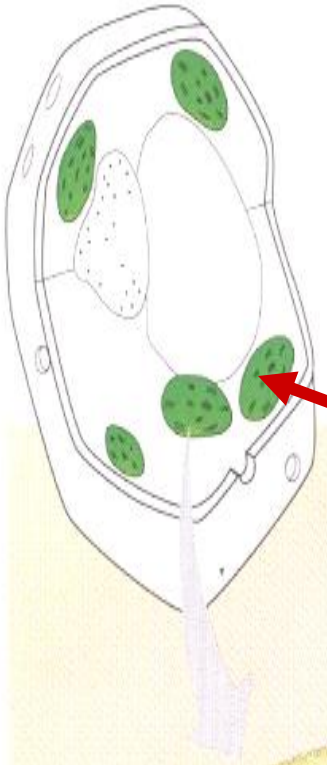
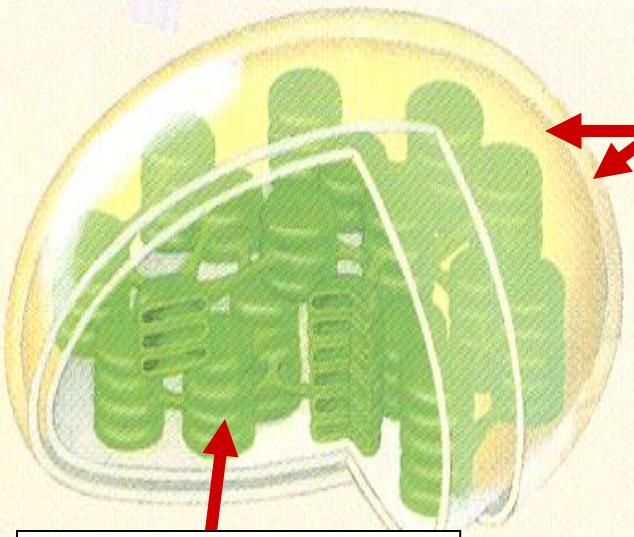
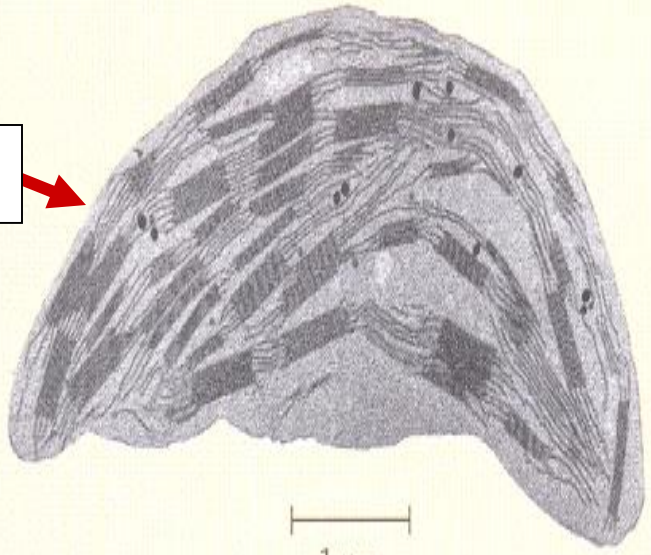
CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST



OUTER & INNER MEMBRANE



THYLAKOID MEMBRANE

THYLAKOID VESICLES

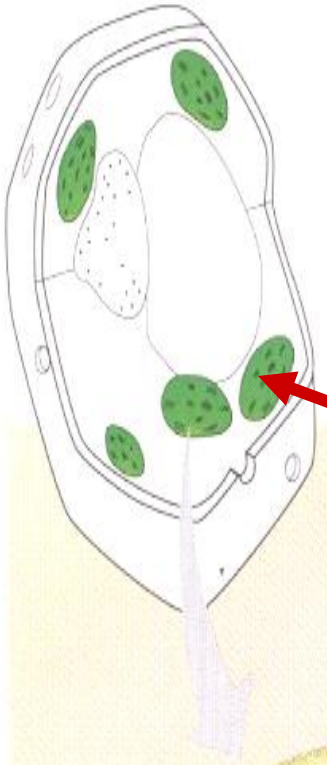
THYLAKOID VESICLES

COMPRISE
THYLAKOID MEMBRANE

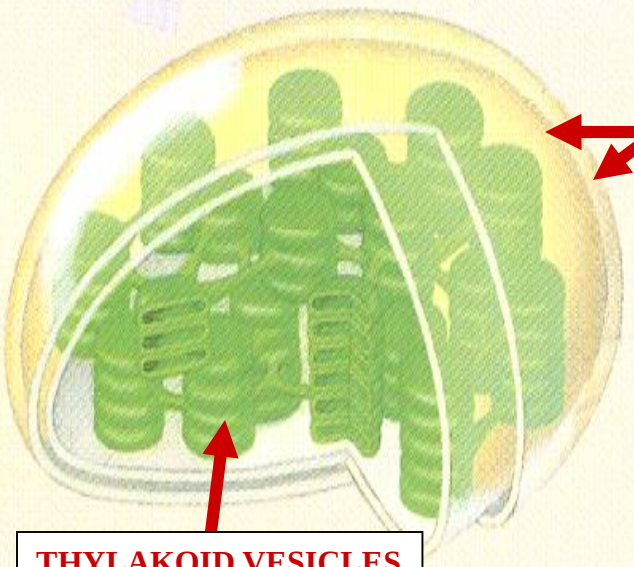
THYLAKOID VESICLES

G

CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST



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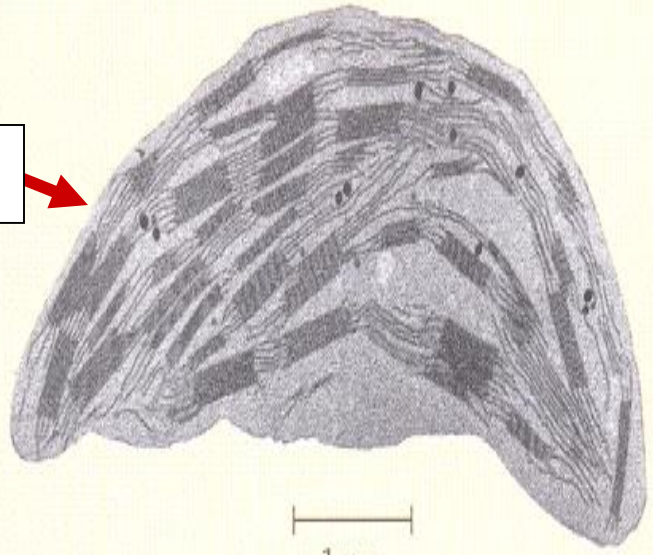


THYLAKOID VESICLES

THYLAKOID
GRANUM / GRANA

THYLAKOID GRANUM

STACKED THYLAKOID VESICLES

THYLAKOID GRANUM

THYLAKOID GRANUM

STACKED
THYLAKOID VESICLES

SITE: LIGHT RXT

THYLAKOID GRANUM

THYLAKOID GRANUM

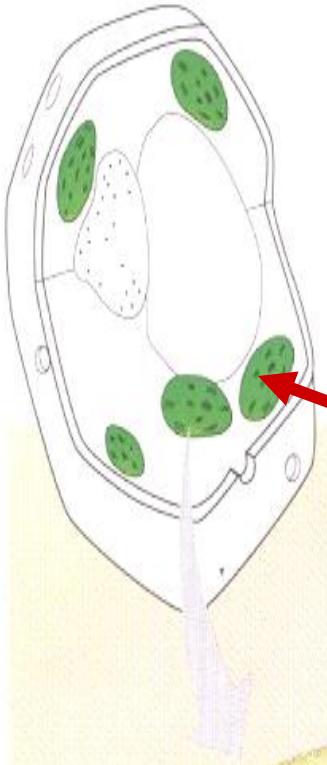
STACKED THYLAKOID VESICLES

SITE: LIGHT RXT DERIVES ATP

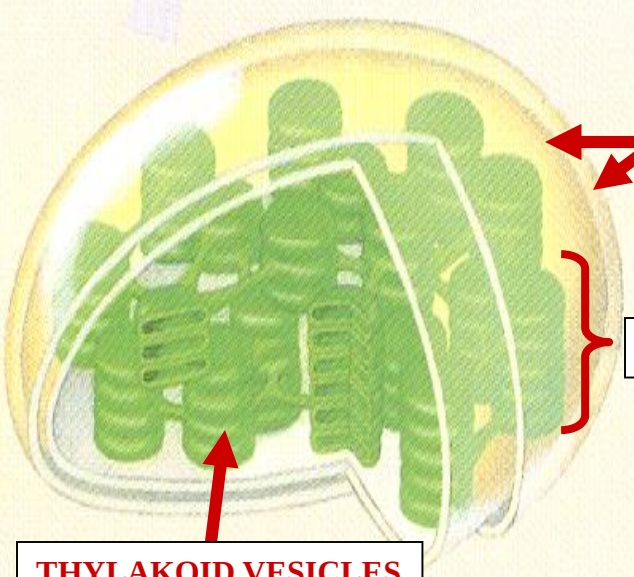
THYLAKOID GRANUM

LR

CHLOROPLAST ULTRASTRUCTURE



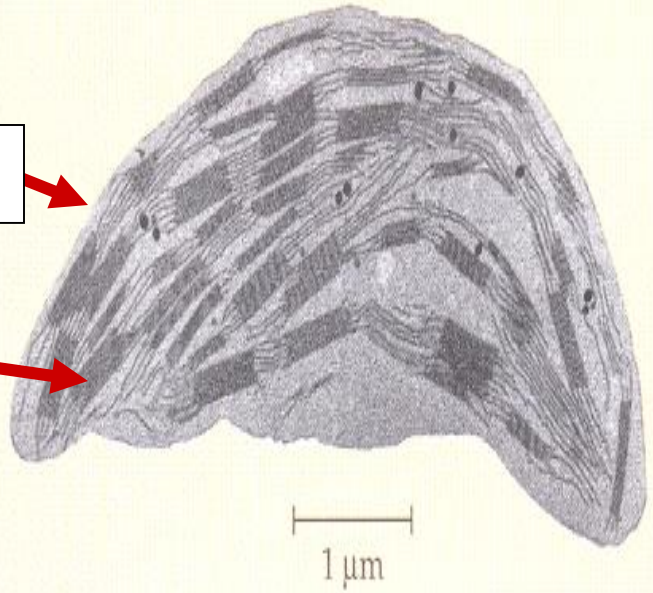
CHLOROPLAST



OUTER & INNER MEMBRANE

GRANUM

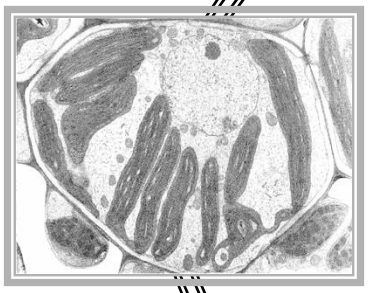
THYLAKOID VESICLES



LIGHT REACTION

PHOTOSYNTHESIS

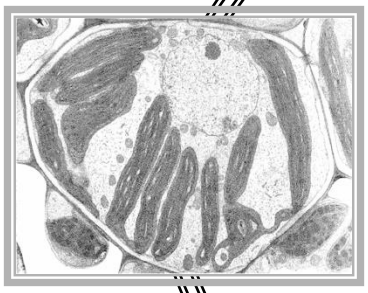
LR



CHLOROPLAST

PHOTOSYNTHESIS

LT



LT RXT

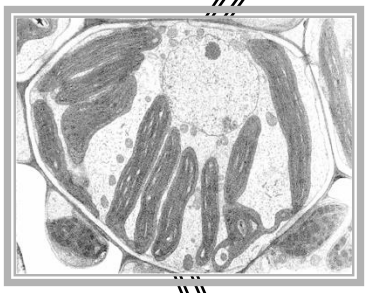
THYLAKOID
GRANUM

CHLOROPLAST

PHOTOSYNTHESIS

C

LIGHT EGY



LT RXT

THYLAKOID
GRANUM

CHLOROPLAST

PHOTOSYNTHESIS

I

WATER

LIGHT EGY

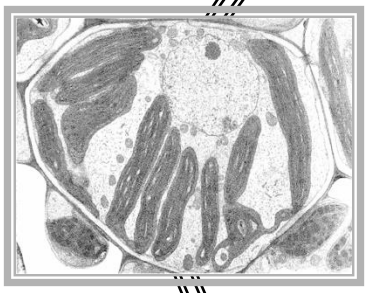
E-

PHOTOLYSIS

LT RXT

THYLAKOID GRANUM

CHEMICAL ENERGY



CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

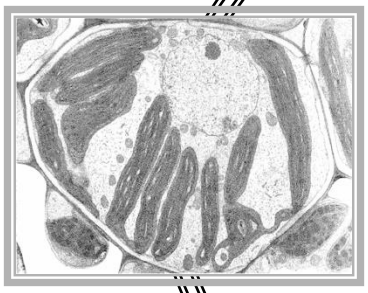
A

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID GRANUM

CHEMICAL ENERGY

P + ADP

CHLOROPLAST

ATMOSPHERE

OXYGEN

CHEM EGY INPUT

PHOTOSYNTHESIS

P

WATER

LIGHT EGY

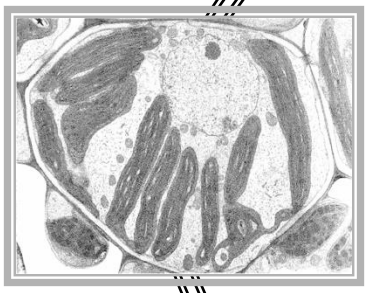
E-

PHOTOLYSIS

LT RXT

THYLAKOID GRANUM

CHEMICAL ENERGY



P + ADP → ATP

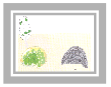
CHLOROPLAST

ATMOSPHERE

OXYGEN

CHEM EGY INPUT

PHOTOSYNTHESIS



F

WATER

LIGHT EGY

E-

PHOTOLYSIS

LT RXT

THYLAKOID GRANUM

CHEMICAL ENERGY

PHOSPHORYLATION

CHLOROPLAST

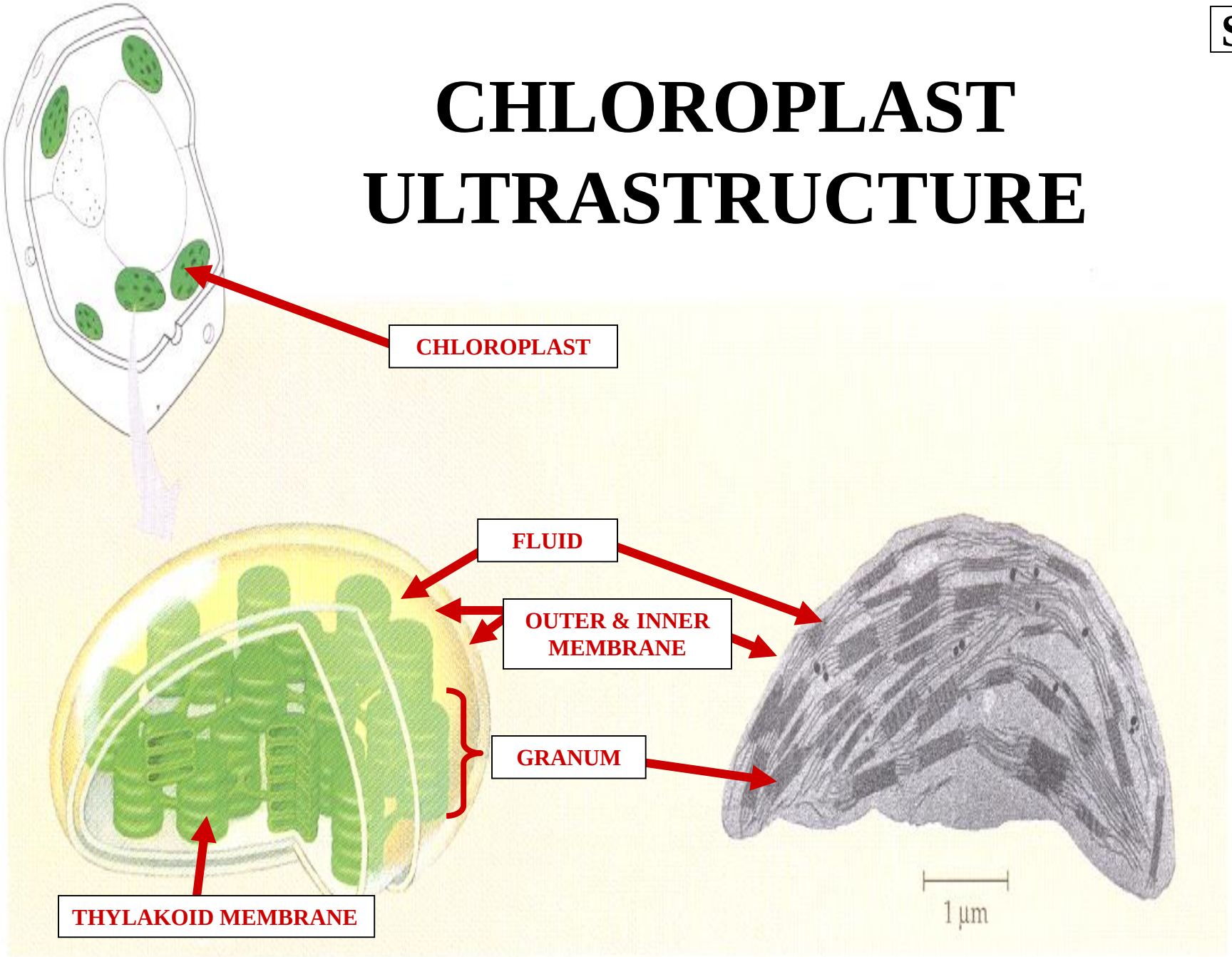
ATMOSPHERE

OXYGEN

CHEM EGY INPUT

S

CHLOROPLAST ULTRASTRUCTURE



STROMA

STROMA

CHLOROPLAST FLUID MATRIX

STROMA

STROMA

CHLOROPLAST FLUID MATRIX

SITE: DARK RXT

STROMA

S

STROMA

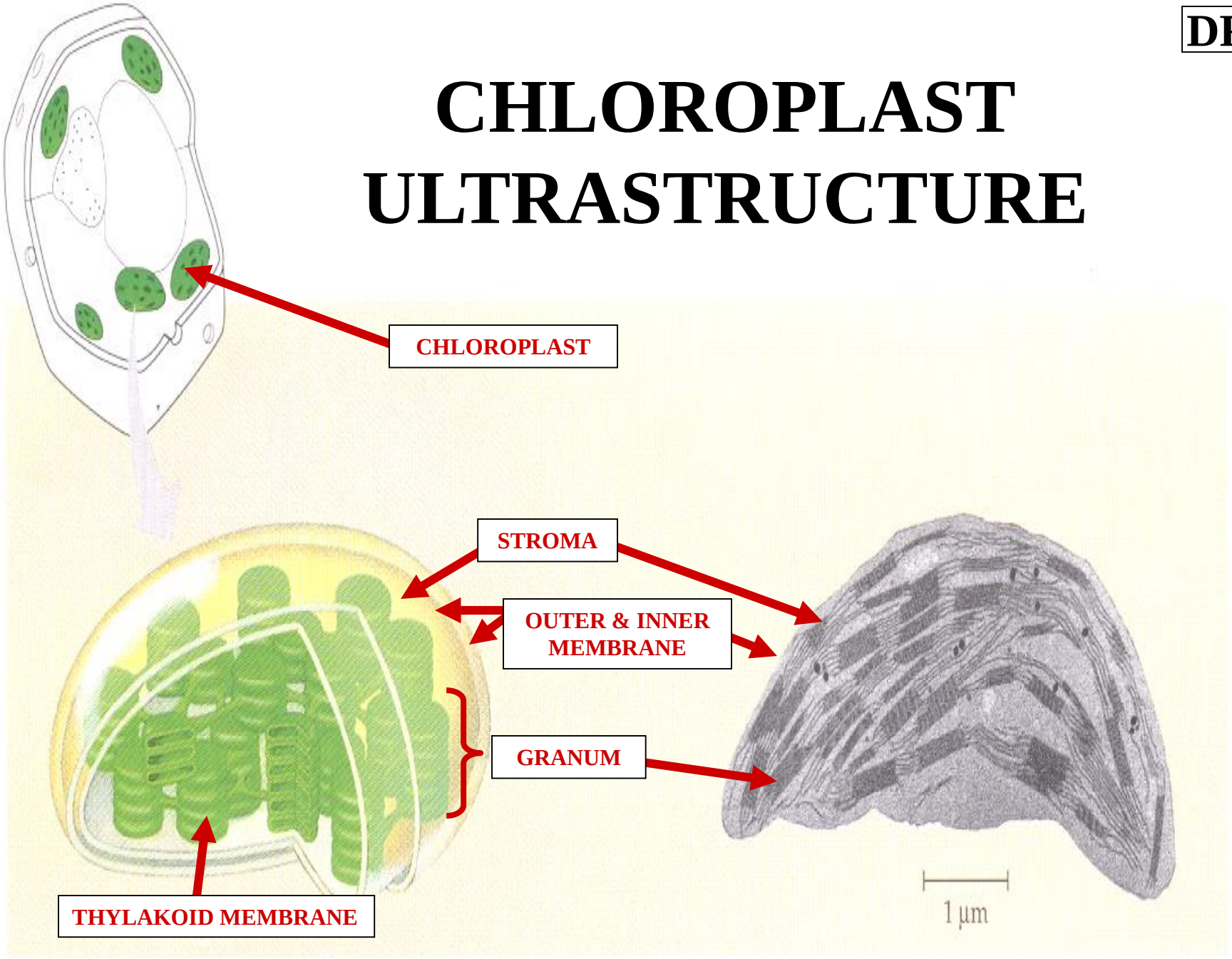
CHLOROPLAST FLUID MATRIX

SITE: DARK RXT DERIVES GLUCOSE

STROMA

DR

CHLOROPLAST ULTRASTRUCTURE



DARK REACTION

PHOTOSYNTHESIS

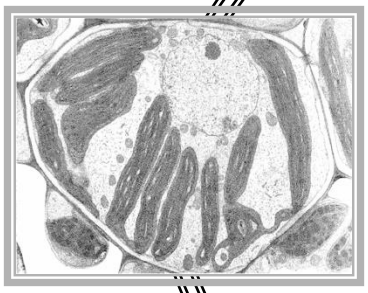
DR

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID

ATP

STROMA

CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

?

