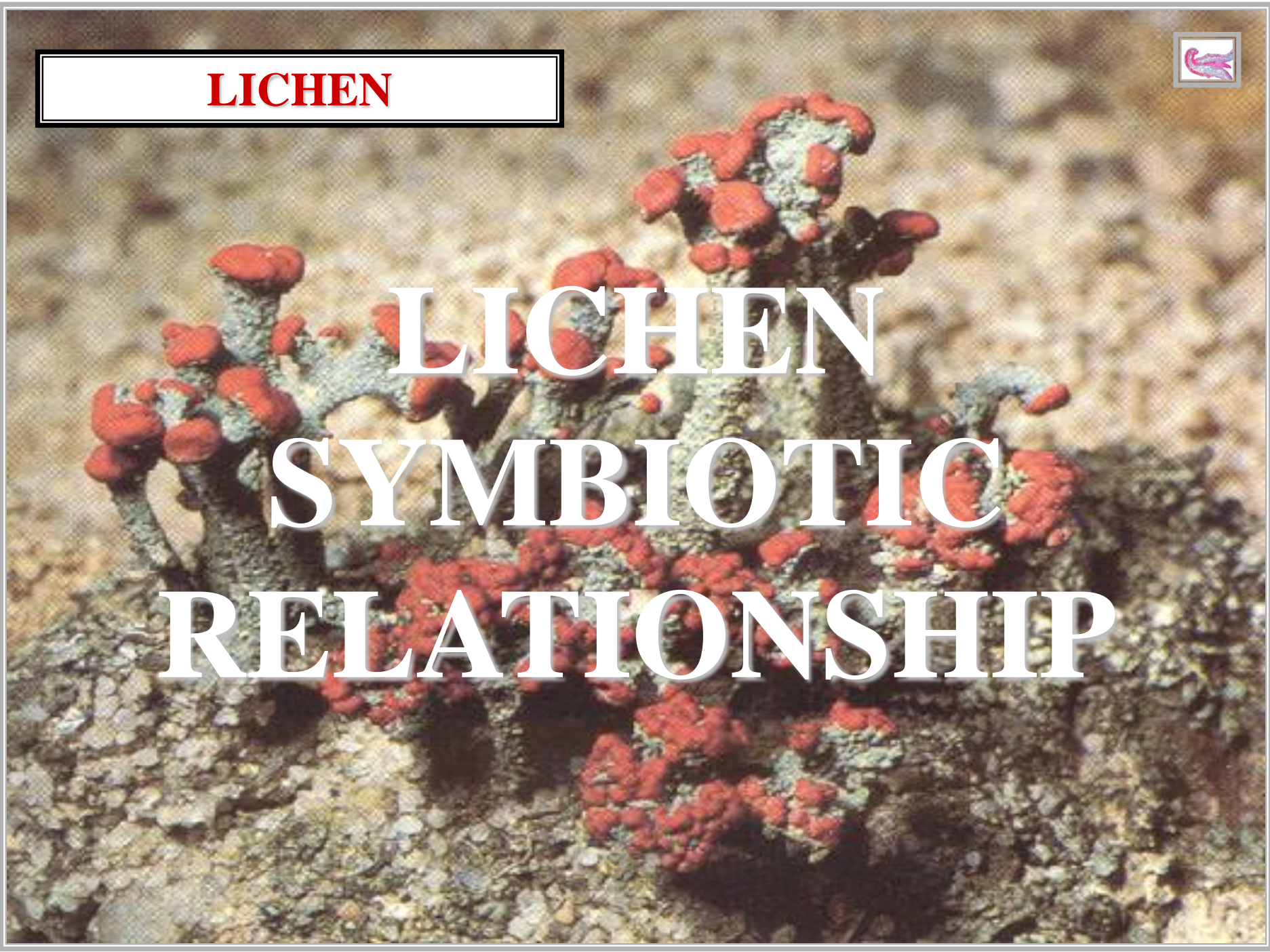
?