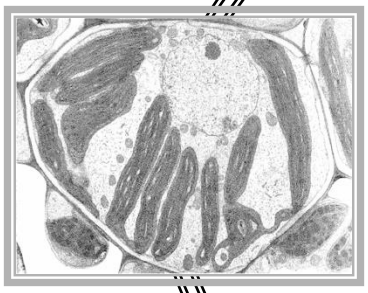
C

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID

ATP

DK RXT

STROMA

CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

C

WATER

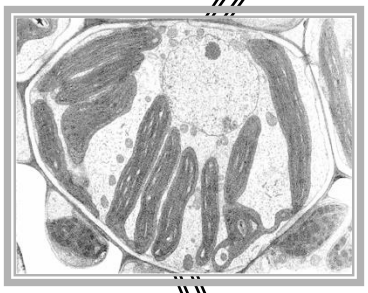
?

LIGHT EGY

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID

ATP

DK RXT

STROMA

CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

?

WATER

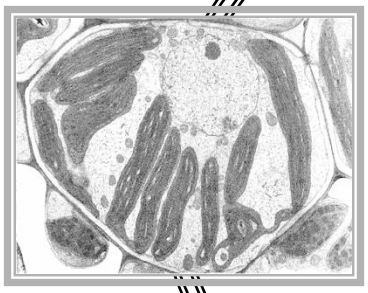
CO2

LIGHT EGY

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID

ATP

DK RXT

STROMA

CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

G

WATER

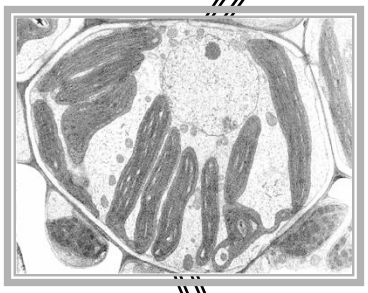
CO2

LIGHT EGY

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID

CHEMICAL ENERGY

DK RXT

STROMA

SYNTHESIS

CHLOROPLAST

ATMOSPHERE

OXYGEN

?

PHOTOSYNTHESIS

WATER

CO2

LIGHT EGY

PHOTO

ATMOSPHERE

E-

PHOTOLYSIS

LT RXT

THYLAKOID

CHEMICAL ENERGY

DK RXT

STROMA

SYNTHESIS

CHEM EGY INPUT

CHLOROPLAST

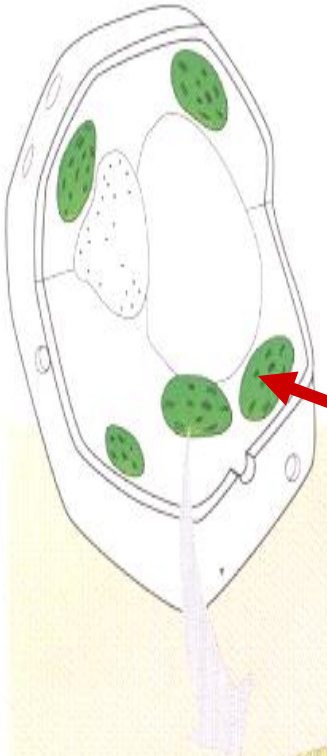
ATMOSPHERE

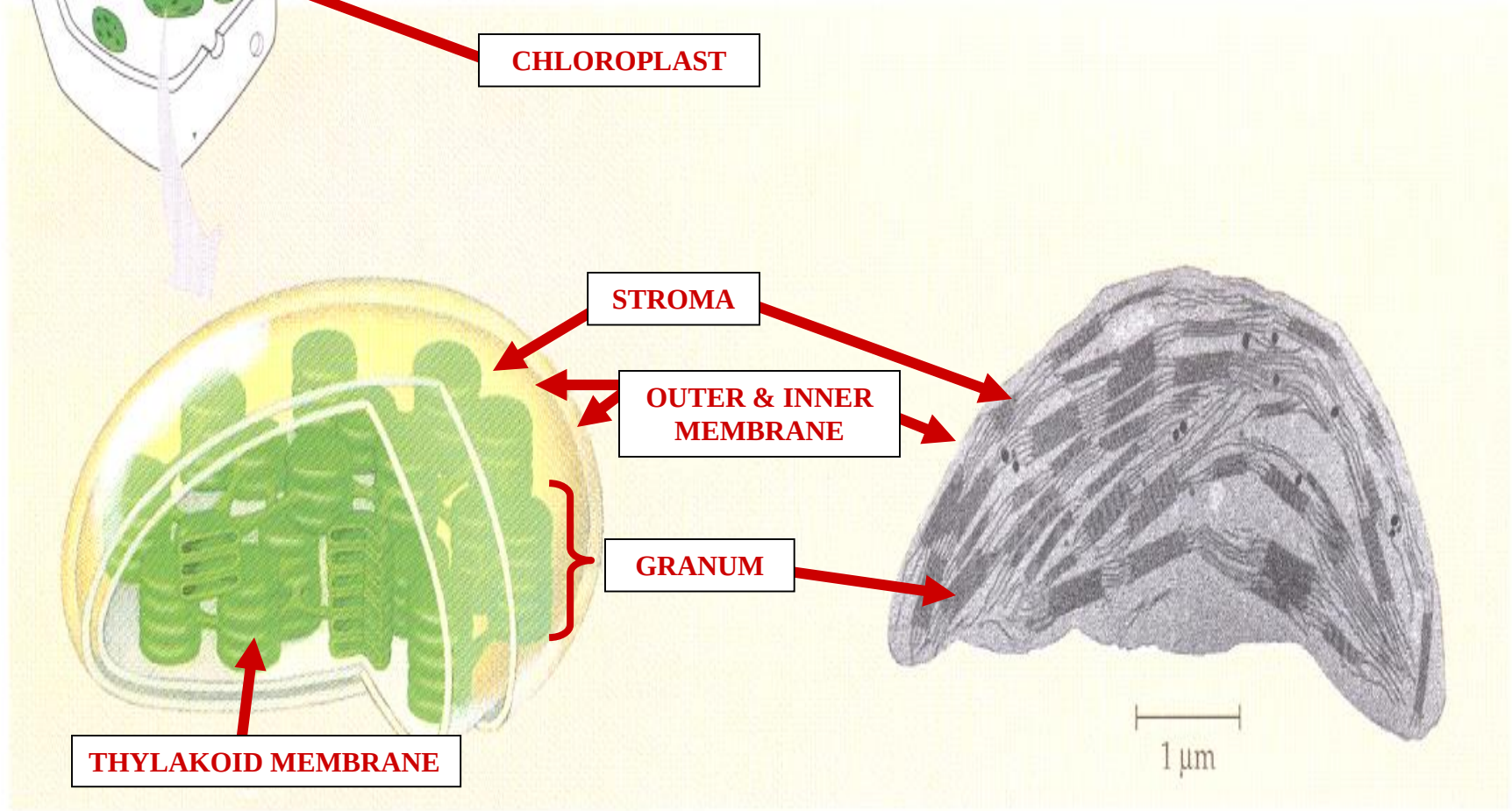
OXYGEN

GLUCOSE

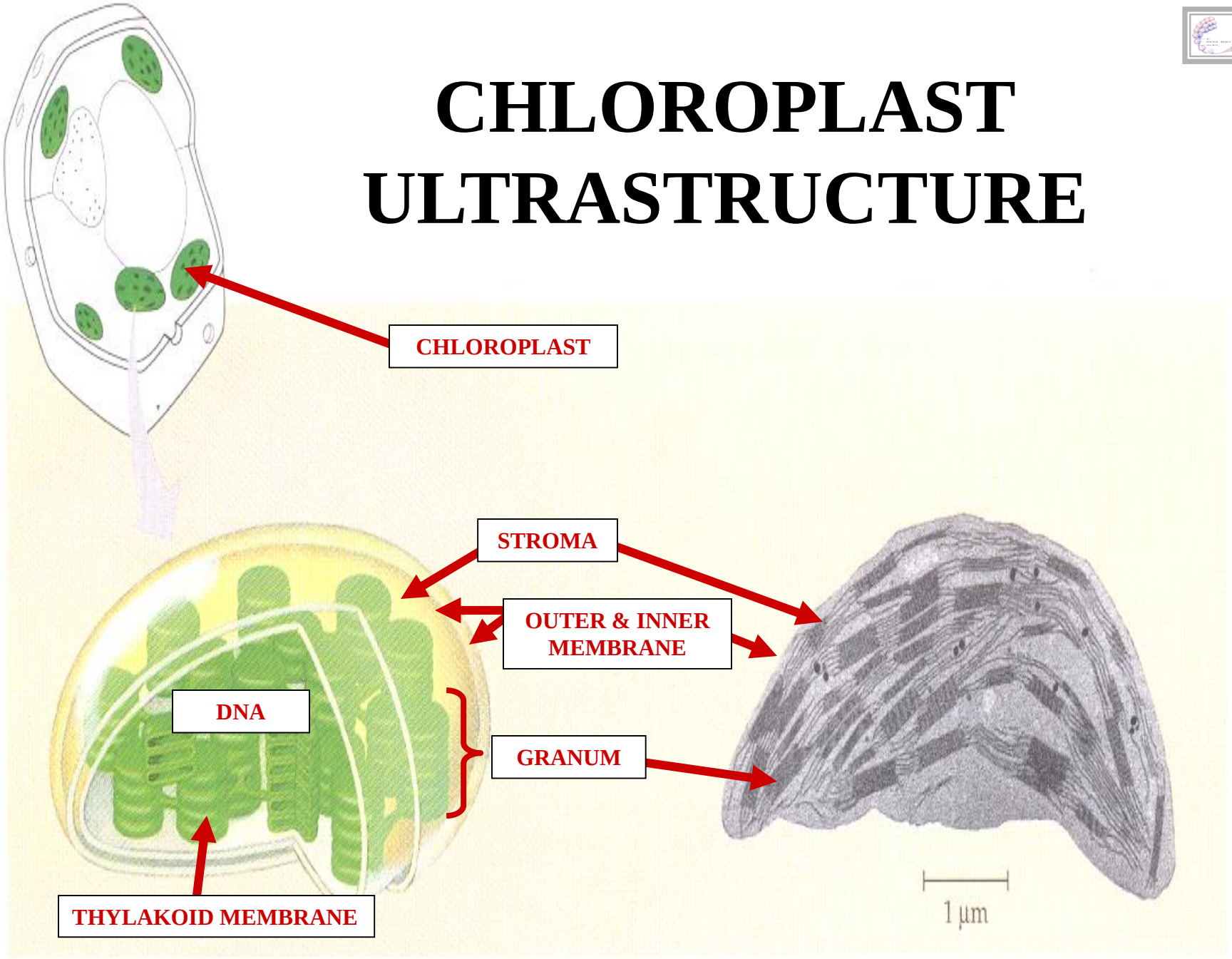
CHLOROPLAST ULTRASTRUCTURE

D

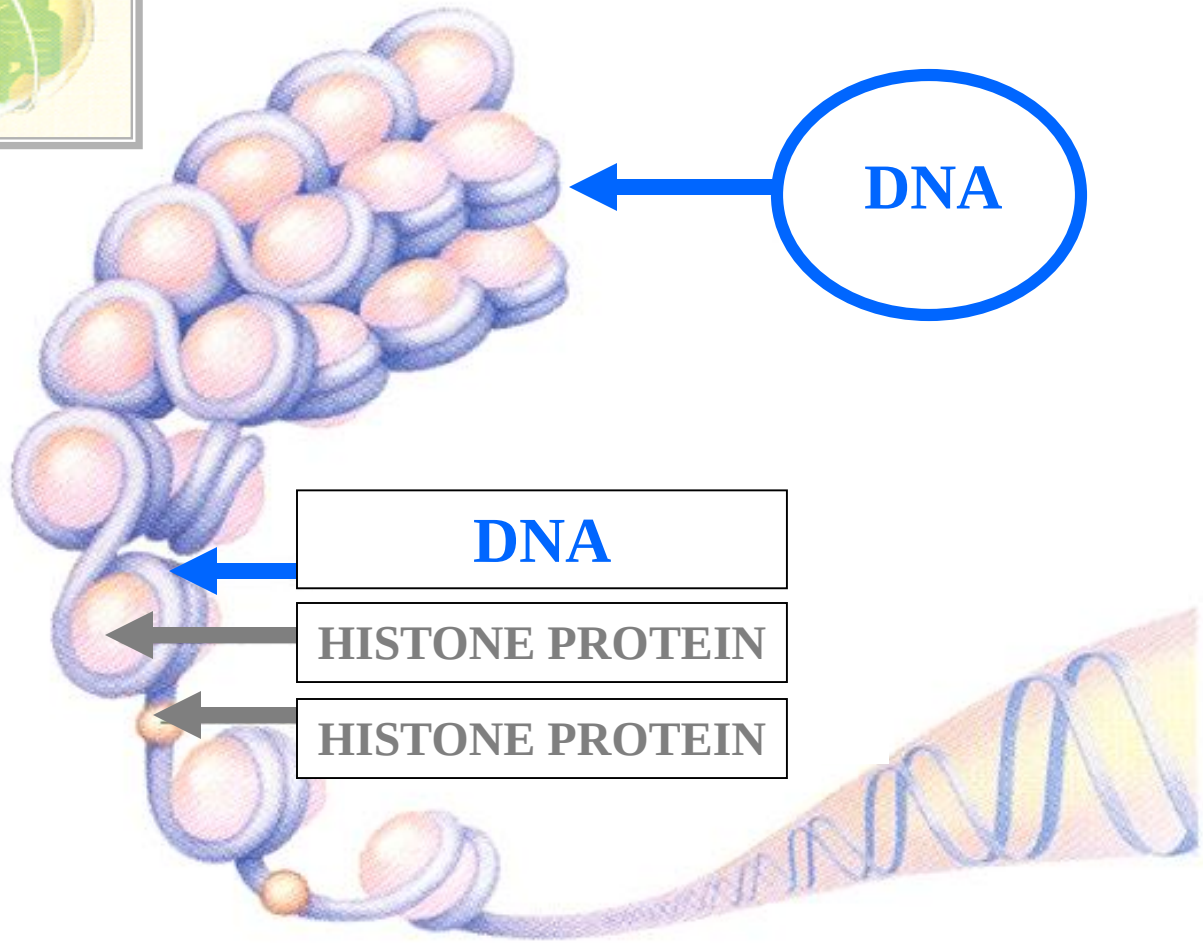




CHLOROPLAST ULTRASTRUCTURE

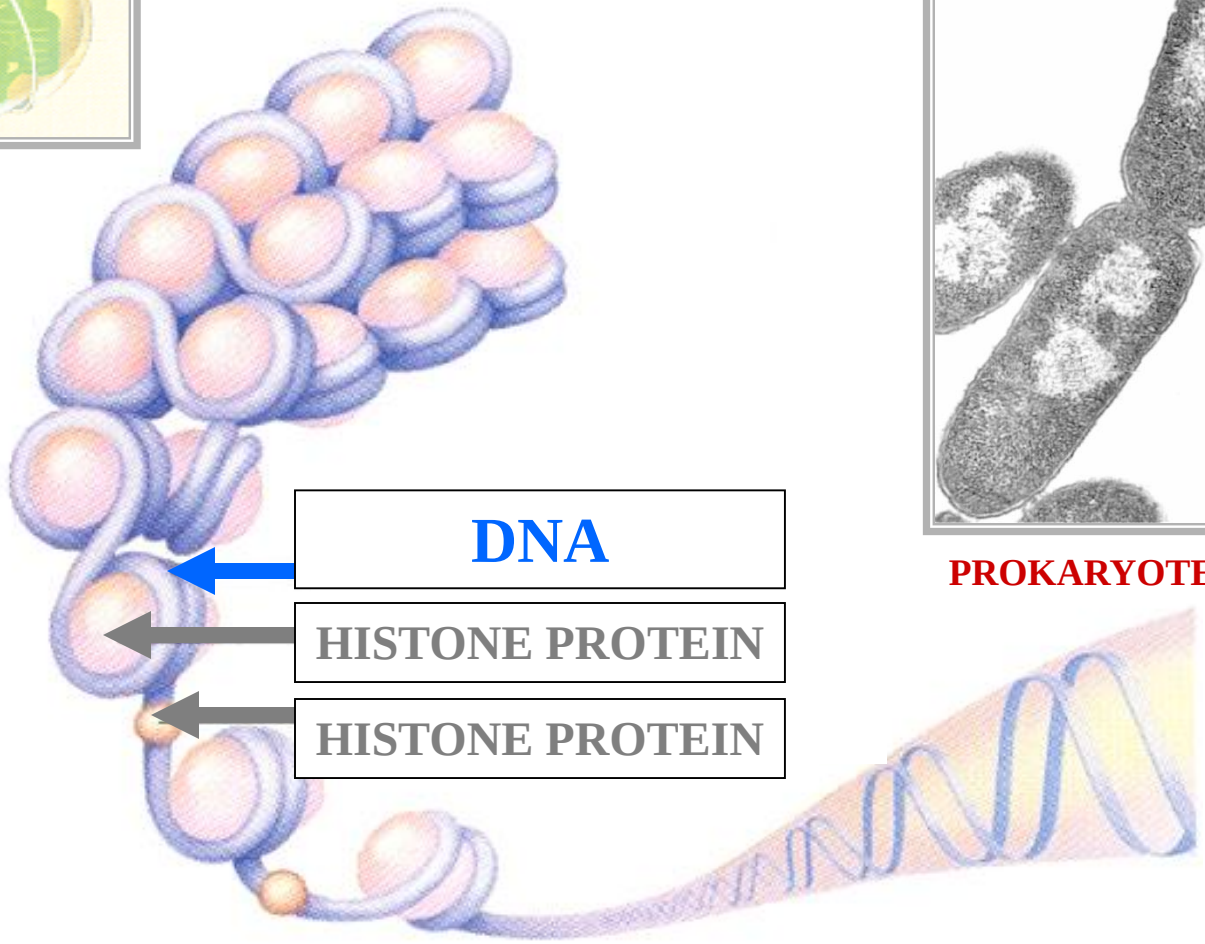


CHLOROPLAST DNA



CHLOROPLAST DNA: HISTONE PROTEINS **ABSENT**

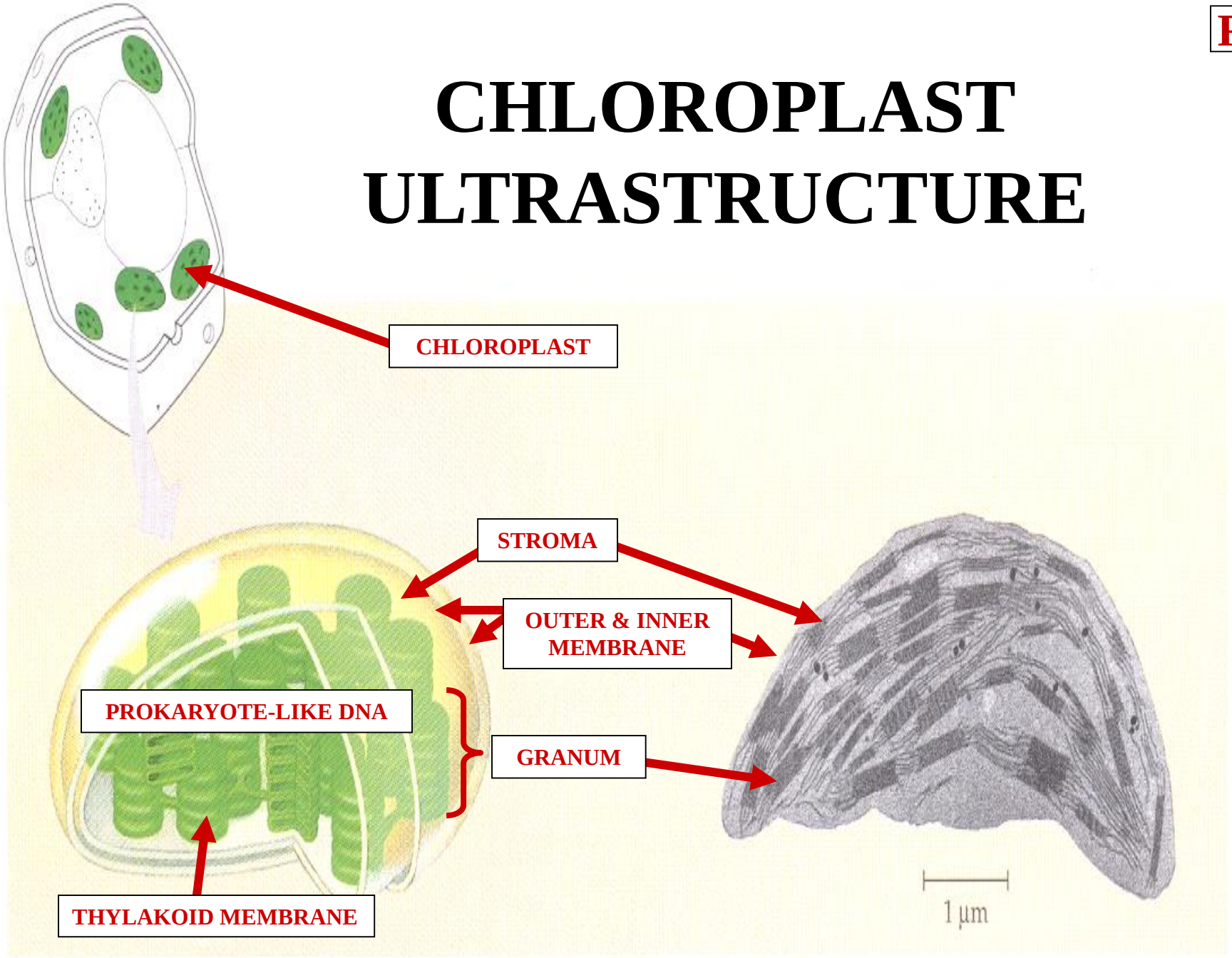
CHLOROPLAST DNA



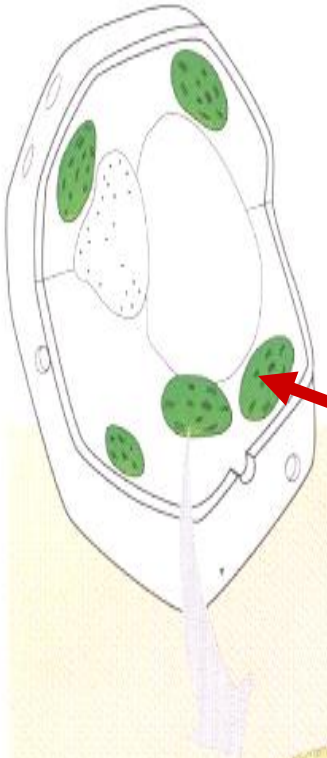
PROKARYOTE-LIKE

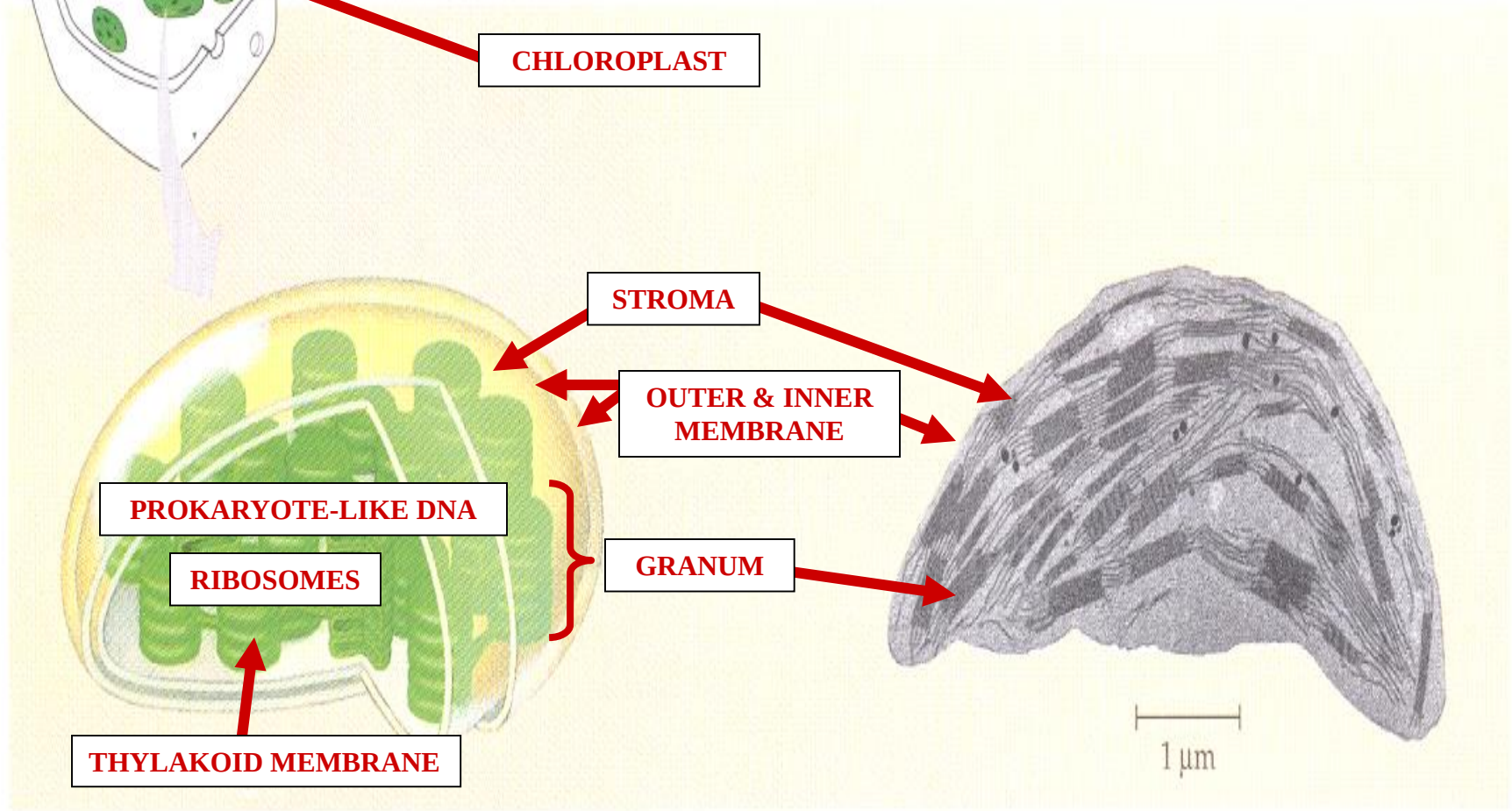
CHLOROPLAST DNA: HISTONE PROTEINS ABSENT