LICHEN



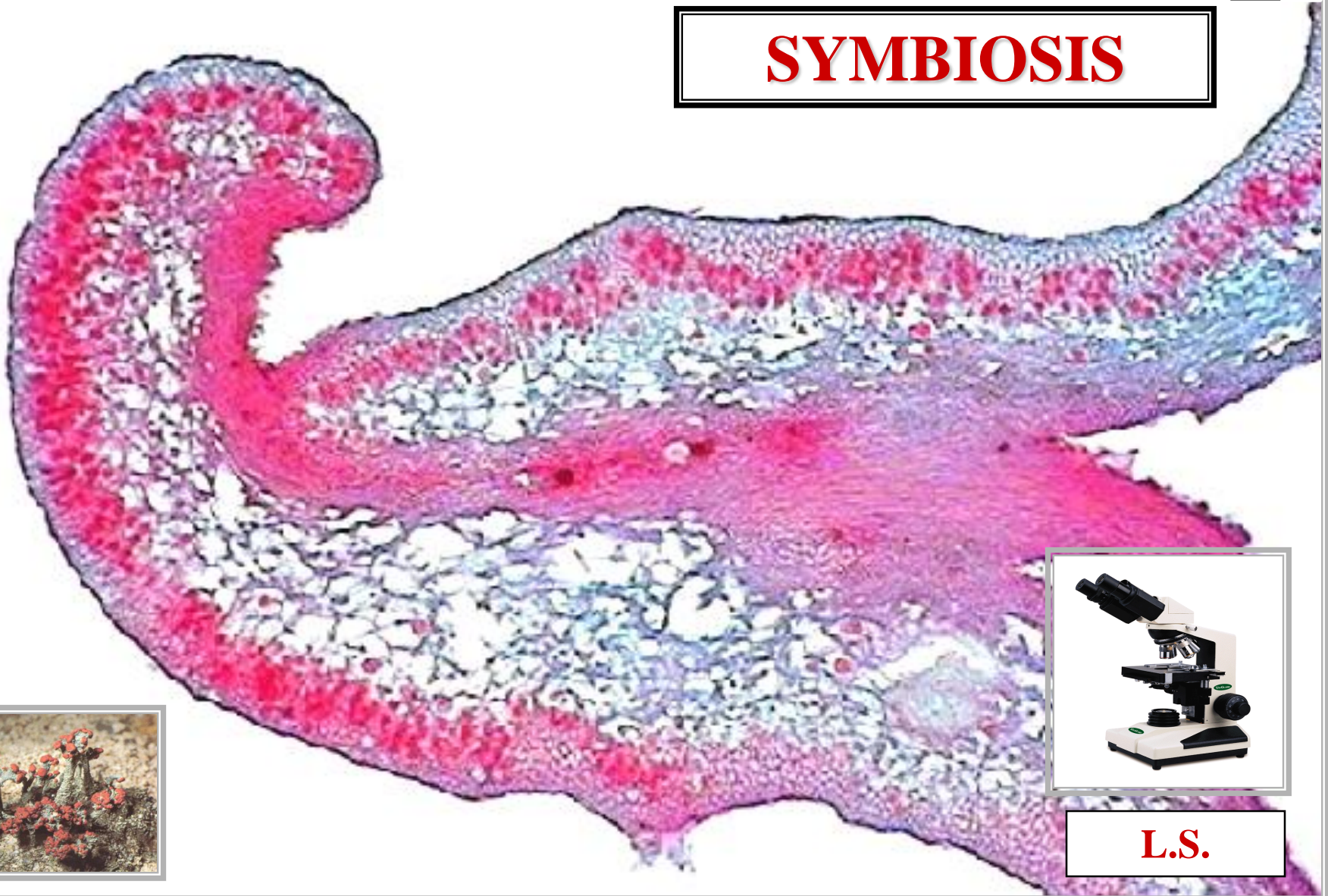
**LICHEN
SYMBIOTIC
RELATIONSHIP**



LICHEN THALLUS



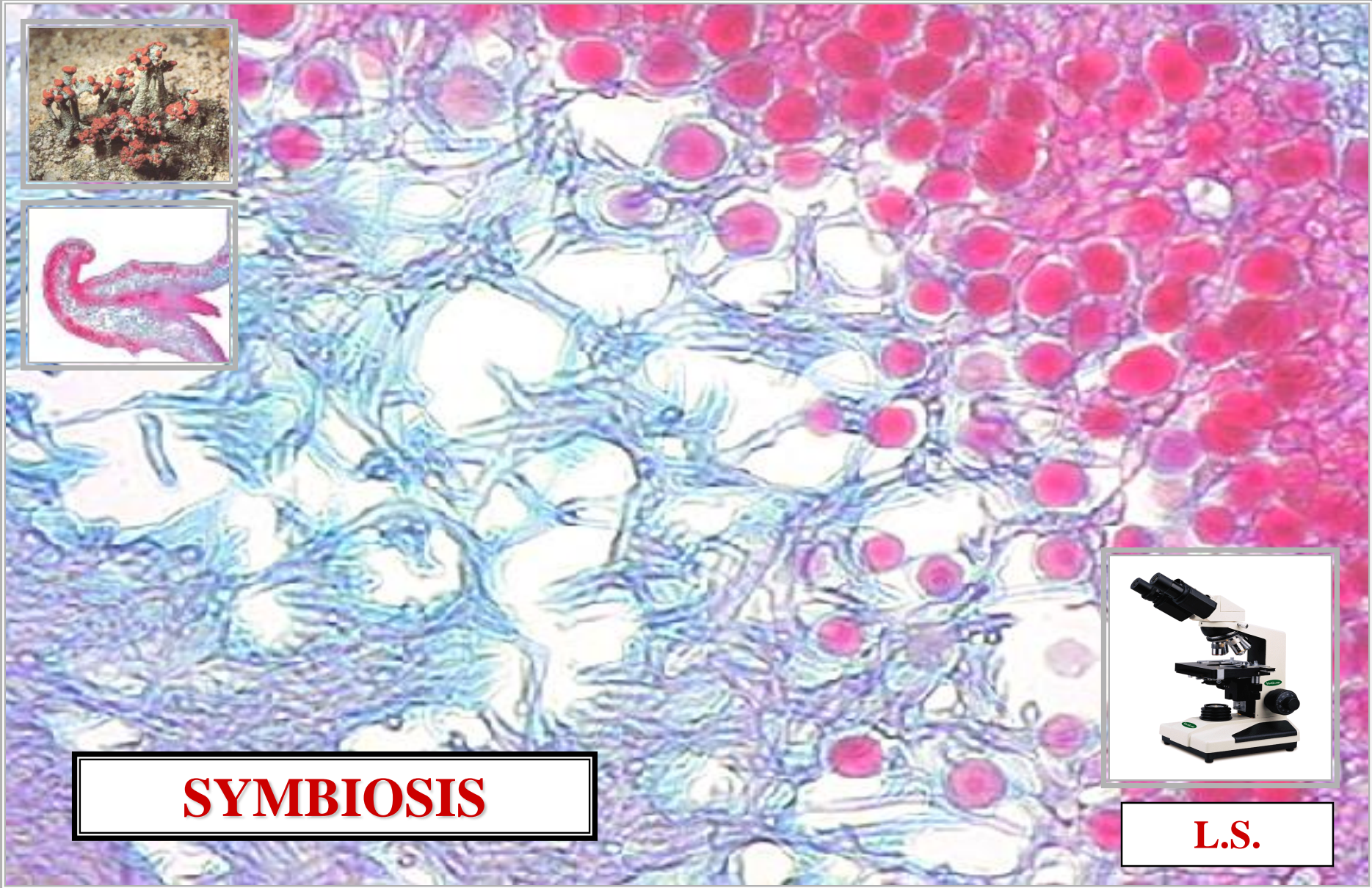
SYMBIOSIS



L.S.

LICHEN THALLUS

FS



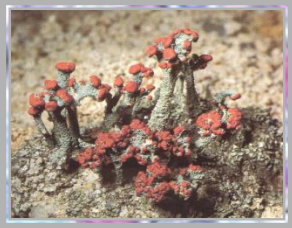
SYMBIOSIS



L.S.

LICHEN THALLUS

BS



FUNGUS SYMBIONT

SYMBIOSIS



L.S.

LICHEN THALLUS

S



BACTERIA SYMBIONT

FUNGUS SYMBIONT

SYMBIOSIS

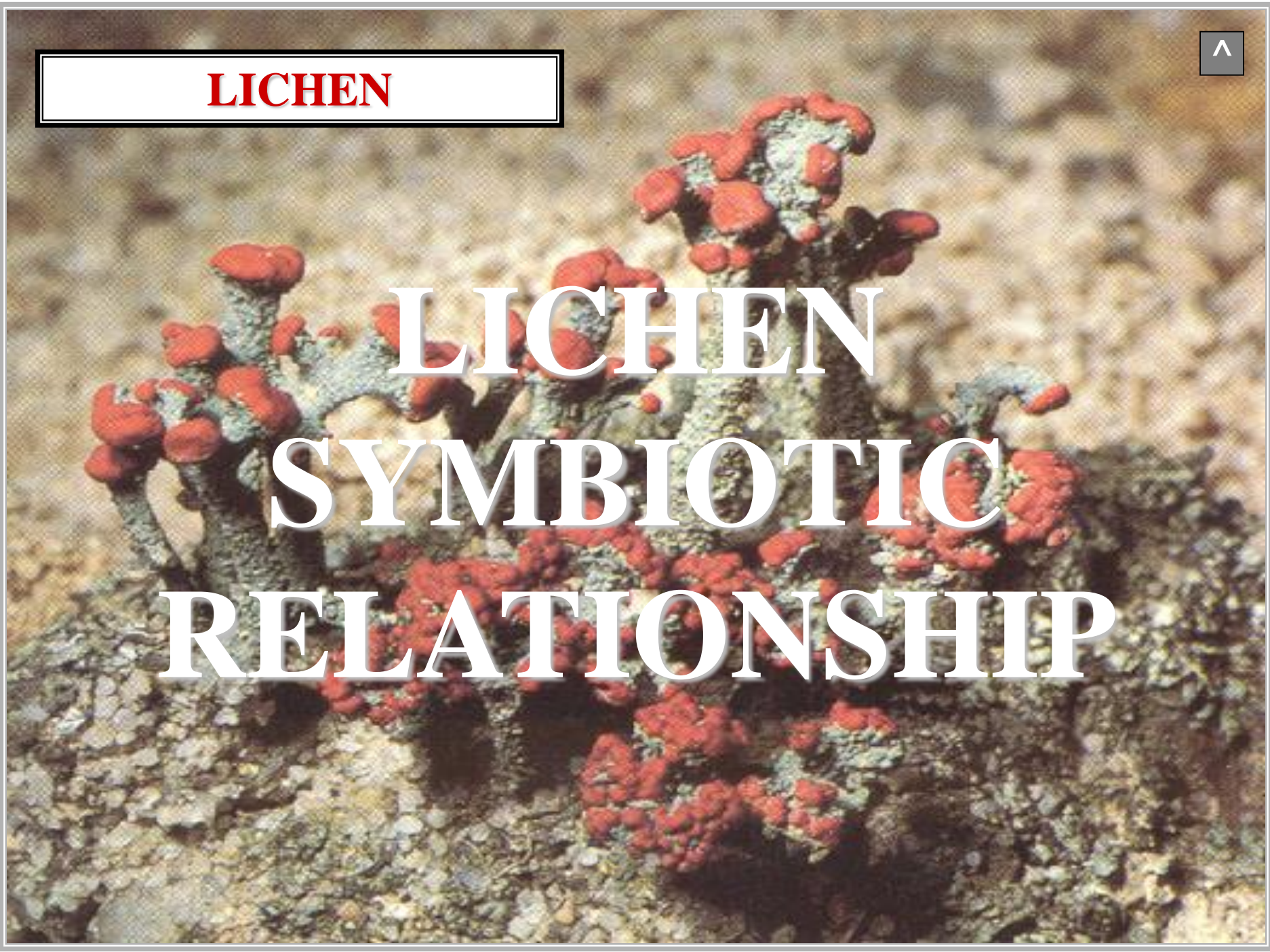


L.S.