CHLOROPLAST ULTRASTRUCTURE

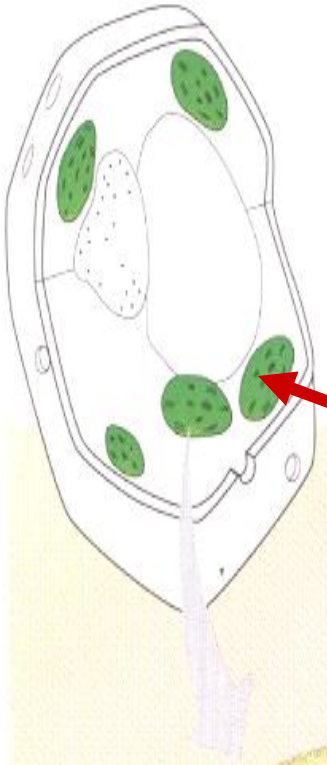


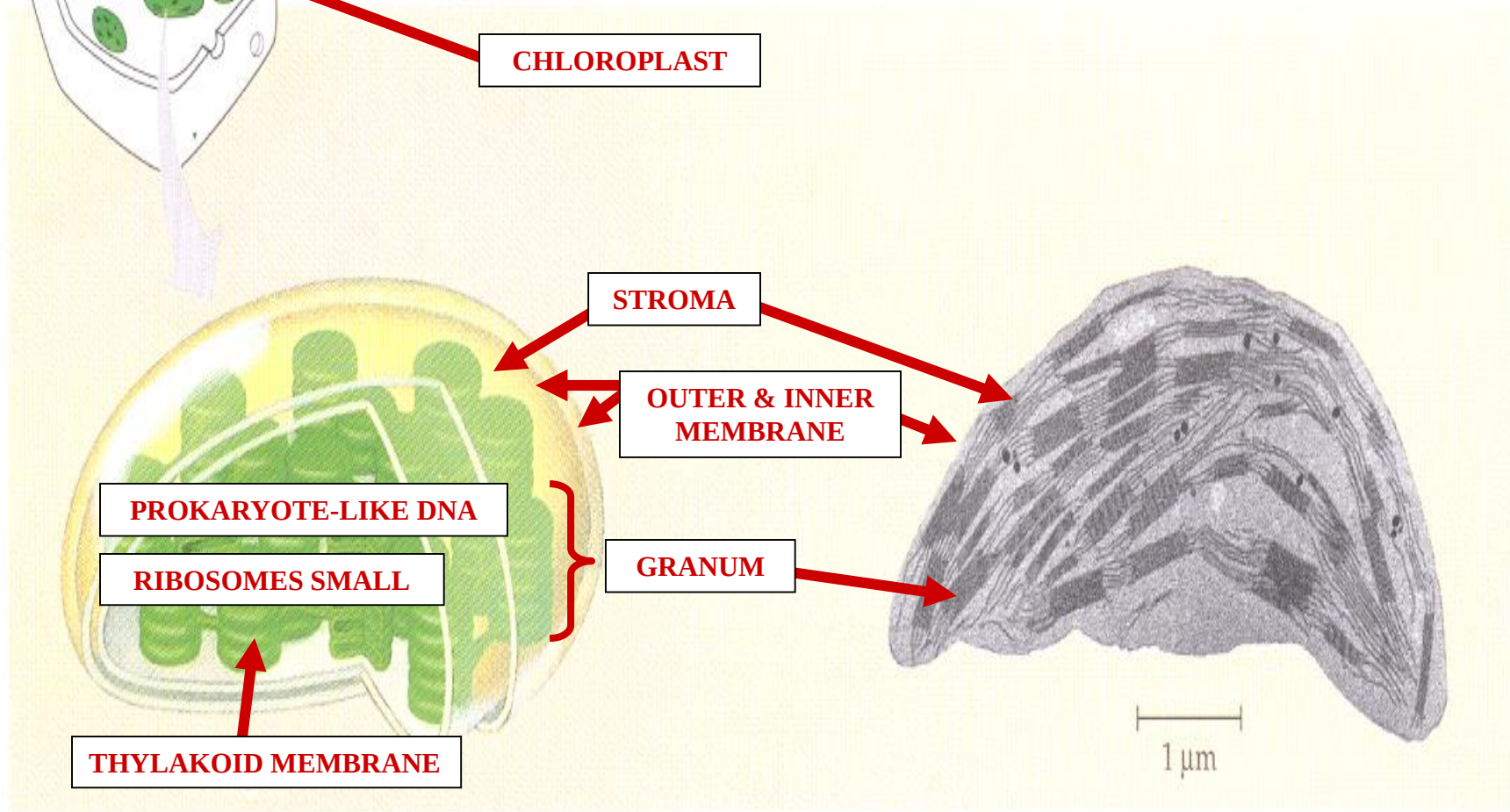
CHLOROPLAST ULTRASTRUCTURE



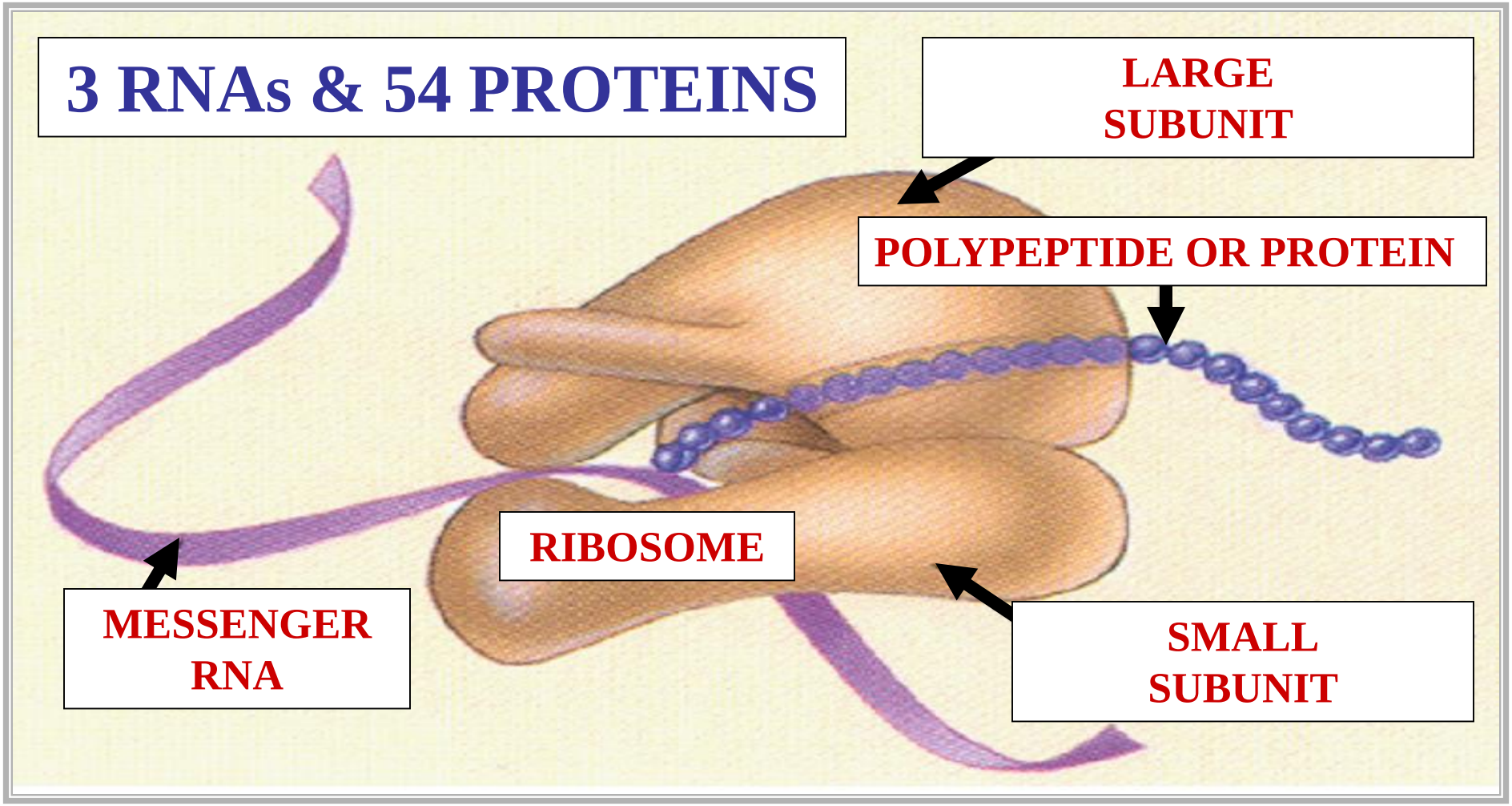


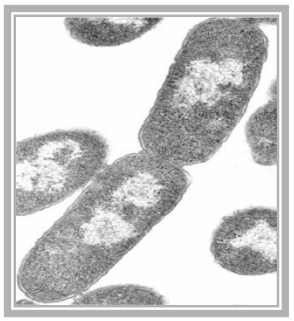
CHLOROPLAST ULTRASTRUCTURE





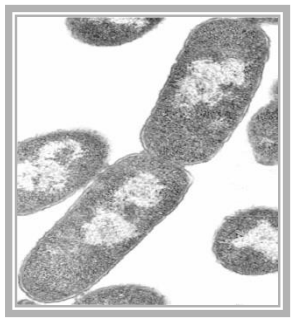
CHLOROPLAST RIBOSOME SMALL





PROKARYOTE-LIKE

CHLOROPLAST RIBOSOME SMALL



PROKARYOTE-LIKE

S

+

3 RNAs & 54 PROTEINS

LARGE SUBUNIT

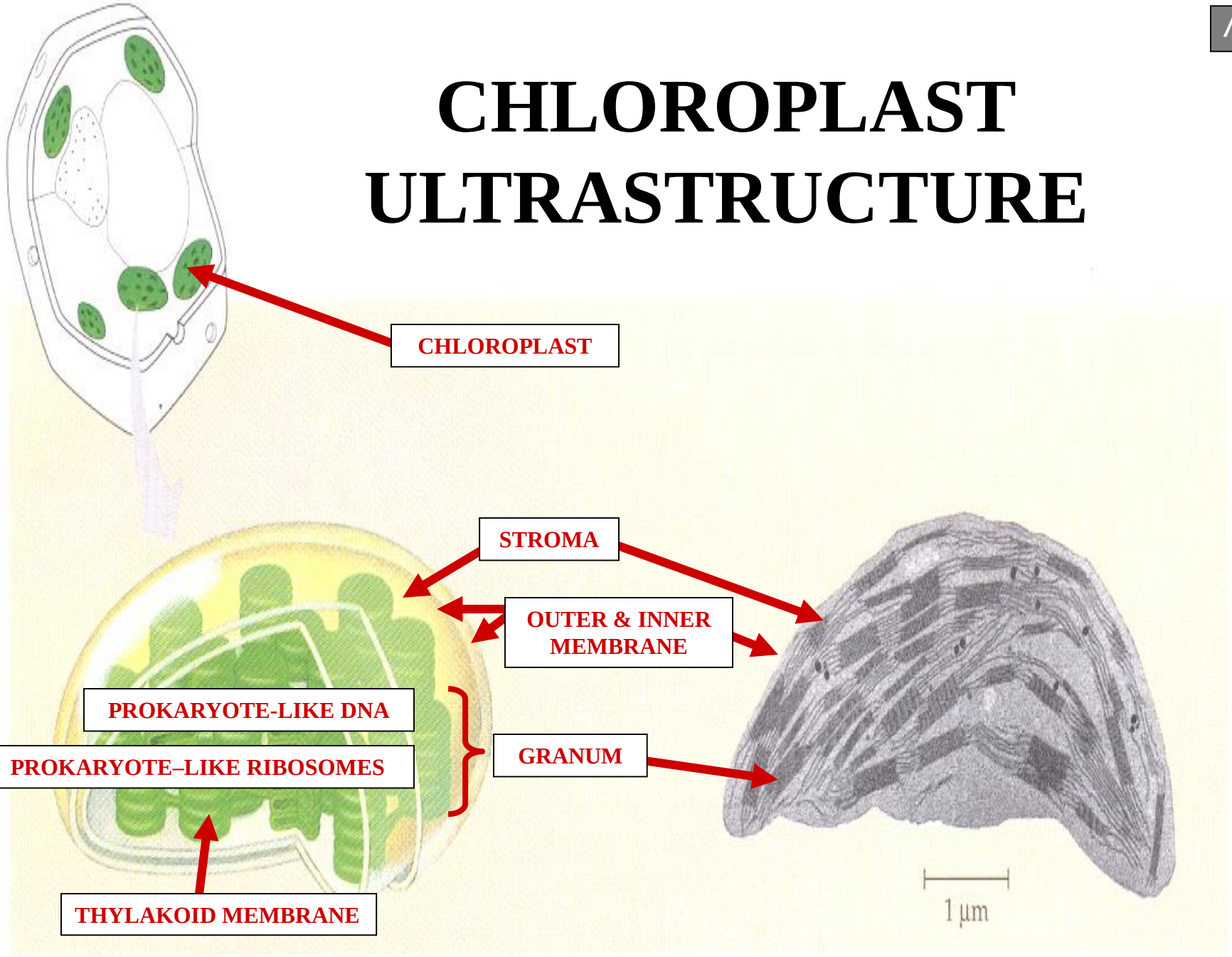
POLYPEPTIDE OR PROTEIN

RIBOSOME

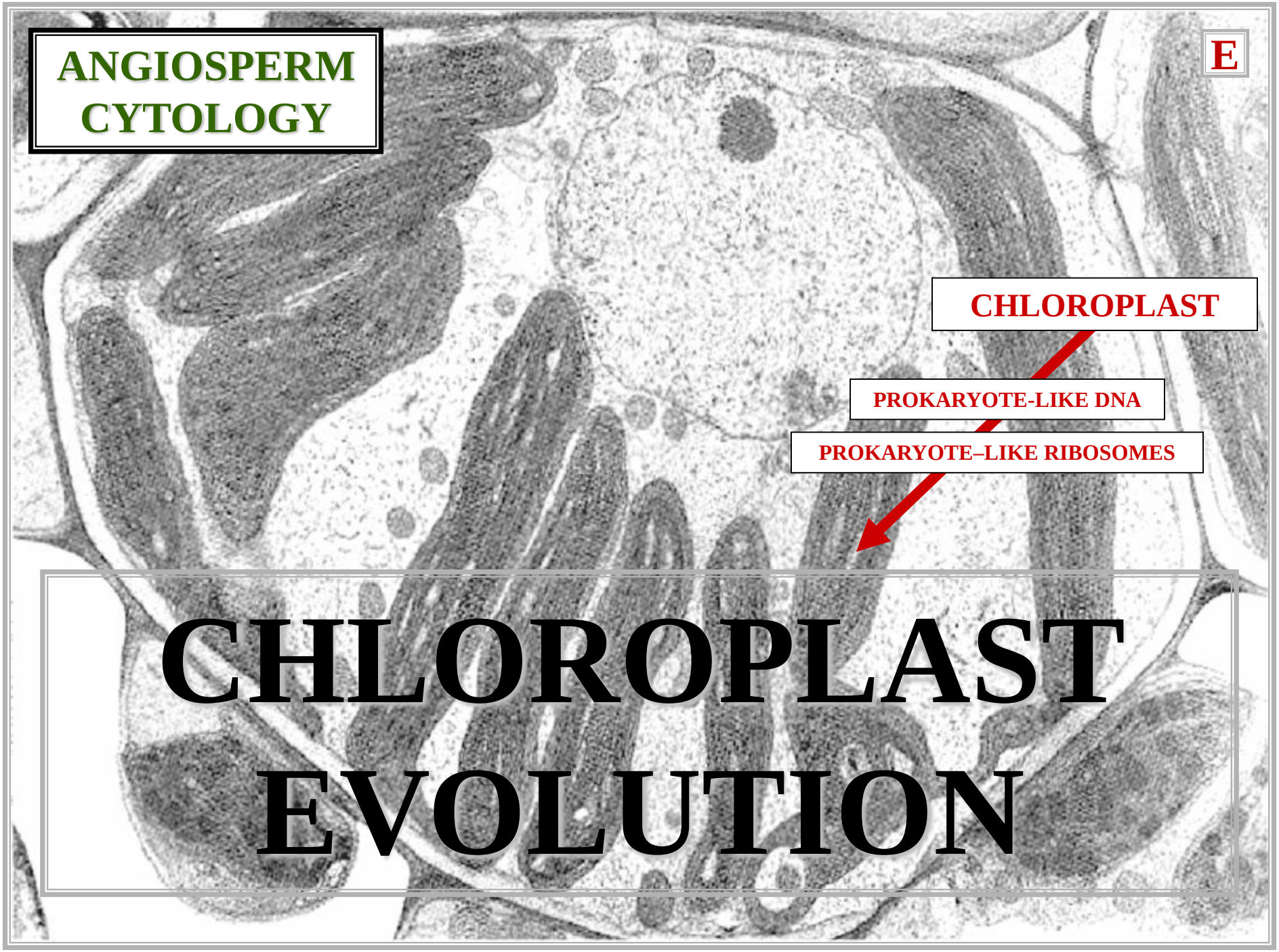
MESSENGER RNA

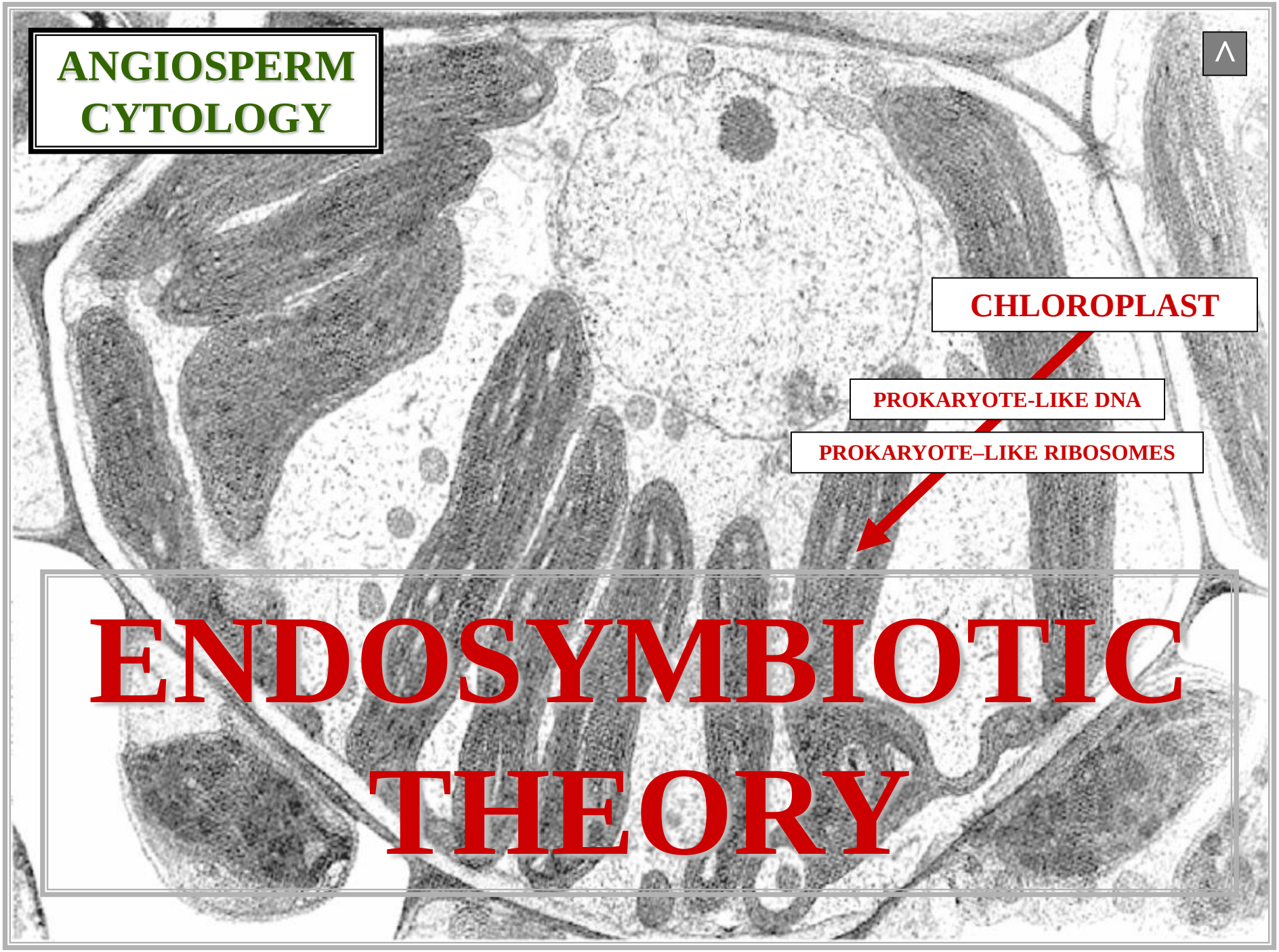
SMALL SUBUNIT

CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST EVOLUTION


ANGIOSPERM CYTOLOGY
E
CHLOROPLAST
PROKARYOTE-LIKE DNA
PROKARYOTE–LIKE RIBOSOMES
CHLOROPLAST EVOLUTION


ANGIOSPERM CYTOLOGY
CHLOROPLAST
PROKARYOTE-LIKE DNA
PROKARYOTE–LIKE RIBOSOMES
ENDOSYMBIOTIC THEORY

M

MITOCHONDRION

MITOCHONDRION

MITOCHONDRION

KNOWN ALL EUKARYOTE CELLS

MITOCHONDRION

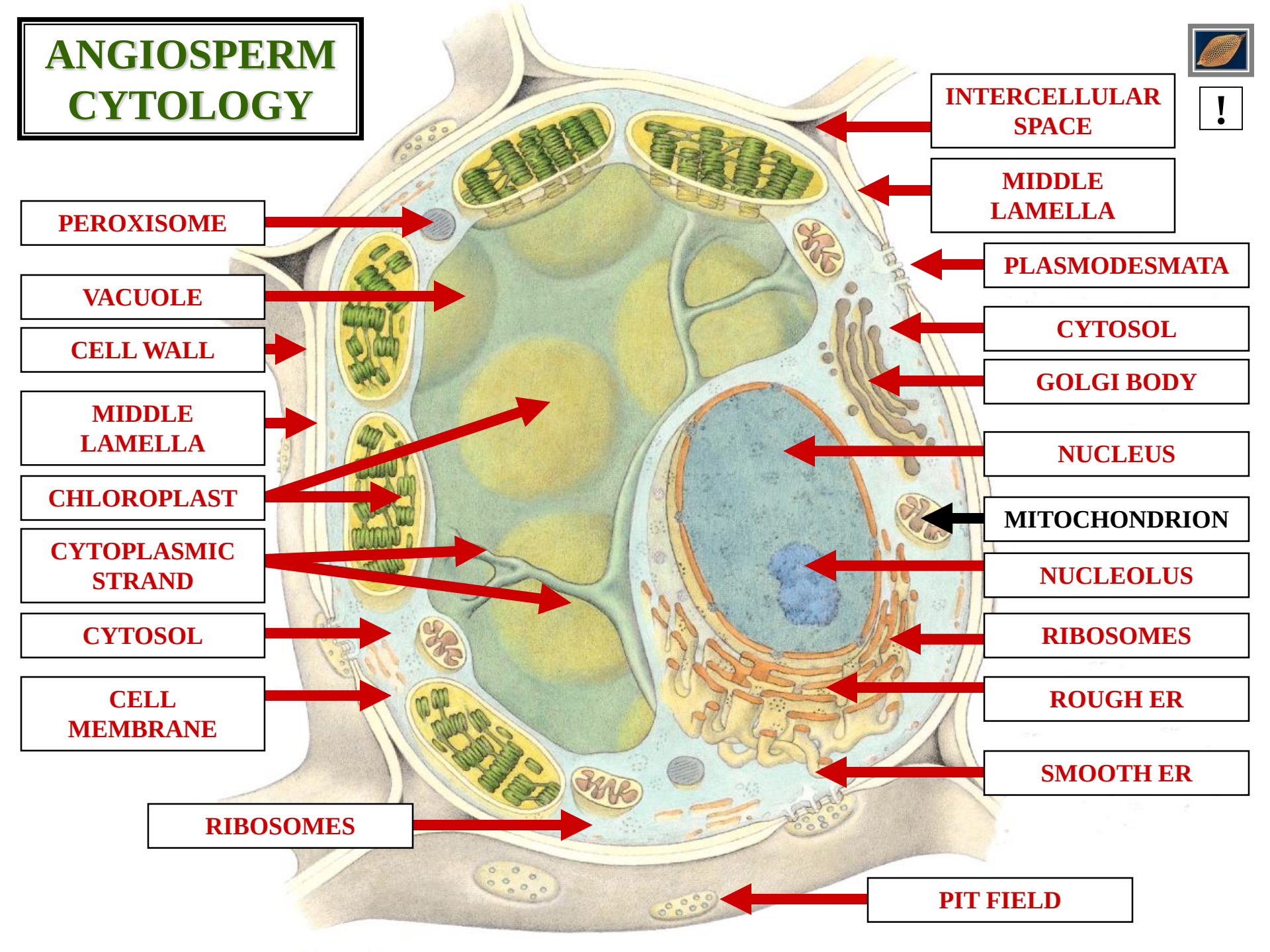
MITOCHONDRION

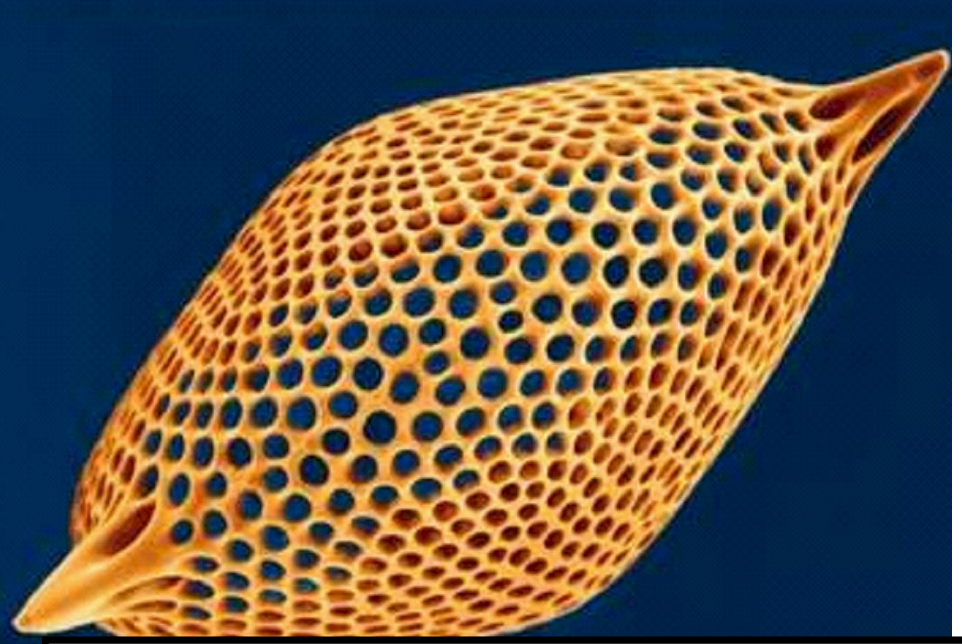
KNOWN ALL EUKARYOTE CELLS

SITE AEROBIC RESPIRATION

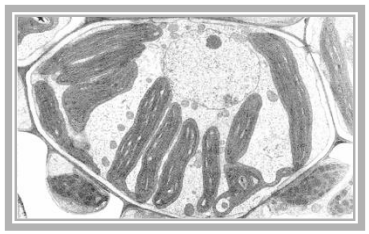
MITOCHONDRION

ANGIOSPERM CYTOLOGY

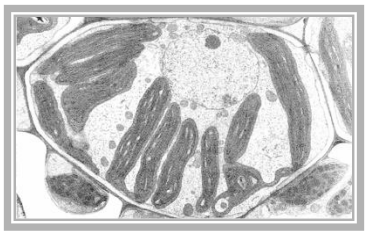




KNOWN ALL EUKARYOTES



AEROBIC RESPIRATION



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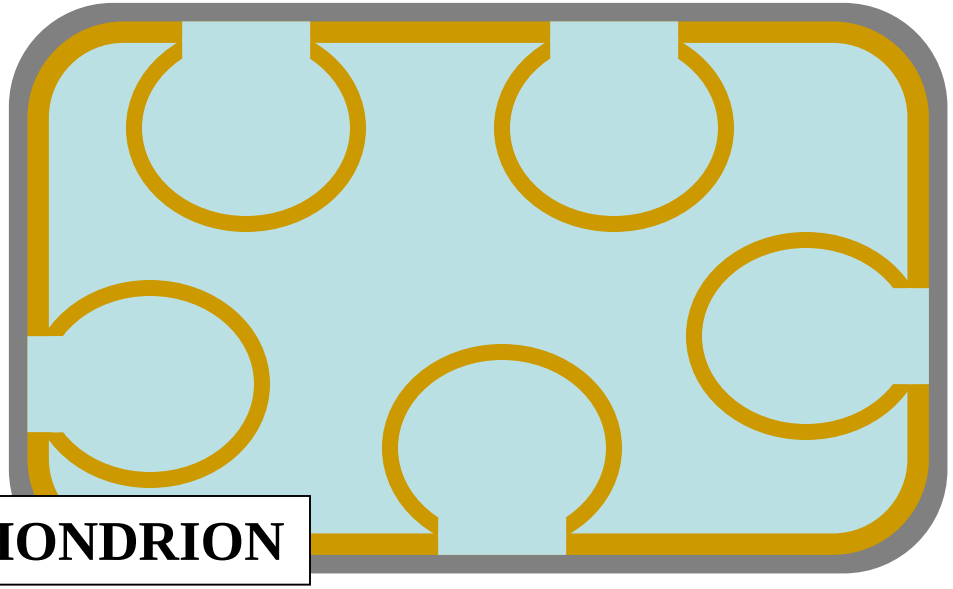
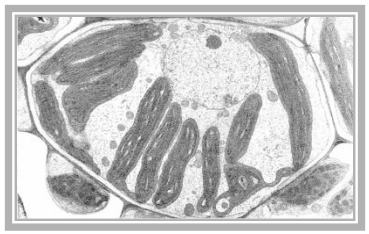