LICHEN



**LICHEN
SYMBIOTIC
RELATIONSHIP**



MUTUALISM

MUTUALISM

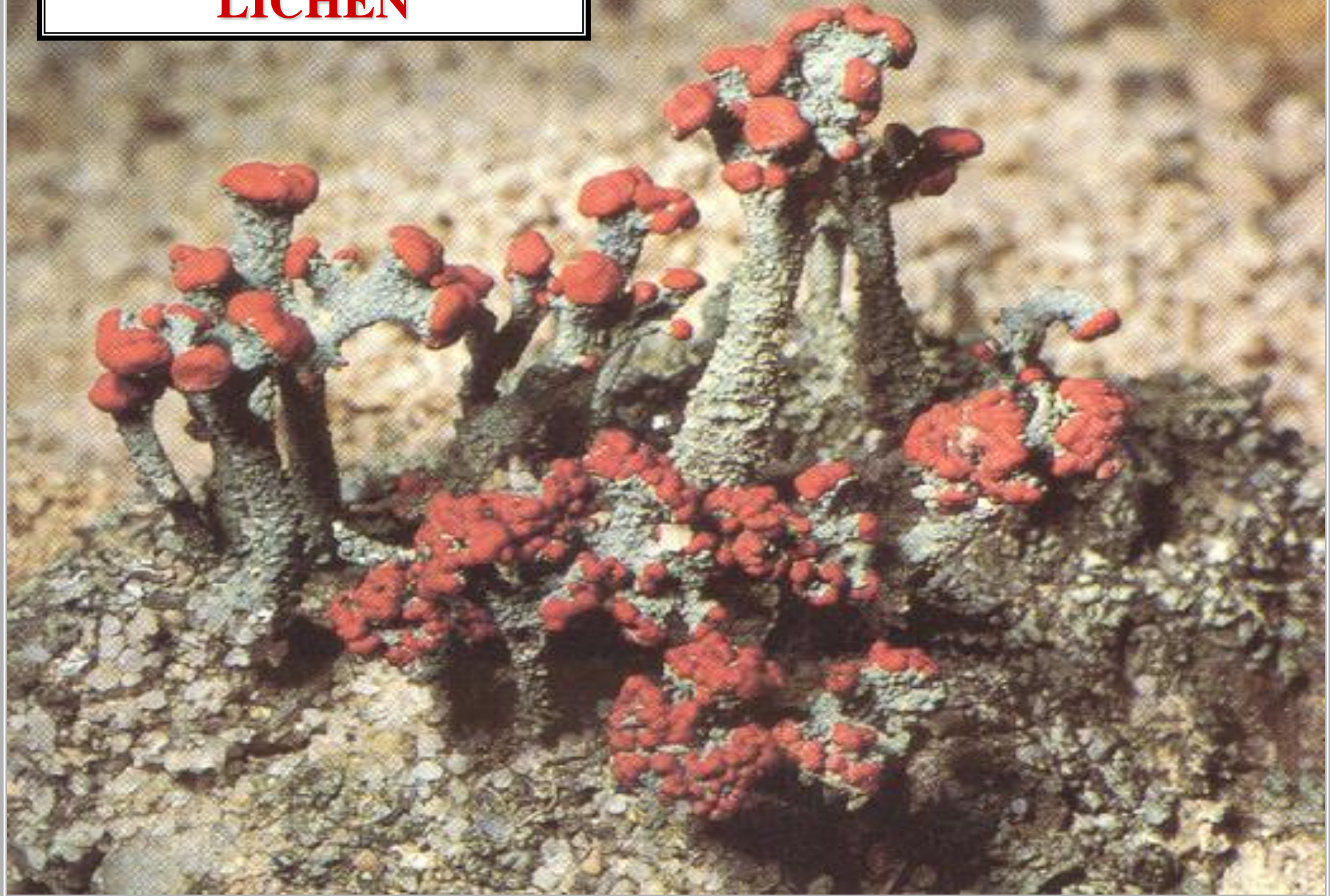


**SYMBIOSIS
MUTUALISM**

**BOTH SPECIES
BENEFIT**

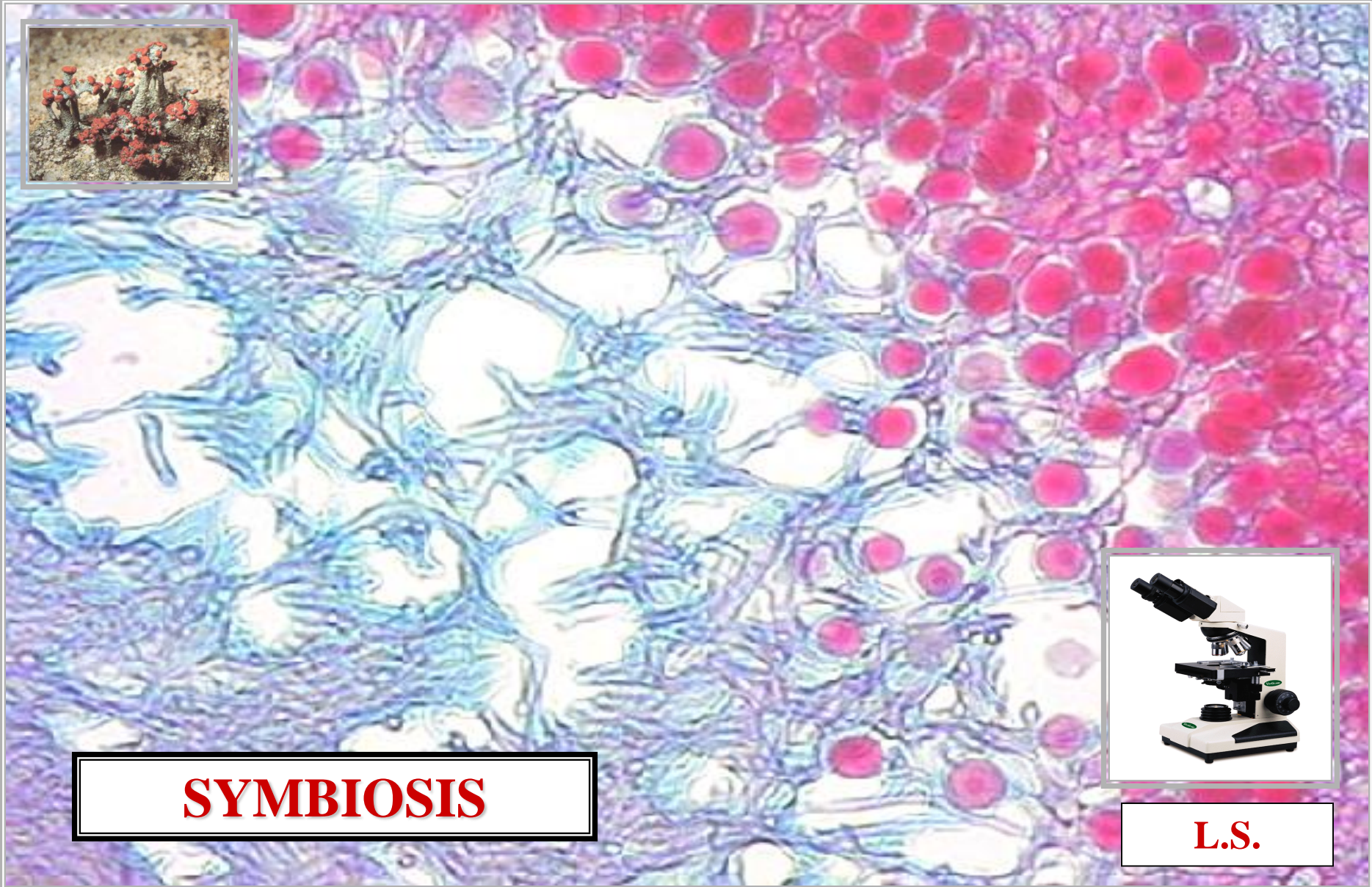
**SYMBIOSIS
MUTUALISM**

LICHEN



LICHEN THALLUS

FS



SYMBIOSIS



L.S.