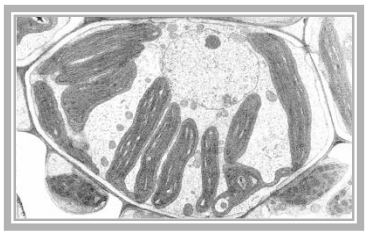
CYTOSOL

MITOCHONDRION

CELL

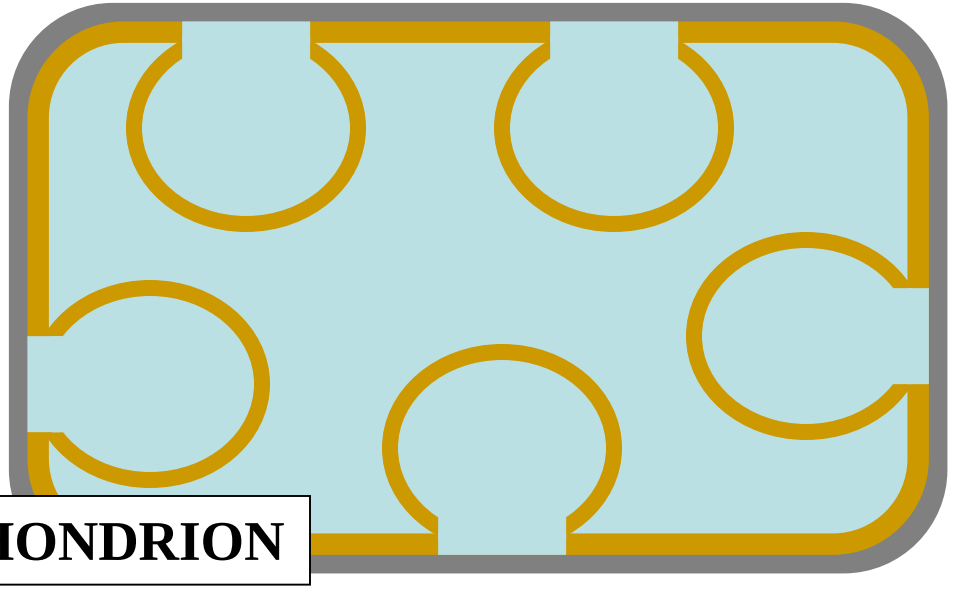


AEROBIC RESPIRATION



K

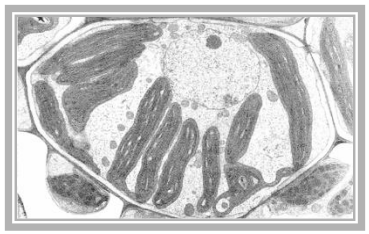
GLYCOLYSIS →



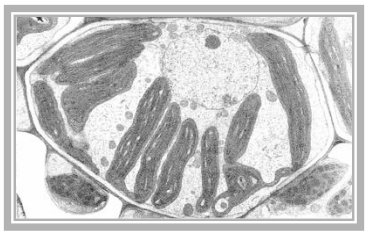
CYTOSOL

MITOCHONDRION

CELL

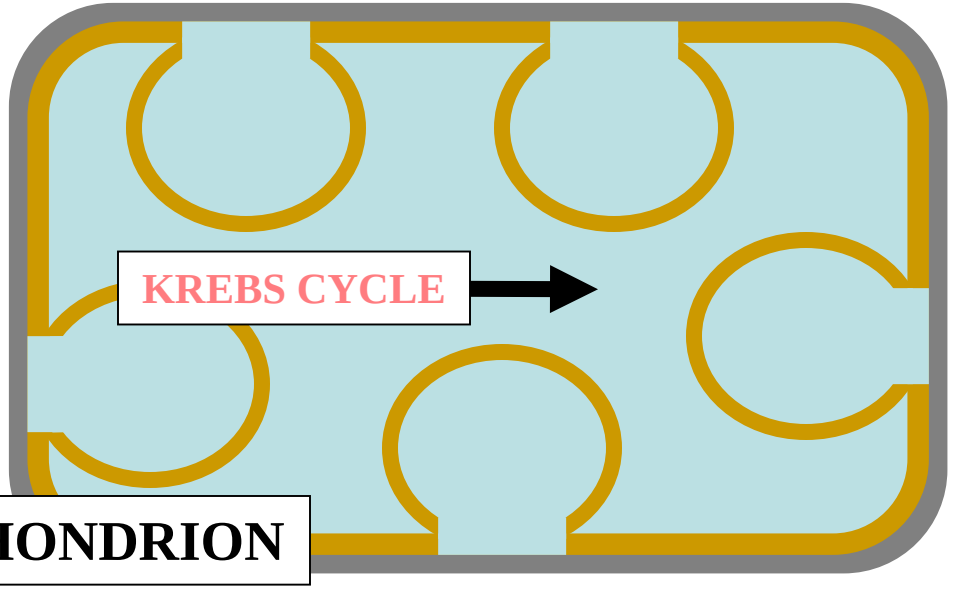


AEROBIC RESPIRATION



E

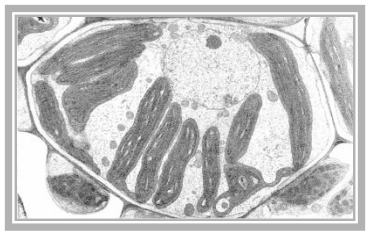
GLYCOLYSIS →



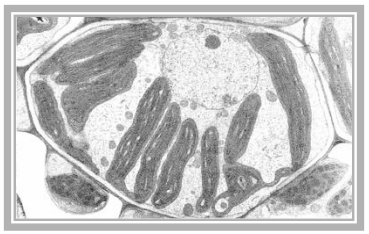
CYTOSOL

MITOCHONDRION

CELL



AEROBIC RESPIRATION



GLYCOLYSIS →

KREBS CYCLE → ETC

CYTOSOL

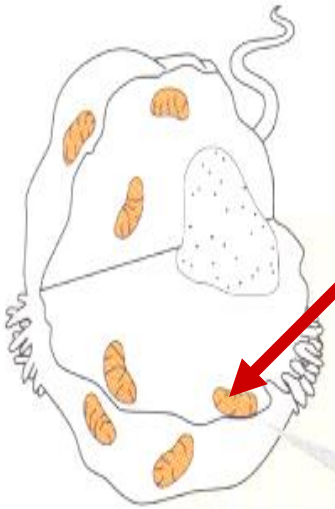
MITOCHONDRION

CELL

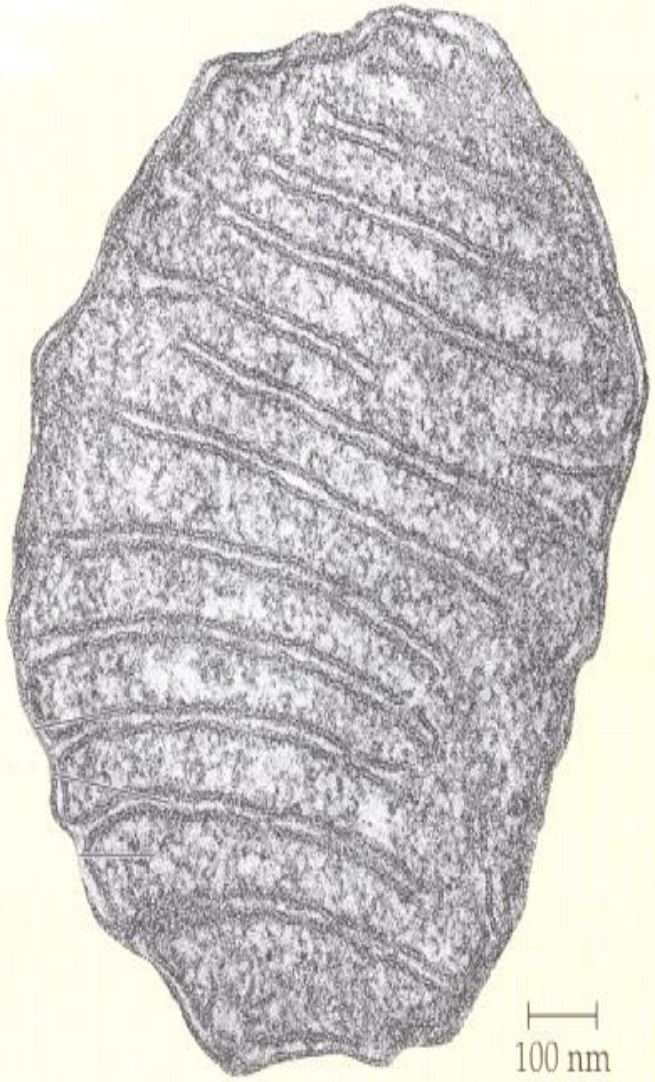
MITOCHONDRION ULTRASTRUCTURE

MITOCHONDRION ULTRASTRUCTURE

O

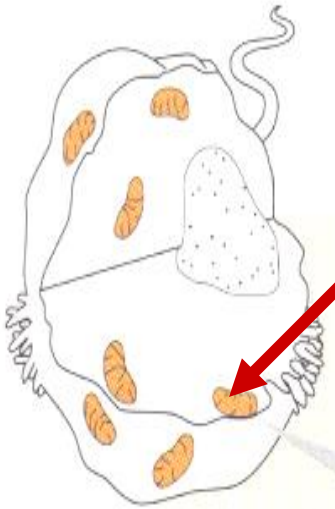


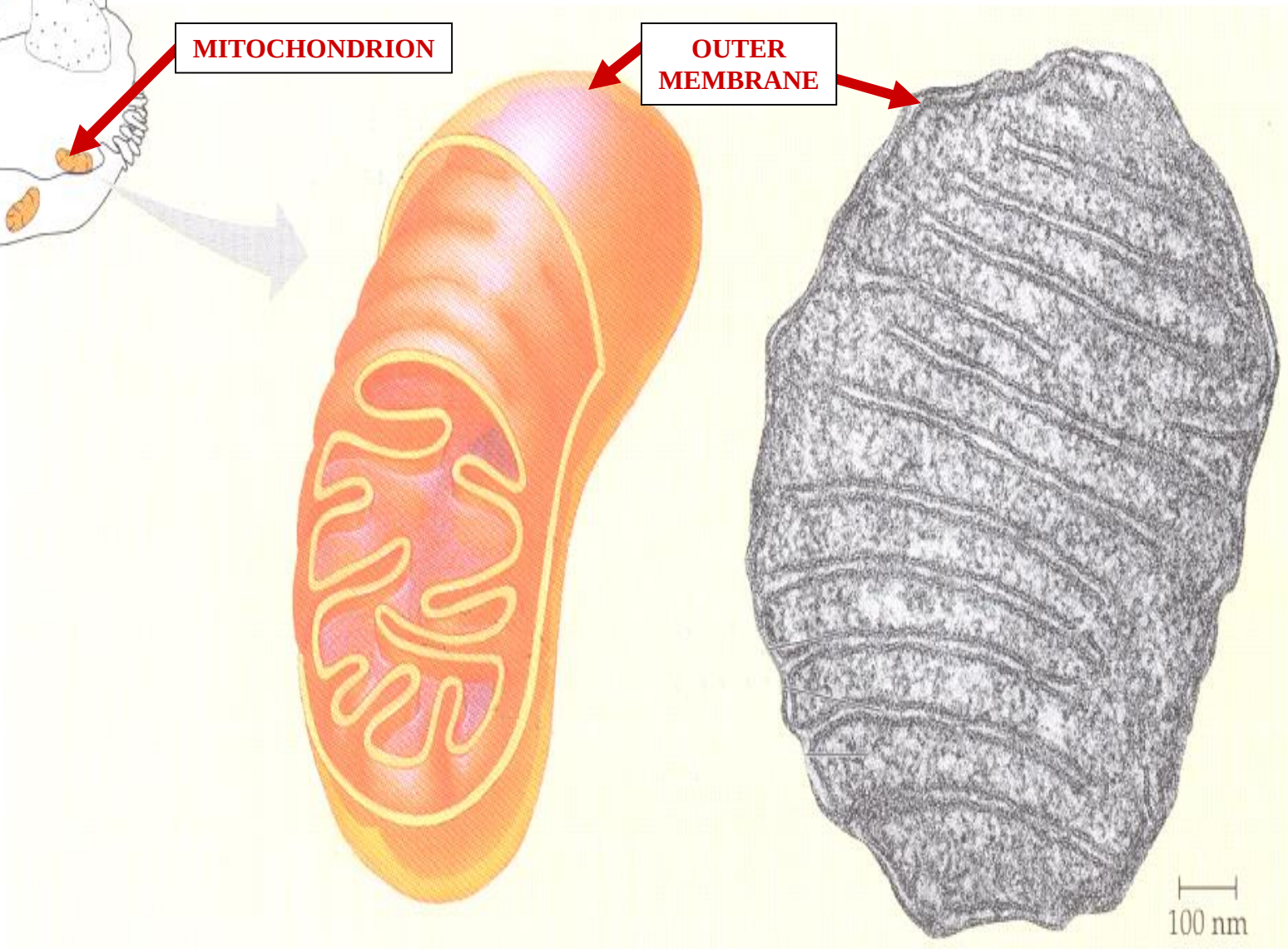
MITOCHONDRION



MITOCHONDRION ULTRASTRUCTURE

I

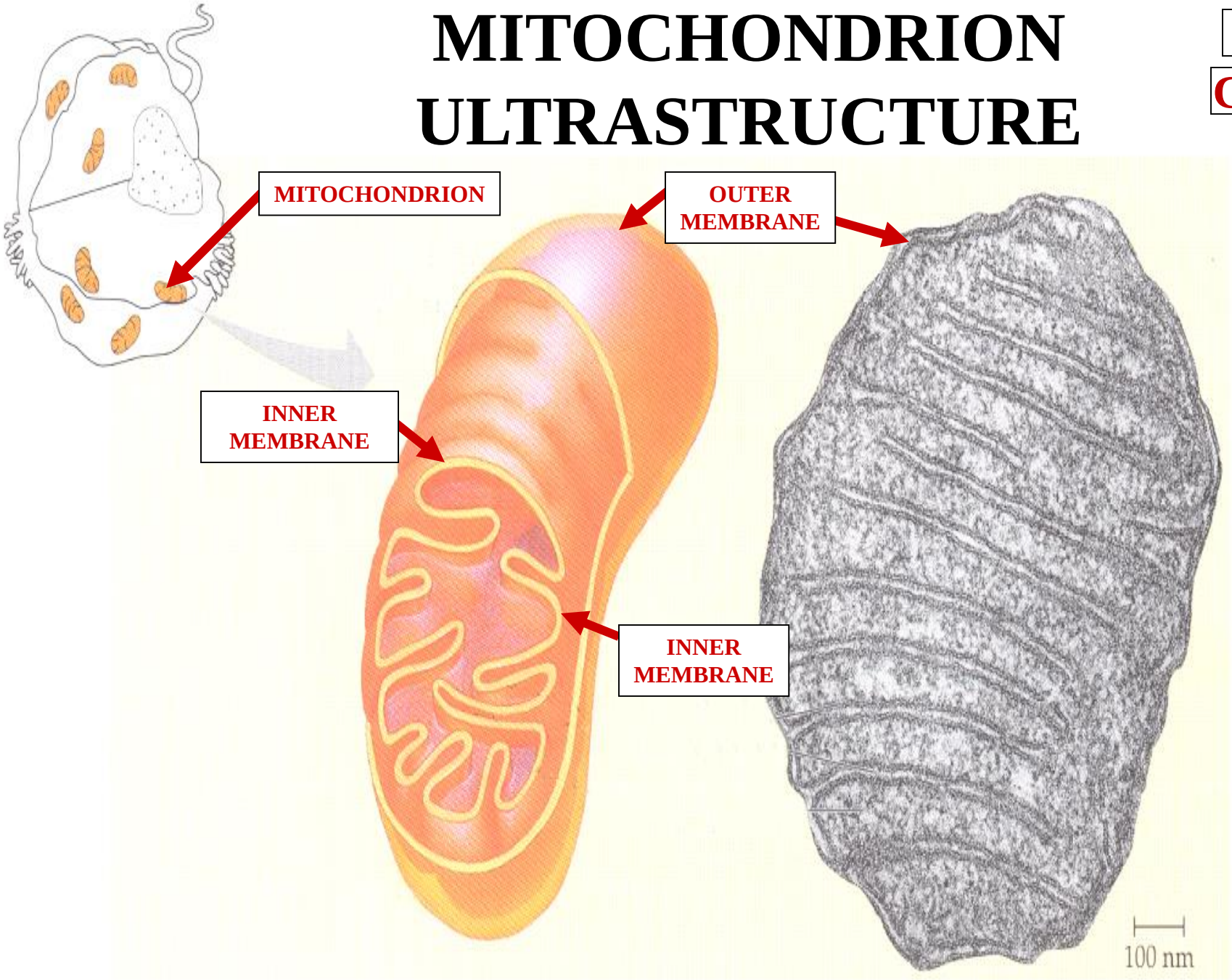




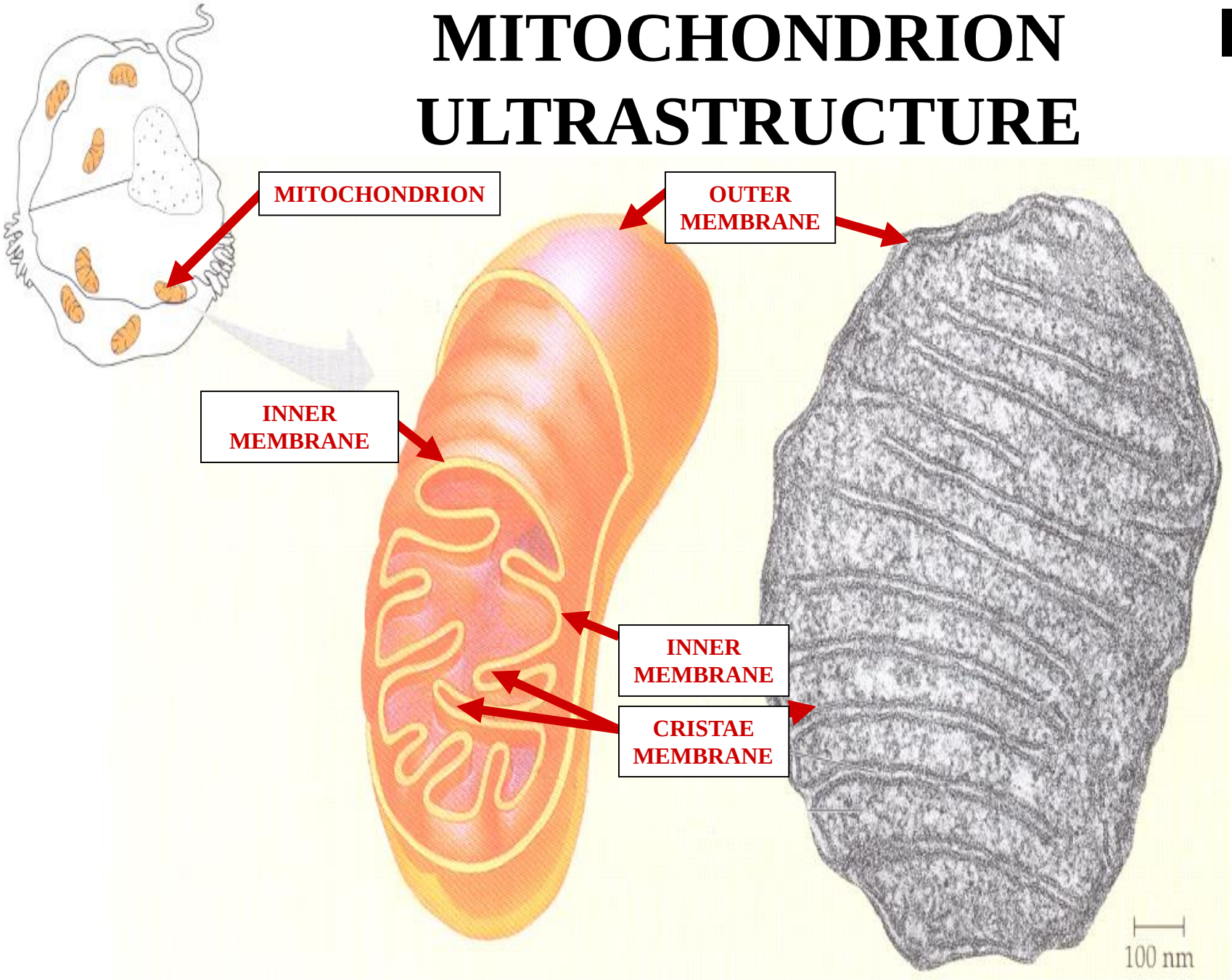
MITOCHONDRION ULTRASTRUCTURE

=

CR



MITOCHONDRION ULTRASTRUCTURE



CM

INNER MEMBRANE

SYNONYMOUS

CRISTAE MEMBRANE

CRISTAE MEMBRANE

CRISTAE MEMBRANE

MITOCHONDRION INNER MEMBRANE

CRISTAE MEMBRANE

CRISTAE MEMBRANE

MITOCHONDRION INNER MEMBRANE

SITE: ETC

CRISTAE MEMBRANE

CRISTAE MEMBRANE

MITOCHONDRION INNER MEMBRANE

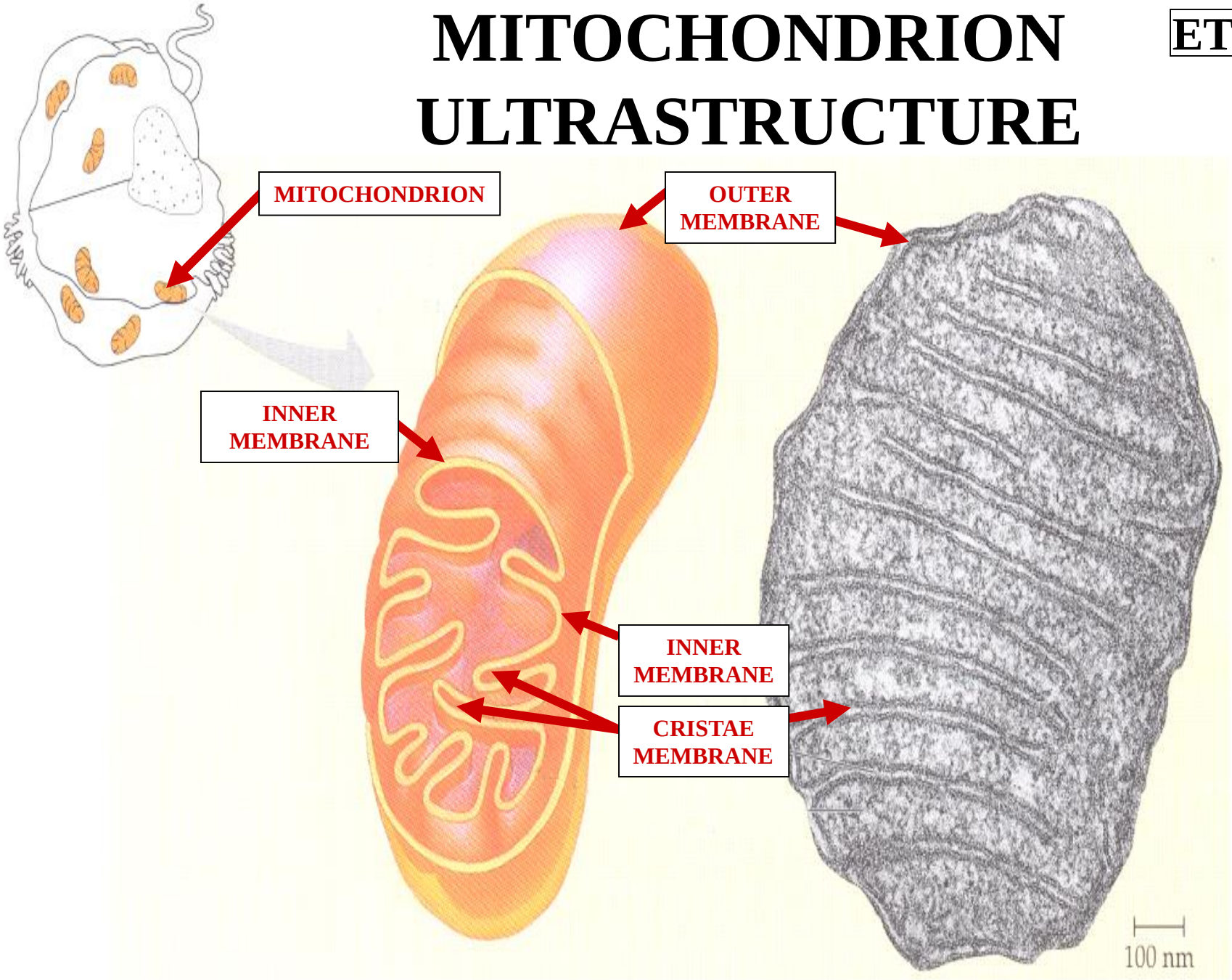
SITE: ETC

DERIVES ATP

CRISTAE MEMBRANE

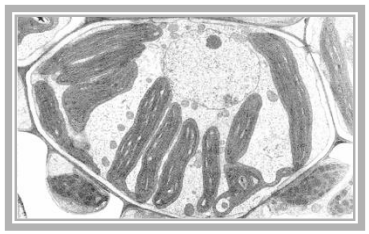
MITOCHONDRION ULTRASTRUCTURE

ETC

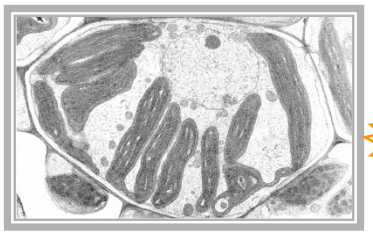


C

ELECTRON TRANSPORT CHAIN



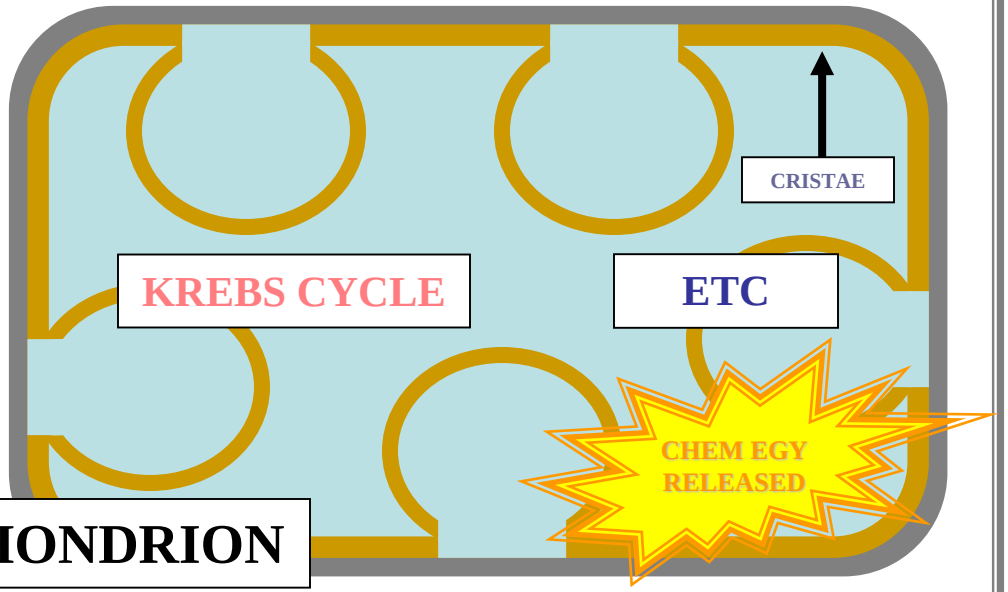
AEROBIC RESPIRATION



I

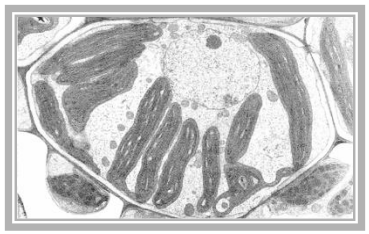
CELL

GLYCOLYSIS

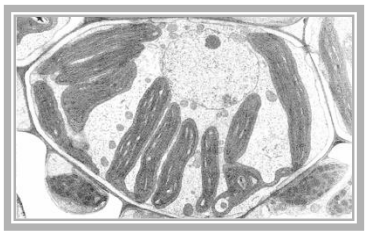


MITOCHONDRION

EGY



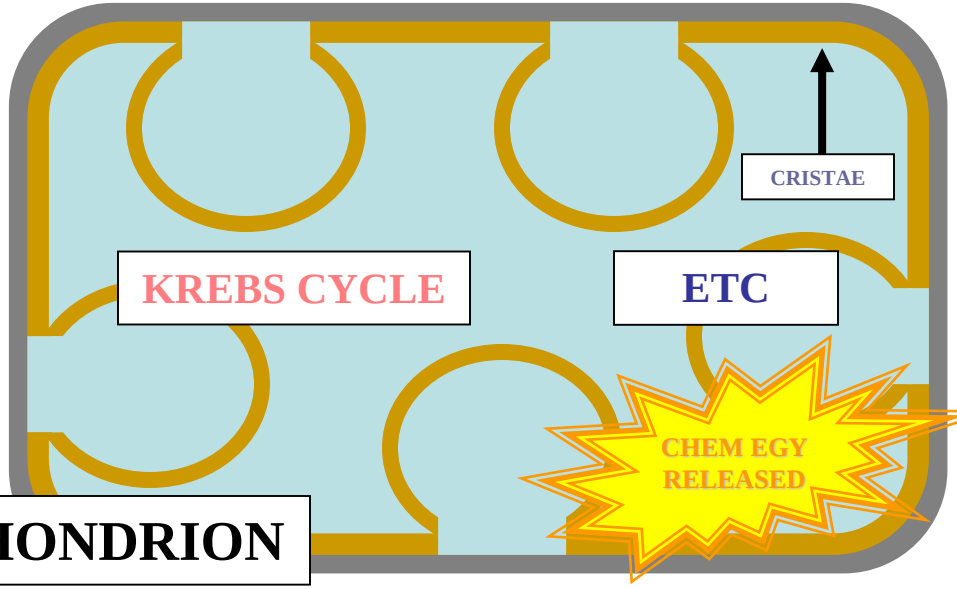
AEROBIC RESPIRATION



A

CELL

GLYCOLYSIS

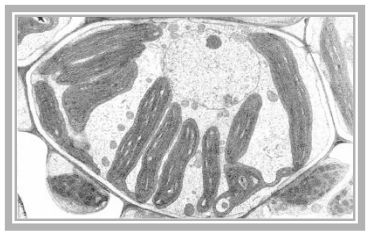


MITOCHONDRION

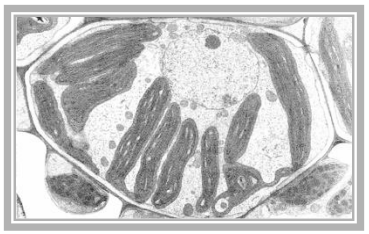
P + ADP

CHEM EGY INPUT

EGY



AEROBIC RESPIRATION



P

CELL

GLYCOLYSIS

CRISTAE

KREBS CYCLE

ETC

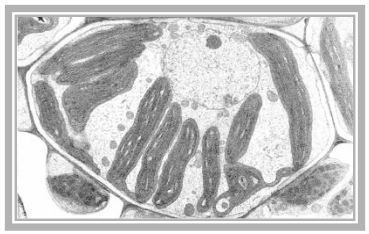
CHEM EGY INPUT

MITOCHONDRION

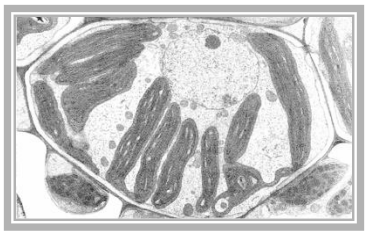
P + ADP → ATP

ATP

EGY



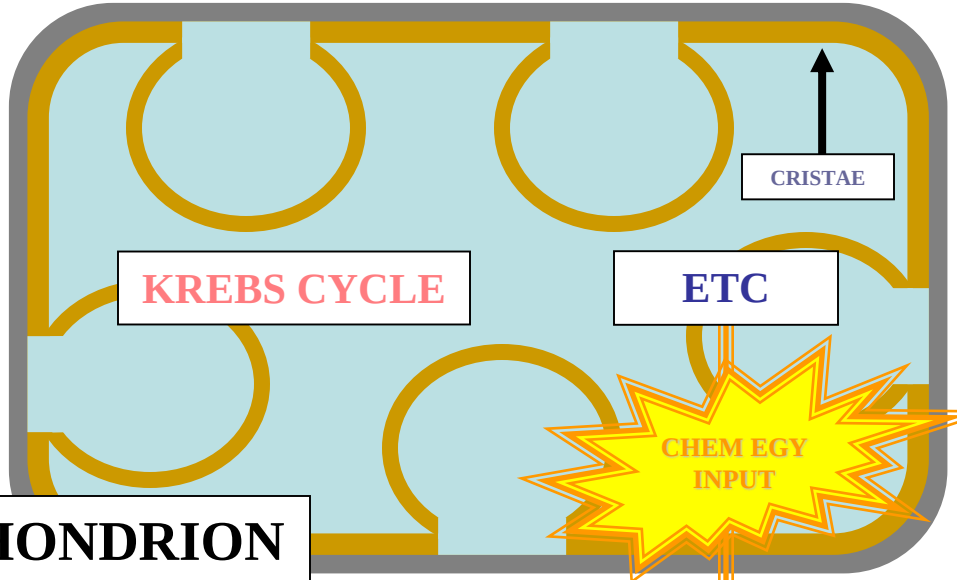
AEROBIC RESPIRATION



F

CELL

GLYCOLYSIS



MITOCHONDRION

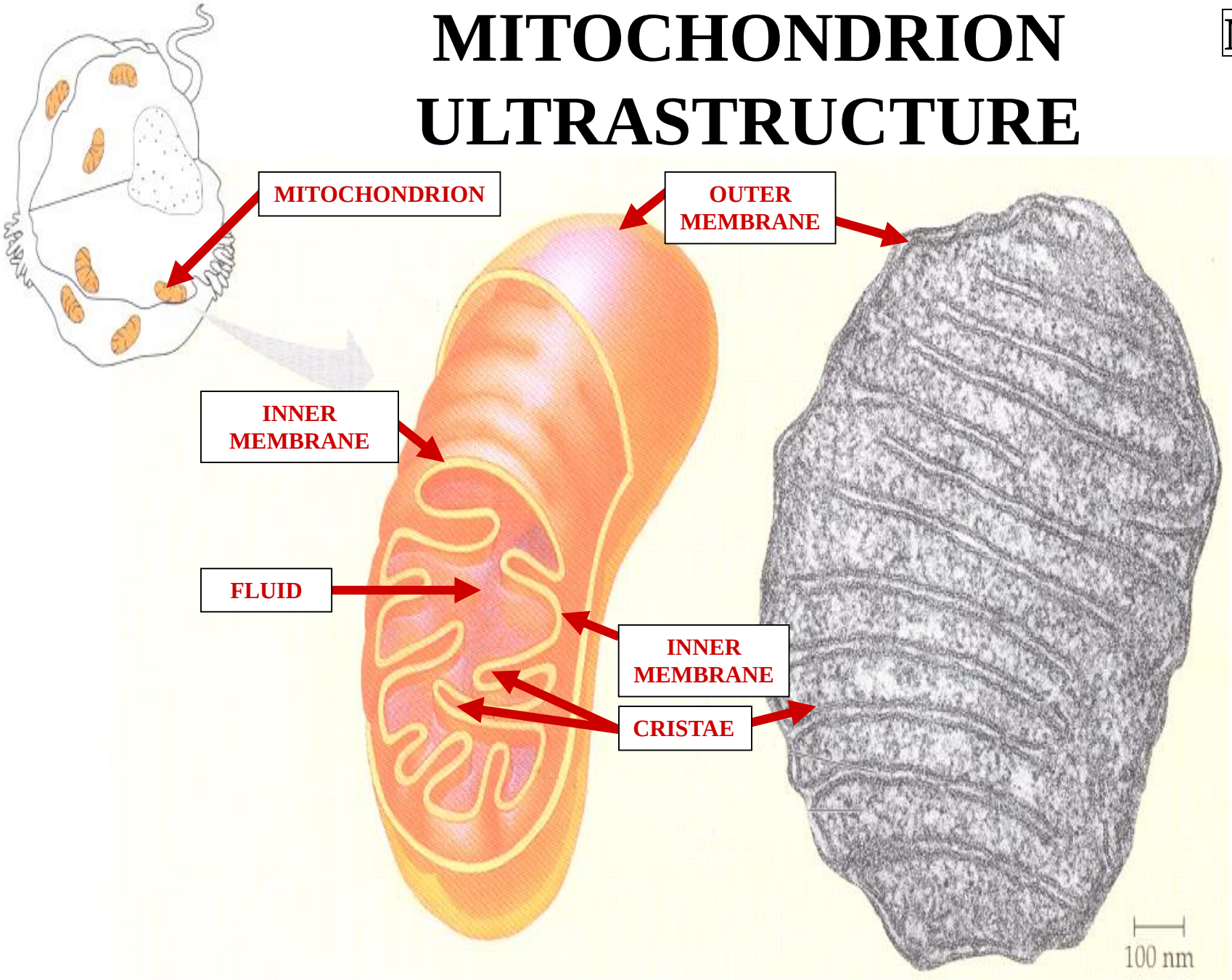
PHOSPHORYLATION

ATP

EGY

MITOCHONDRION ULTRASTRUCTURE

M



MATRIX

MATRIX

MITOCHONDRION INNER FLUID

MATRIX

MATRIX

MITOCHONDRION INNER FLUID

SITE: KREBS CYCLE

MATRIX

MATRIX

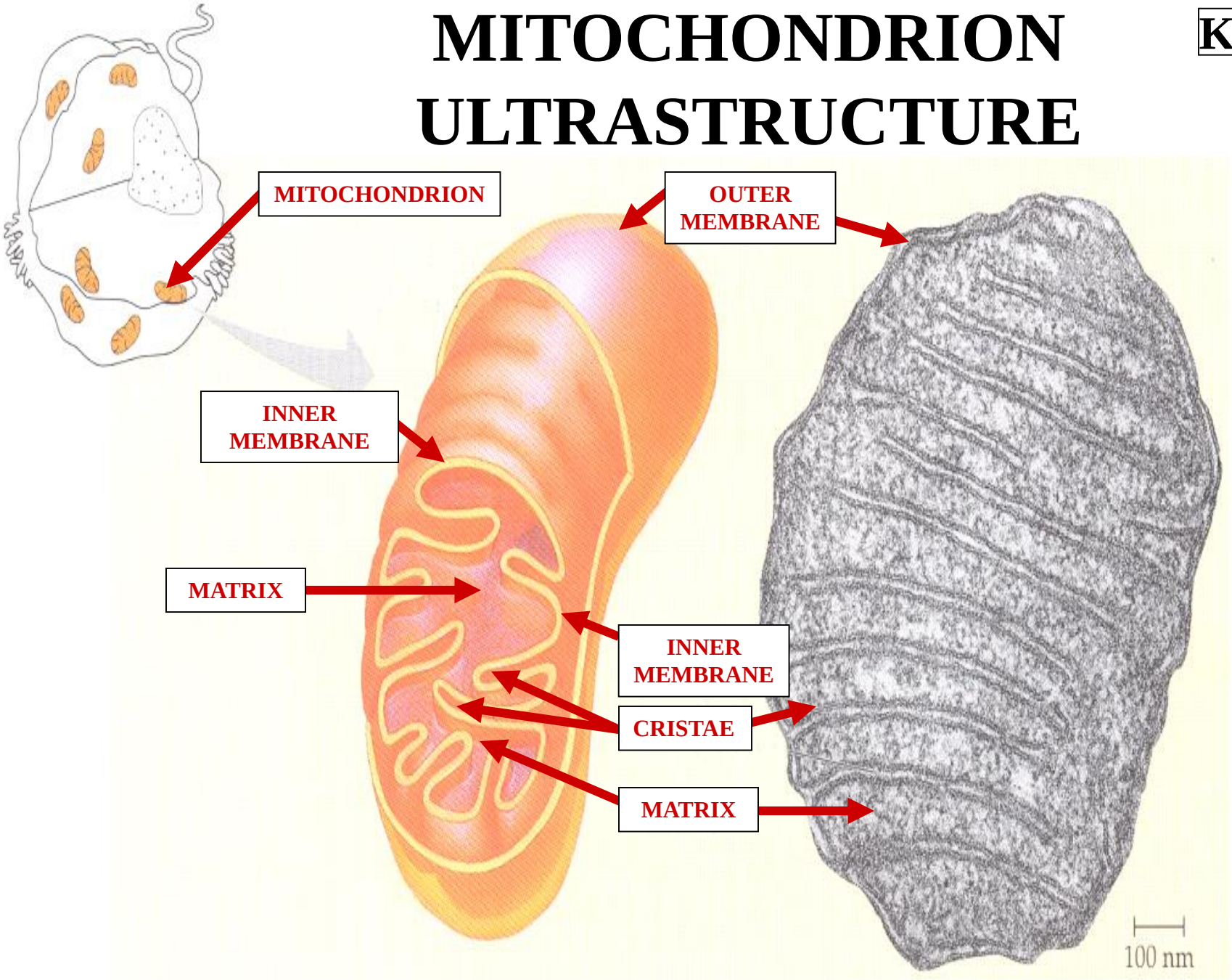
MITOCHONDRION INNER FLUID

SITE: KREBS CYCLE DERIVES ATP

MATRIX

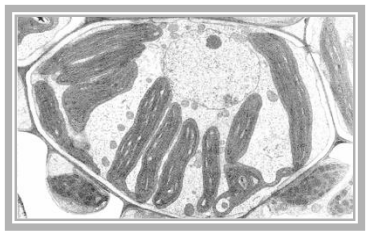
MITOCHONDRION ULTRASTRUCTURE

KC

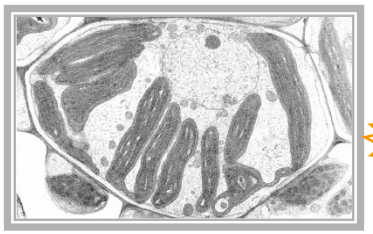


C

KREBS CYCLE



AEROBIC RESPIRATION

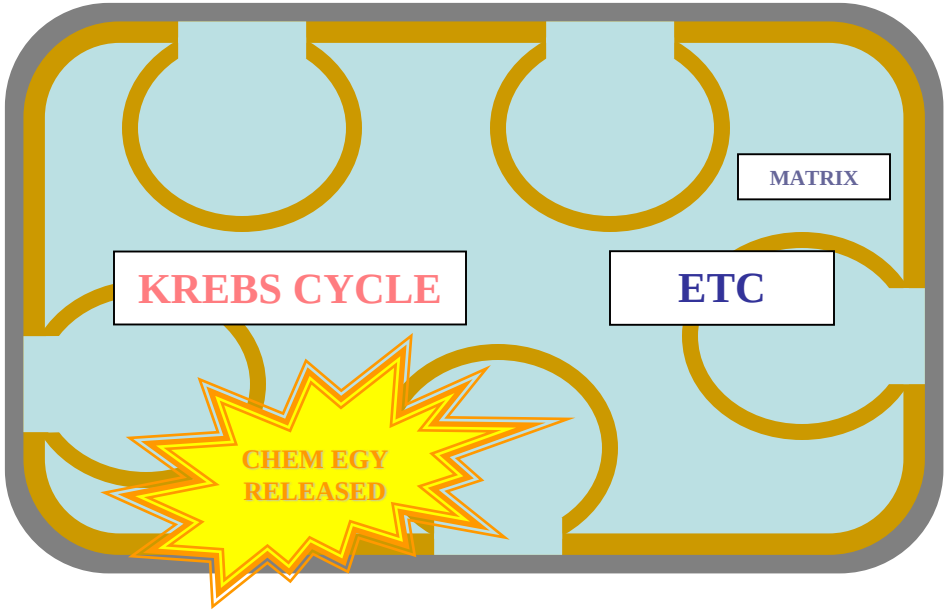


I

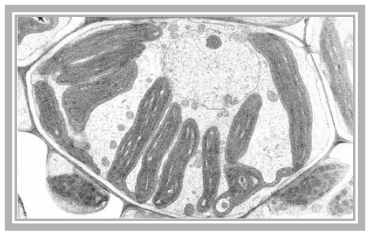
CELL

GLYCOLYSIS

MITOCHONDRION



EGY



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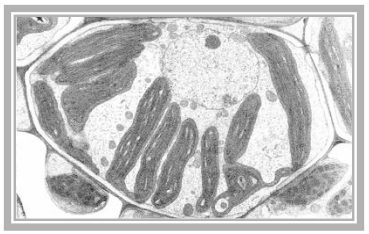
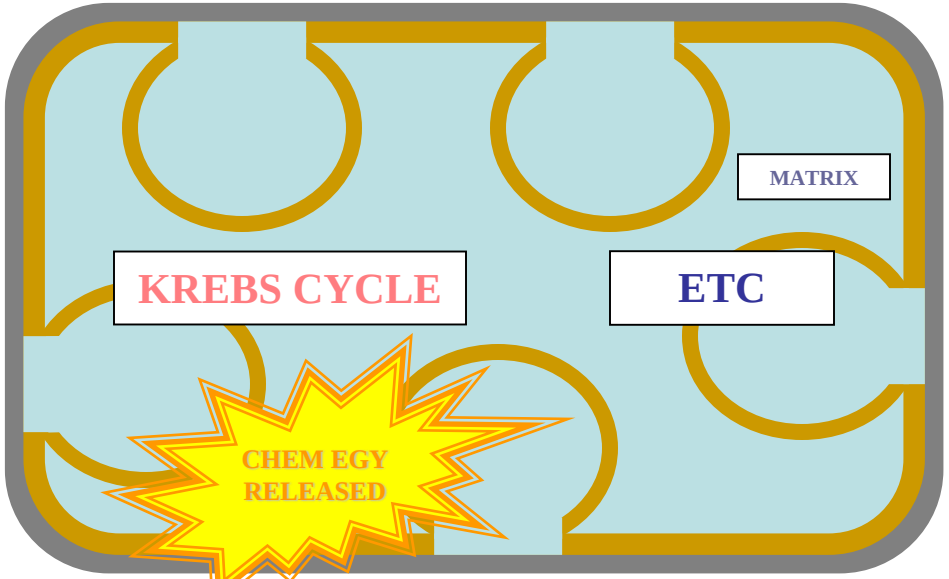


A

CELL

GLYCOLYSIS

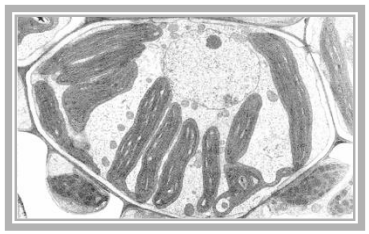
MITOCHONDRION



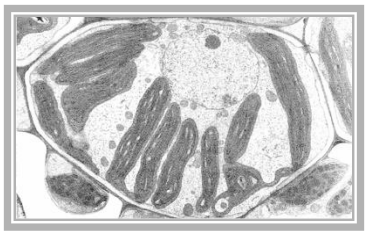
P + ADP

CHEM EGY INPUT

EGY



AEROBIC RESPIRATION

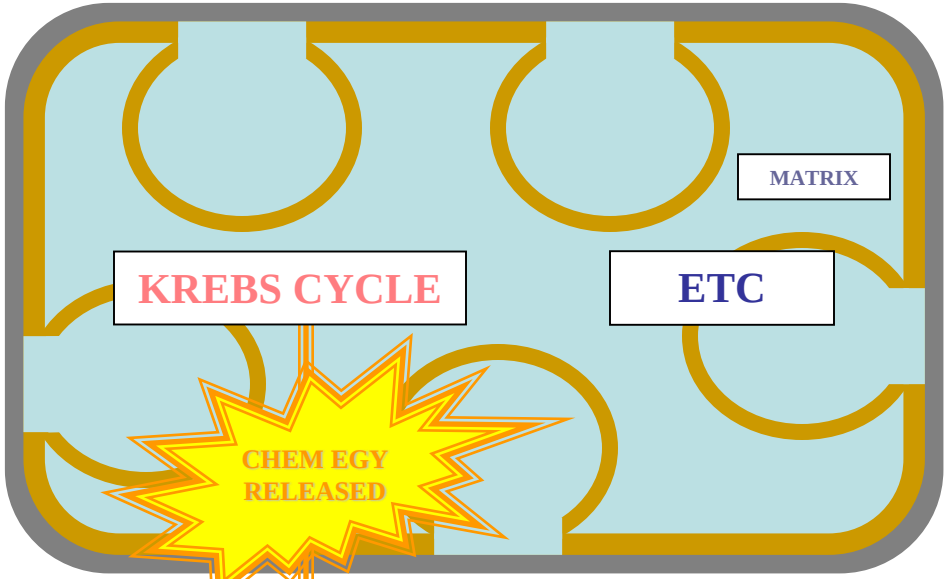


P

CELL

GLYCOLYSIS

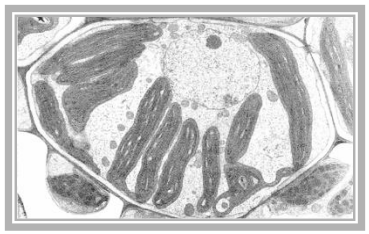
MITOCHONDRION



P + ADP → ATP

ATP

EGY



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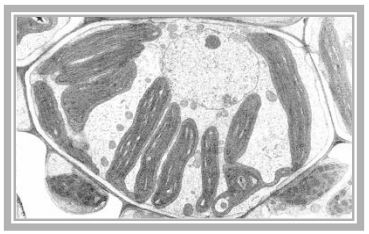