LICHEN THALLUS

BS



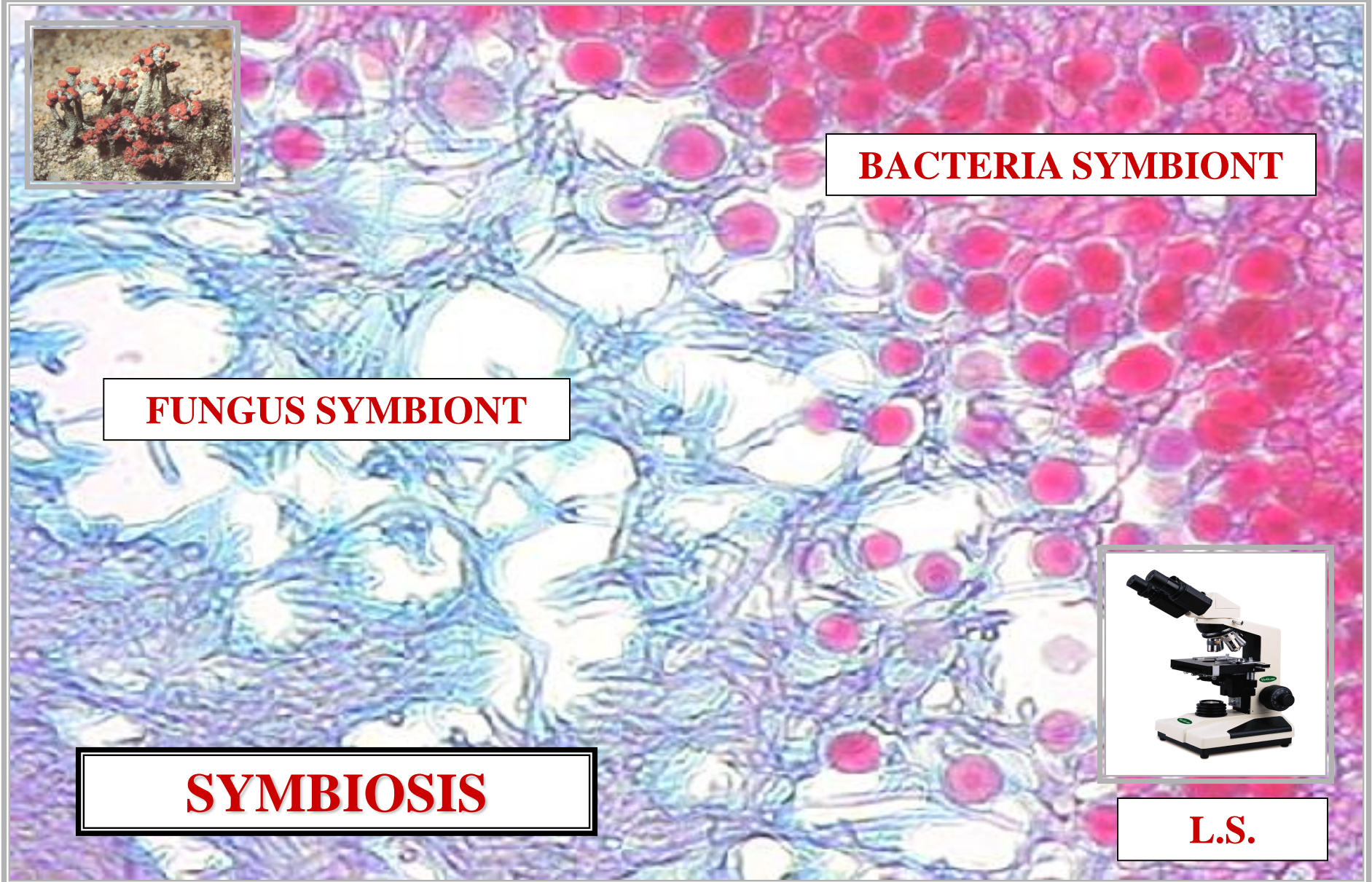
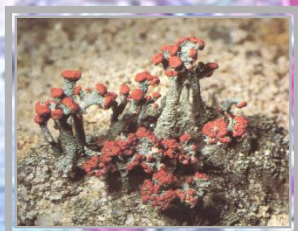
FUNGUS SYMBIONT

SYMBIOSIS



L.S.

LICHEN THALLUS



BACTERIA SYMBIONT

FUNGUS SYMBIONT

SYMBIOSIS



L.S.

LICHEN THALLUS



BACTERIA SYMBIONT
PHOTOSYNTHESIS

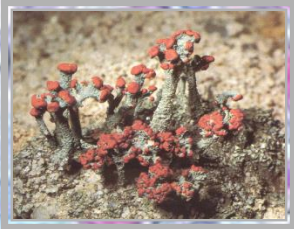
FUNGUS SYMBIONT

SYMBIOSIS



L.S.

LICHEN THALLUS



**BACTERIA SYMBIONT
PROVIDES: FUNGUS
WITH GLUCOSE**

**FUNGUS SYMBIONT
GLUCOSE**

SYMBIOSIS



L.S.

LICHEN THALLUS



BACTERIA SYMBIONT

FUNGUS SYMBIONT

SYMBIOSIS



L.S.

LICHEN THALLUS



**BACTERIA SYMBIONT
SECURITY**

**FUNGUS SYMBIONT
PROVIDES: BACTERIA
WITH SECURITY**

SYMBIOSIS



L.S.

LICHEN THALLUS



**BACTERIA SYMBIONT
PROVIDES: FUNGUS
WITH GLUCOSE**

**FUNGUS SYMBIONT
PROVIDES: BACTERIA
WITH SECURITY**

SYMBIOSIS



L.S.

LICHEN THALLUS



**BACTERIA SYMBIONT
PROVIDES: FUNGUS
WITH GLUCOSE**

**FUNGUS SYMBIONT
PROVIDES: BACTERIA
WITH SECURITY**

MUTUALISM

SYMBIOSIS



L.S.

ENDOSYMBIOSIS

ENDOSYMBIOSIS



ENDOSYMBIOSIS

**ONE SPECIES
EXISTS WITHIN A
SECOND HOST SPECIES**

ENDOSYMBIOSIS

PLANT CELL

P

CHLOROPLASTS

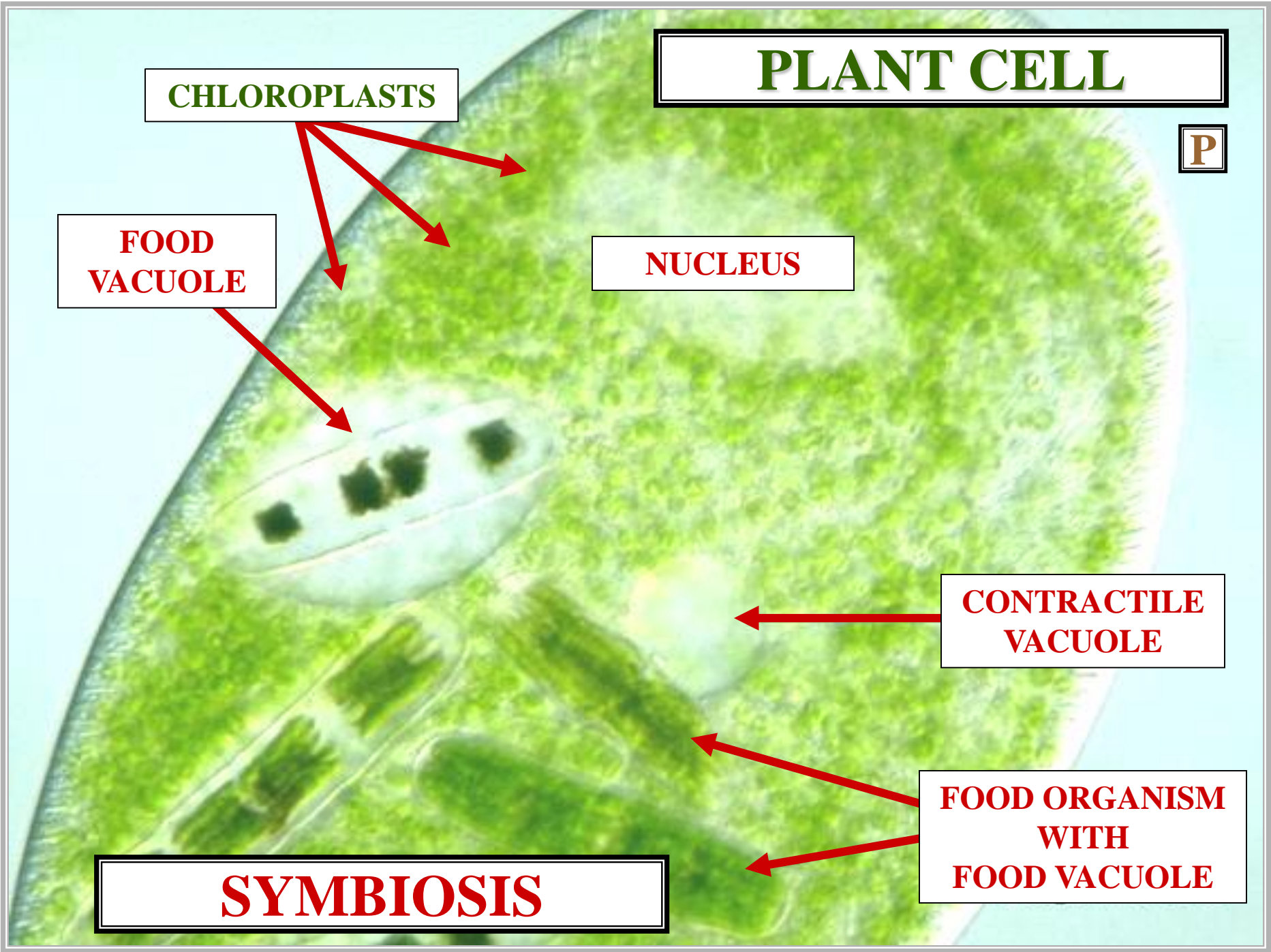
FOOD
VACUOLE

NUCLEUS

CONTRACTILE
VACUOLE

FOOD ORGANISM
WITH
FOOD VACUOLE

SYMBIOSIS



PROTOZOAN

G

CHLOROPLASTS

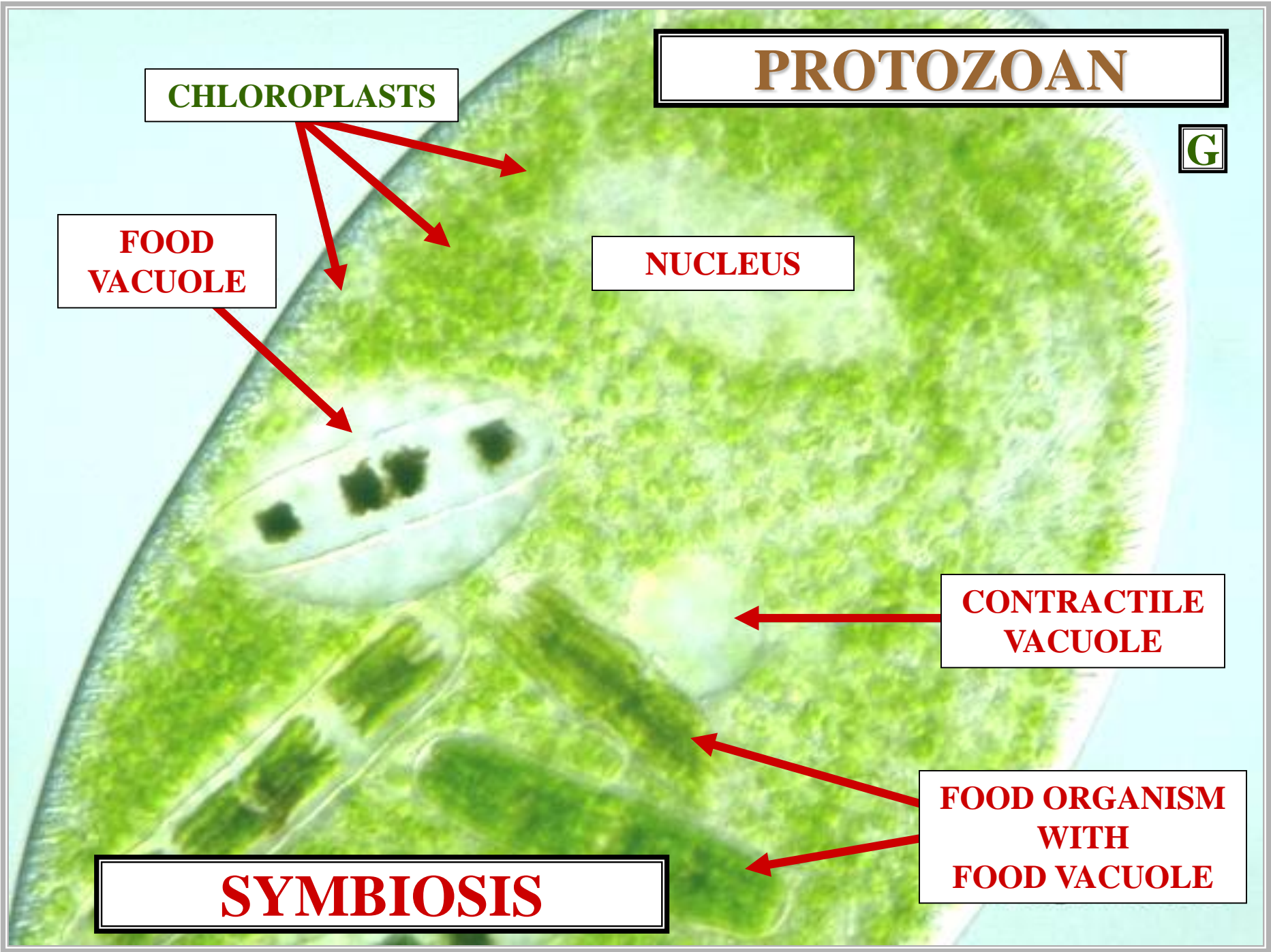
FOOD
VACUOLE

NUCLEUS

CONTRACTILE
VACUOLE

FOOD ORGANISM
WITH
FOOD VACUOLE

SYMBIOSIS



**SYMBIOTIC
GREEN ALGAE**

PROTOZOAN

E

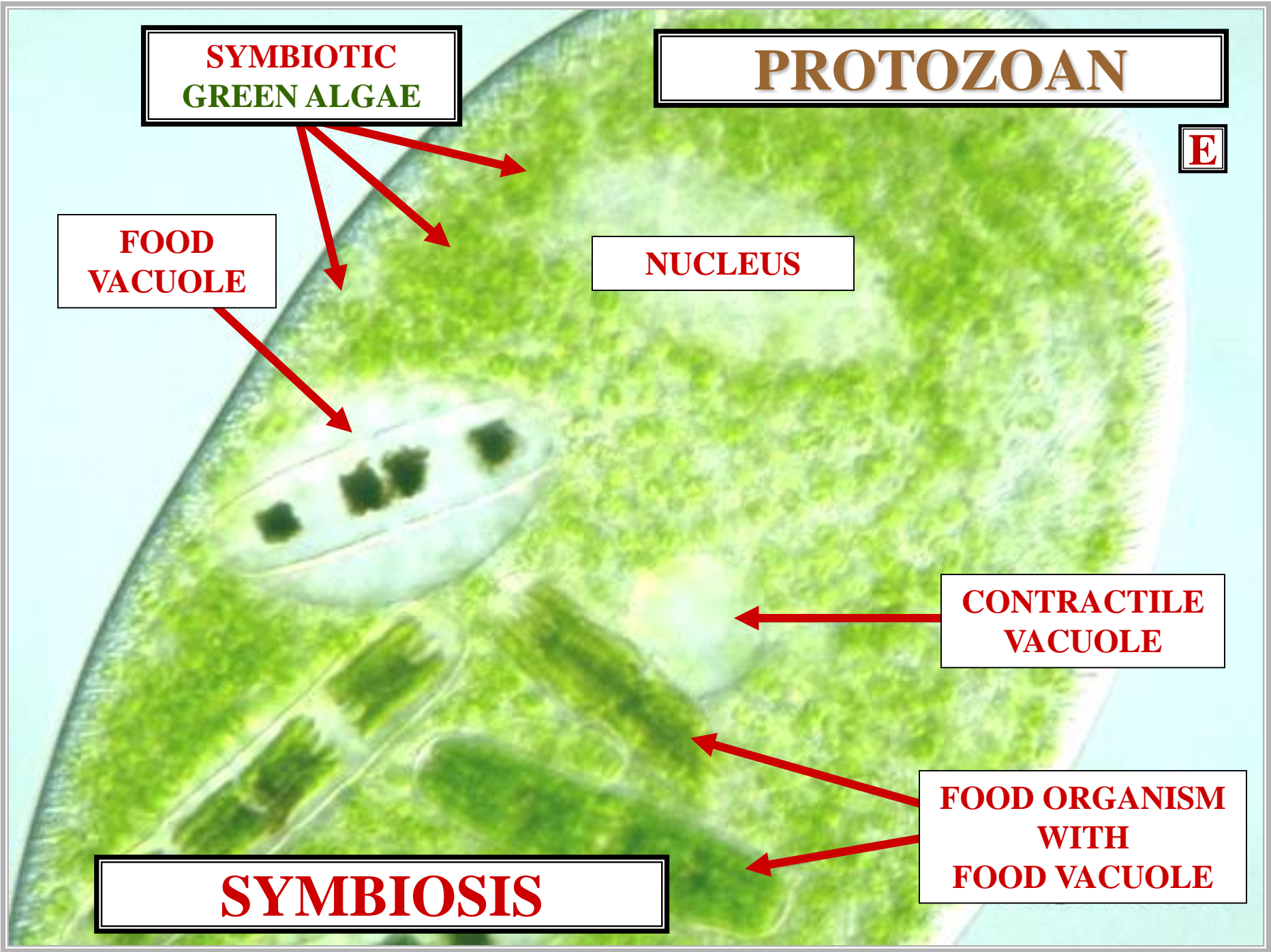
**FOOD
VACUOLE**

NUCLEUS

**CONTRACTILE
VACUOLE**

**FOOD ORGANISM
WITH
FOOD VACUOLE**

SYMBIOSIS



PROTOZOAN

**ENDOSYMBIOTIC
GREEN ALGAE**

**FOOD
VACUOLE**

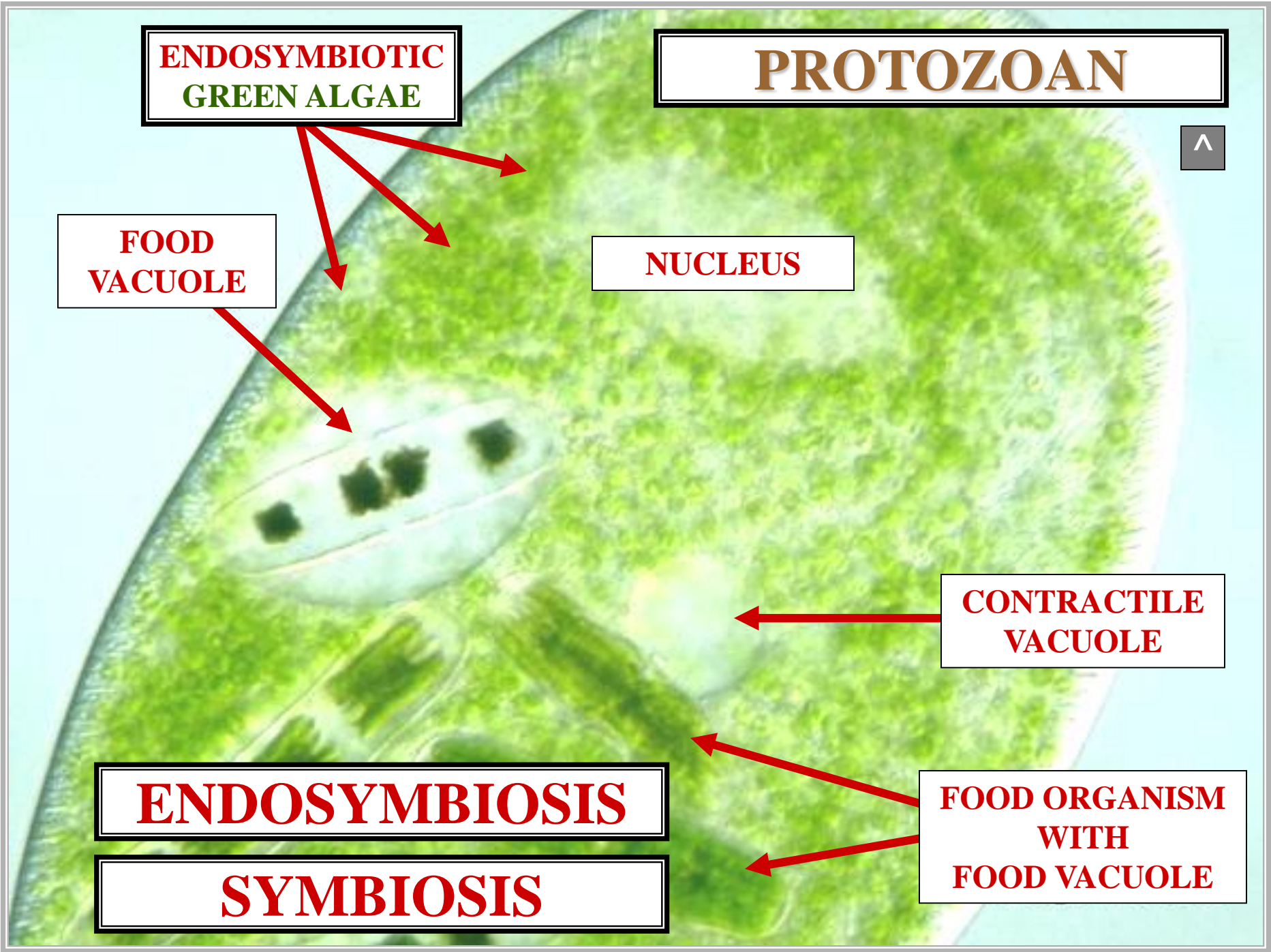
NUCLEUS

**CONTRACTILE
VACUOLE**

ENDOSYMBIOSIS

SYMBIOSIS

**FOOD ORGANISM
WITH
FOOD VACUOLE**





PLASTID EVOLUTION

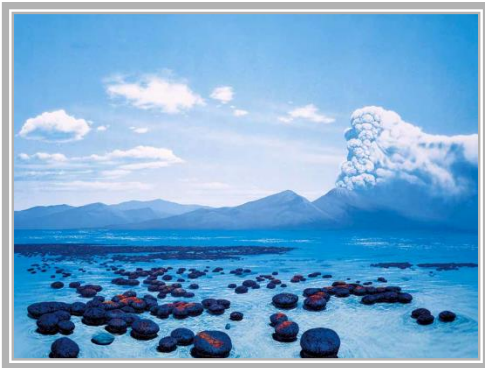


**PLASTID
EVOLUTION
HYPOTHETICAL
SCENARIO**

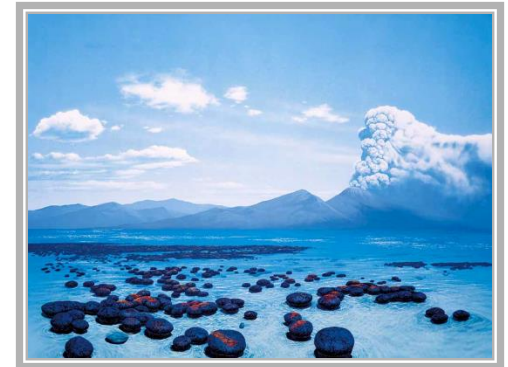
**HETEROTROPHIC
HOST CELL**
DNA W\ HISTONE PROTEINS
LARGE RIBOSOMES

**AUTOTROPHIC
PROKARYOTE**
DNA W\OUT HISTONE PROTEINS
SMALL RIBOSOMES

**HETEROTROPHIC
HOST CELL
DNA W\ HISTONE PROTEINS
LARGE RIBOSOMES**



**AUTOTROPHIC
PROKARYOTE
DNA W\OUT HISTONE PROTEINS
SMALL RIBOSOMES**



HETEROTROPH & AUTOTROPH: SAME HABITAT