A

A

CELL

GLYCOLYSIS

MITOCHONDRION

MATRIX

KREBS CYCLE

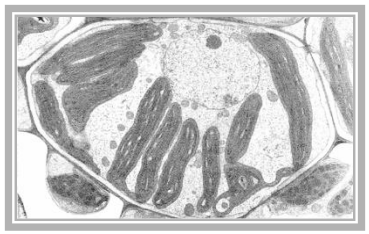
ETC

CHEM EGY RELEASED

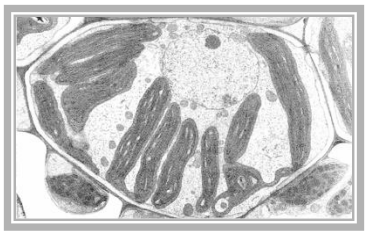
PHOSPHORYLATION

ATP

EGY



AEROBIC RESPIRATION

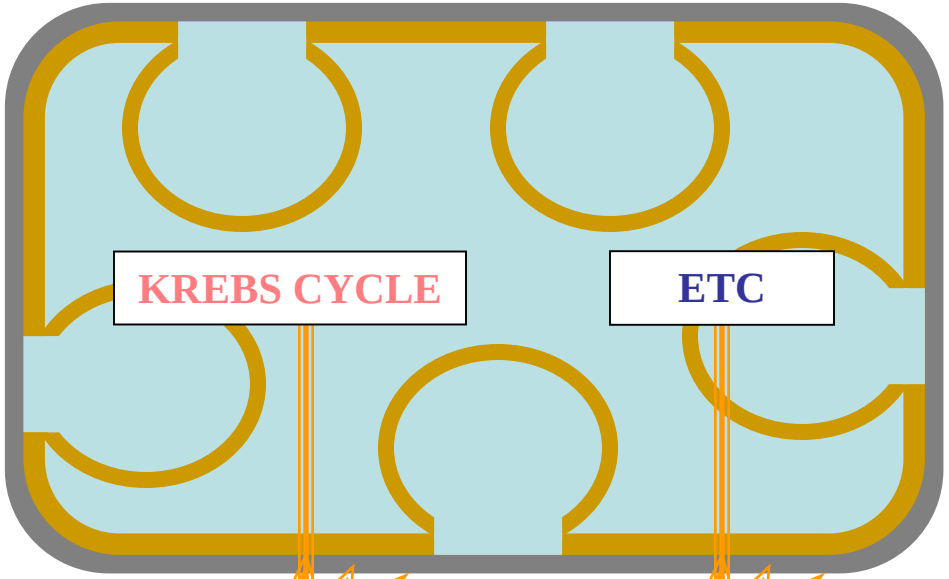


A

CELL

GLYCOLYSIS

MITOCHONDRION

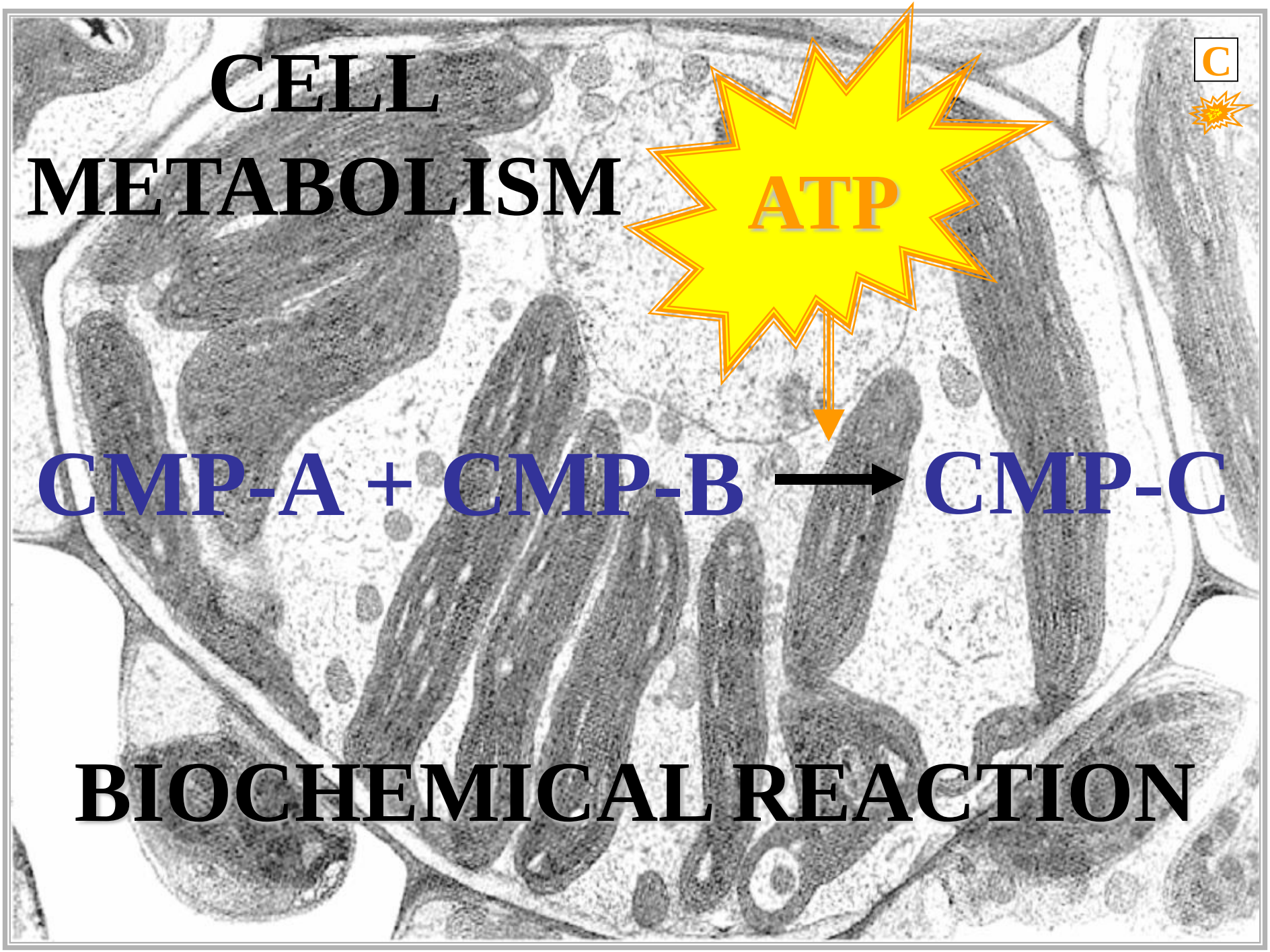


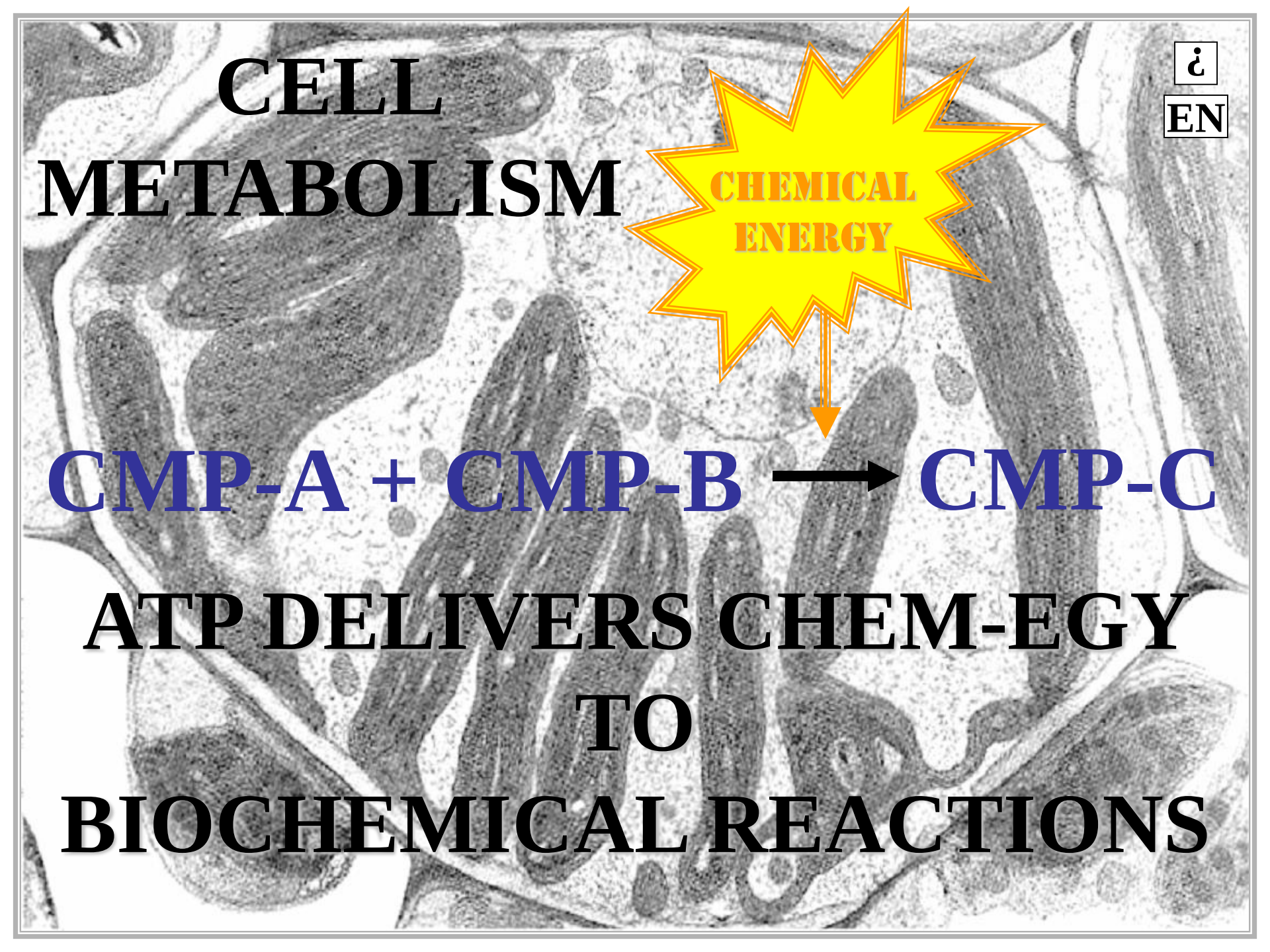
PHOSPHORYLATION

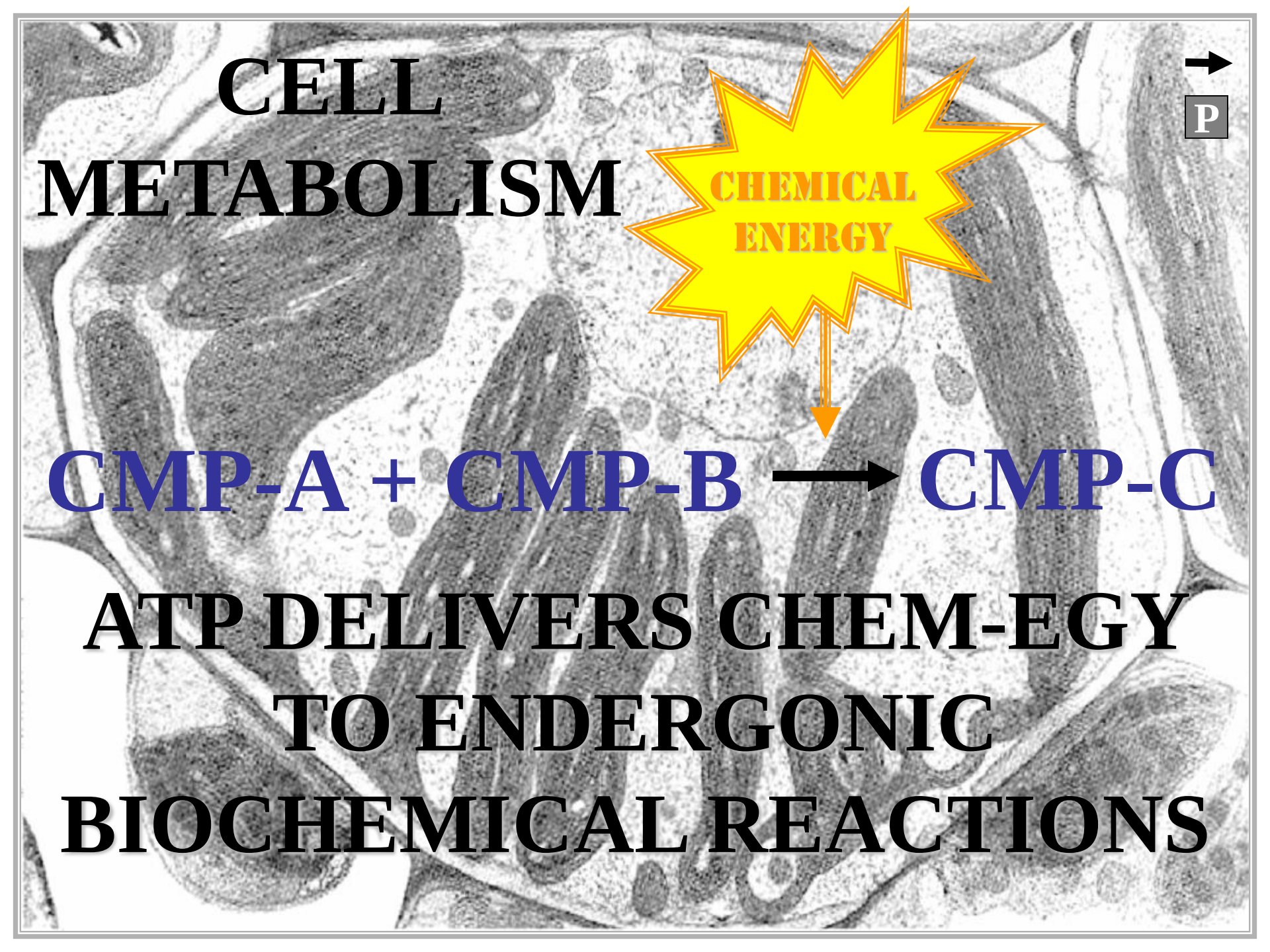
ATP

ATP

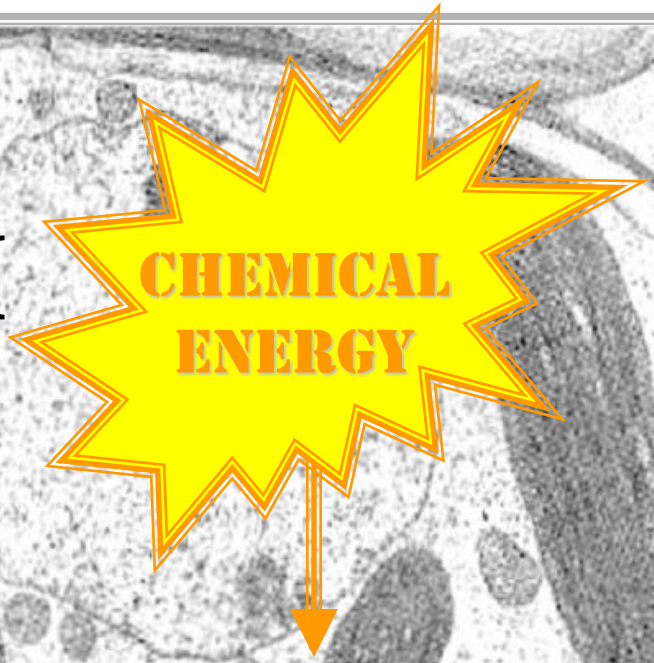
EGY


CELL
METABOLISM
ATP
C
CMP-A + CMP-B → CMP-C
BIOCHEMICAL REACTION


CELL
METABOLISM
CHEMICAL
ENERGY
¿
EN
CMP-A + CMP-B → CMP-C
ATP DELIVERS CHEM-EGY
TO
BIOCHEMICAL REACTIONS


CELL
METABOLISM
CHEMICAL
ENERGY
P
CMP-A + CMP-B → CMP-C
ATP DELIVERS CHEM-EGY
TO ENDERGONIC
BIOCHEMICAL REACTIONS

CELL METABOLISM



CMP-A + CMP-B → CMP-C

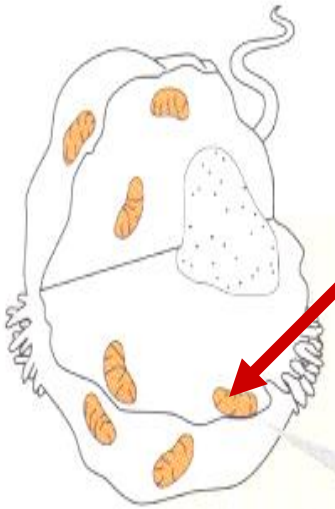
ATP DELIVERS CHEM-EGY TO DRIVE ENDERGONIC BIOCHEMICAL REACTIONS TO A PRODUCT

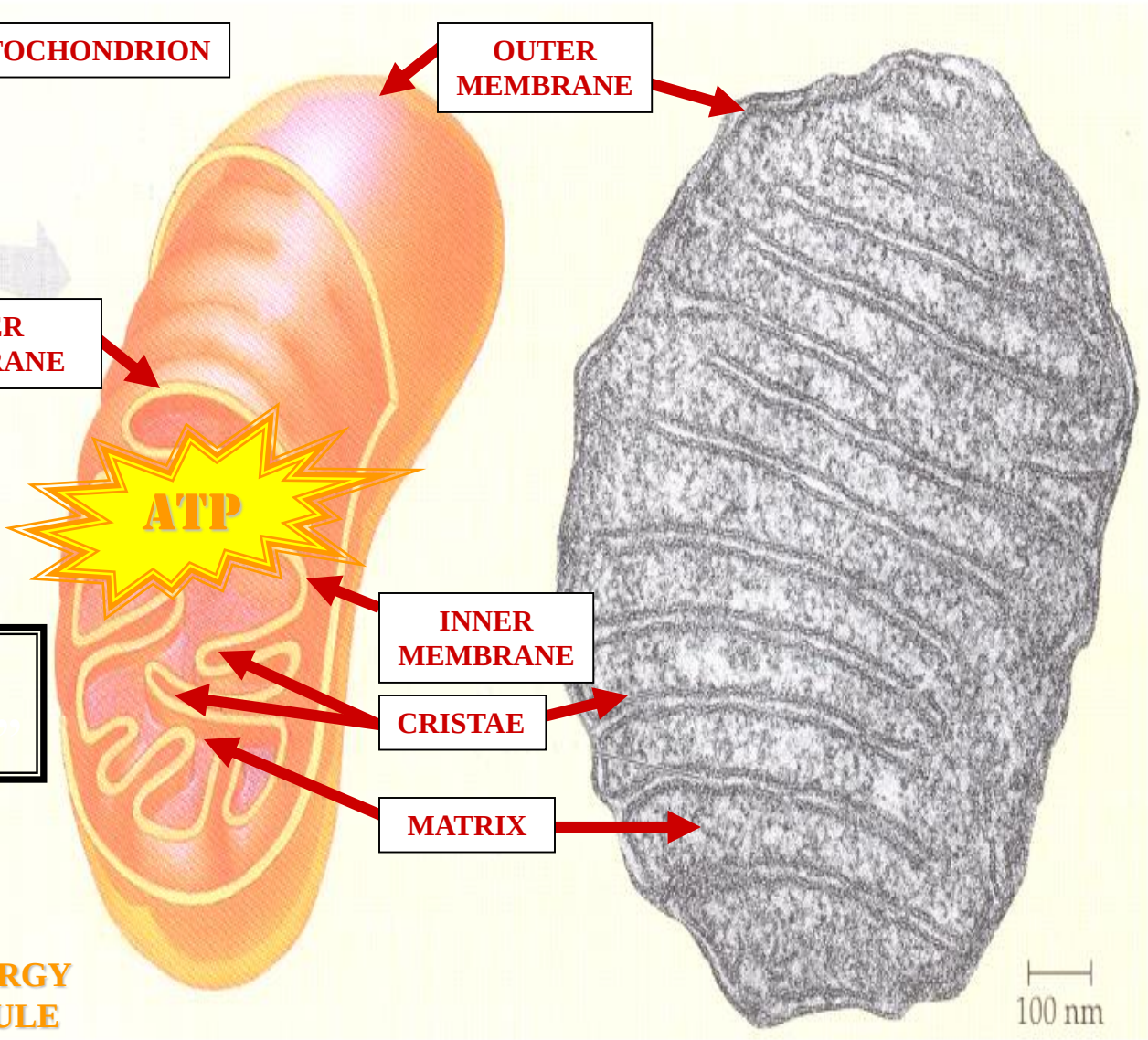

H
EFFICIENT
CELL
METABOLISM


?
HOMEOSTASIS

MITOCHONDRION ULTRASTRUCTURE

CP

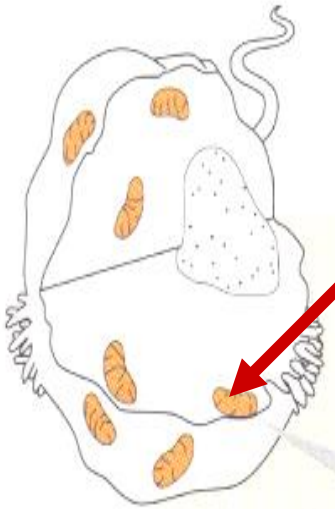




?

ATP = BIO ENERGY MOLECULE

MITOCHONDRION ULTRASTRUCTURE



MITOCHONDRION

OUTER MEMBRANE

INNER MEMBRANE

ATP

INNER MEMBRANE

CRISTAE

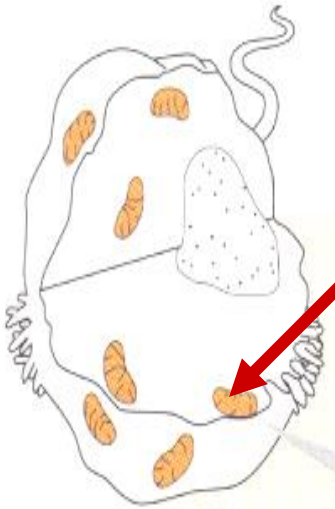
MATRIX

CELL "POWER-HOUSE"

ATP = BIO ENERGY MOLECULE

100 nm

MITOCHONDRION ULTRASTRUCTURE



MITOCHONDRION

OUTER MEMBRANE

INNER MEMBRANE

DNA

ATP

INNER MEMBRANE

CRISTAE

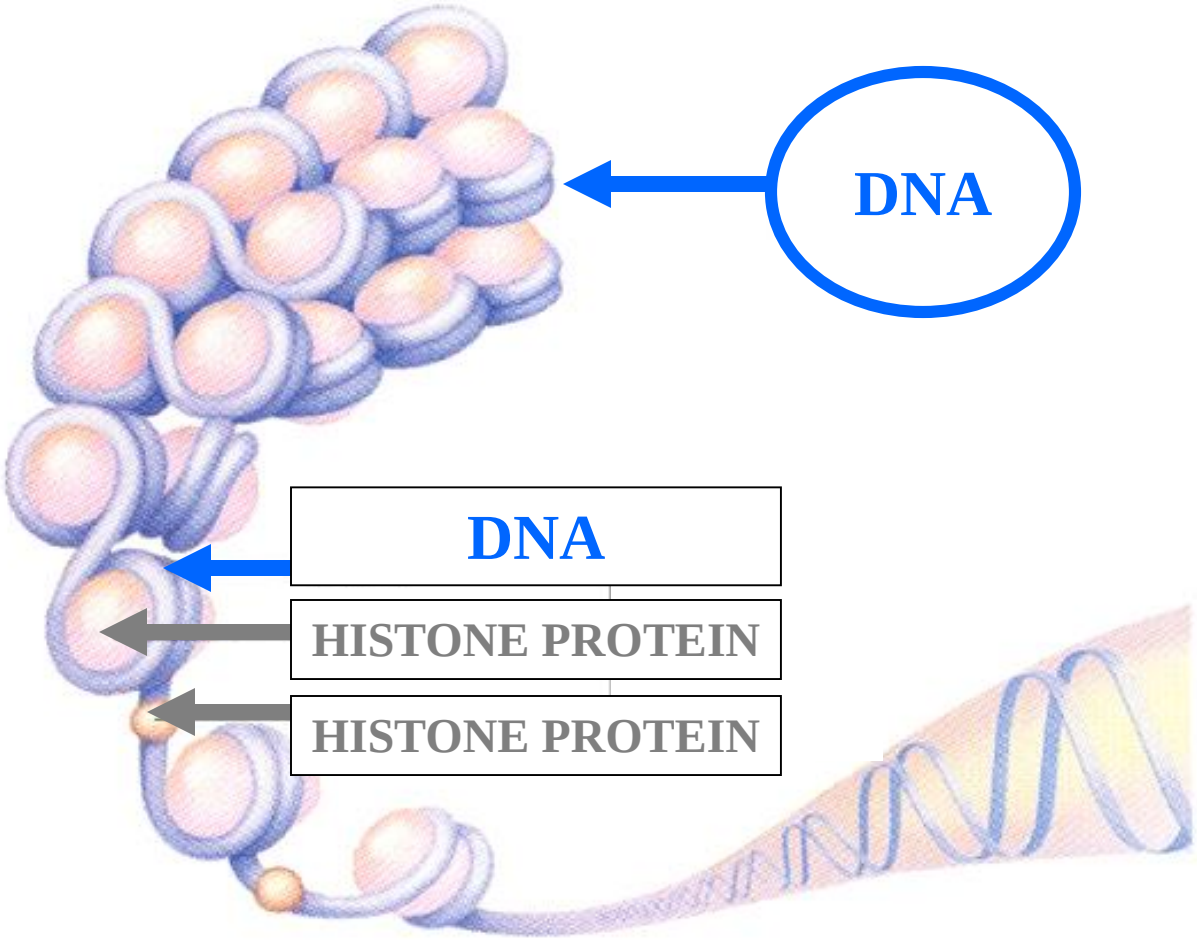
MATRIX

CELL "POWER-HOUSE"

ATP = BIO ENERGY MOLECULE

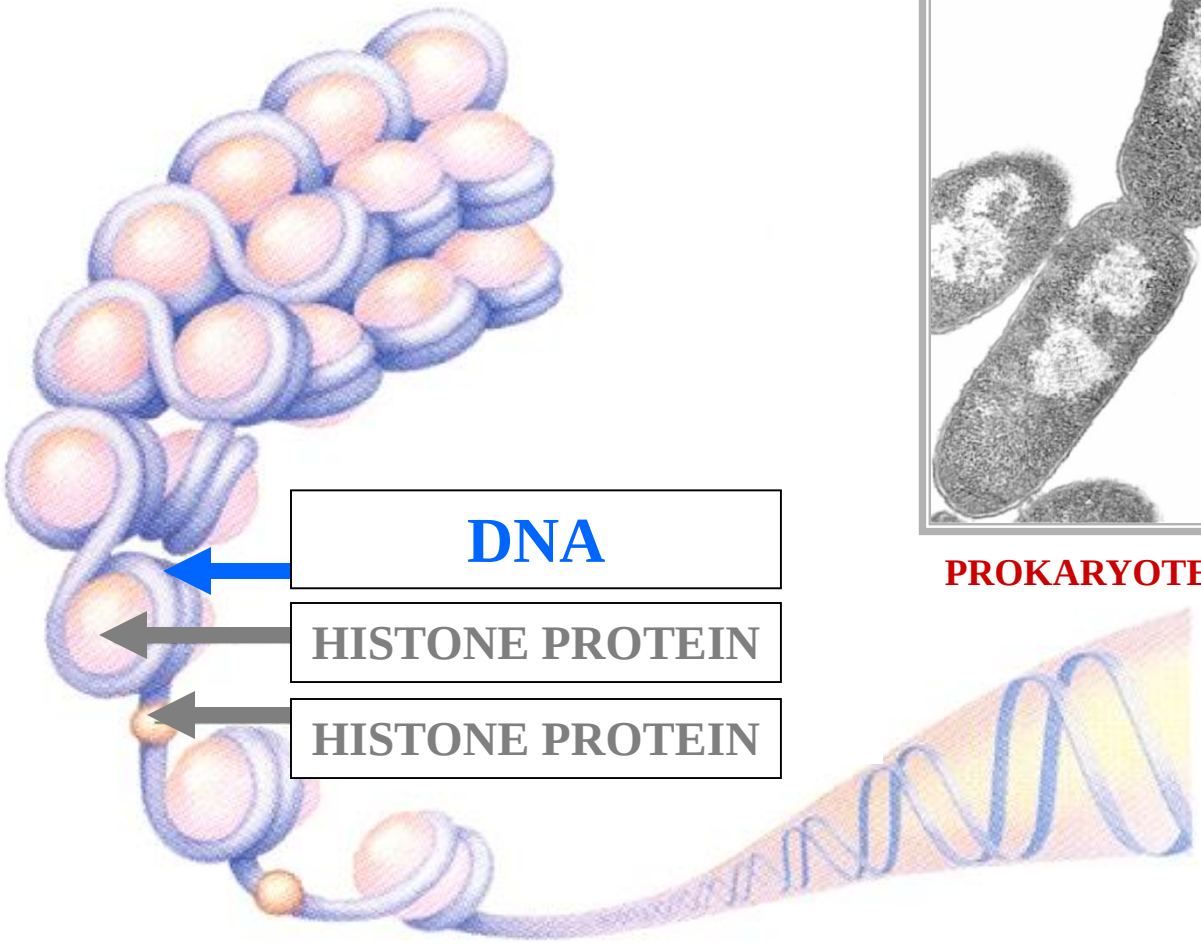
100 nm

MITOCHONDRION DNA



MITOCHONDRION DNA: HISTONE PROTEINS **ABSENT**

MITOCHONDRION DNA

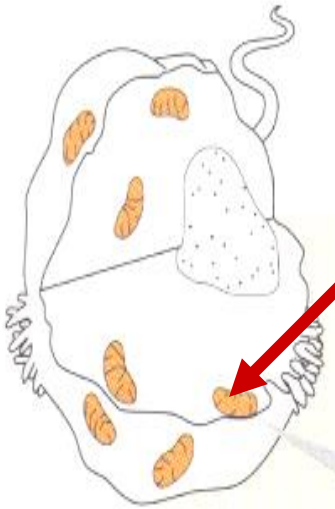


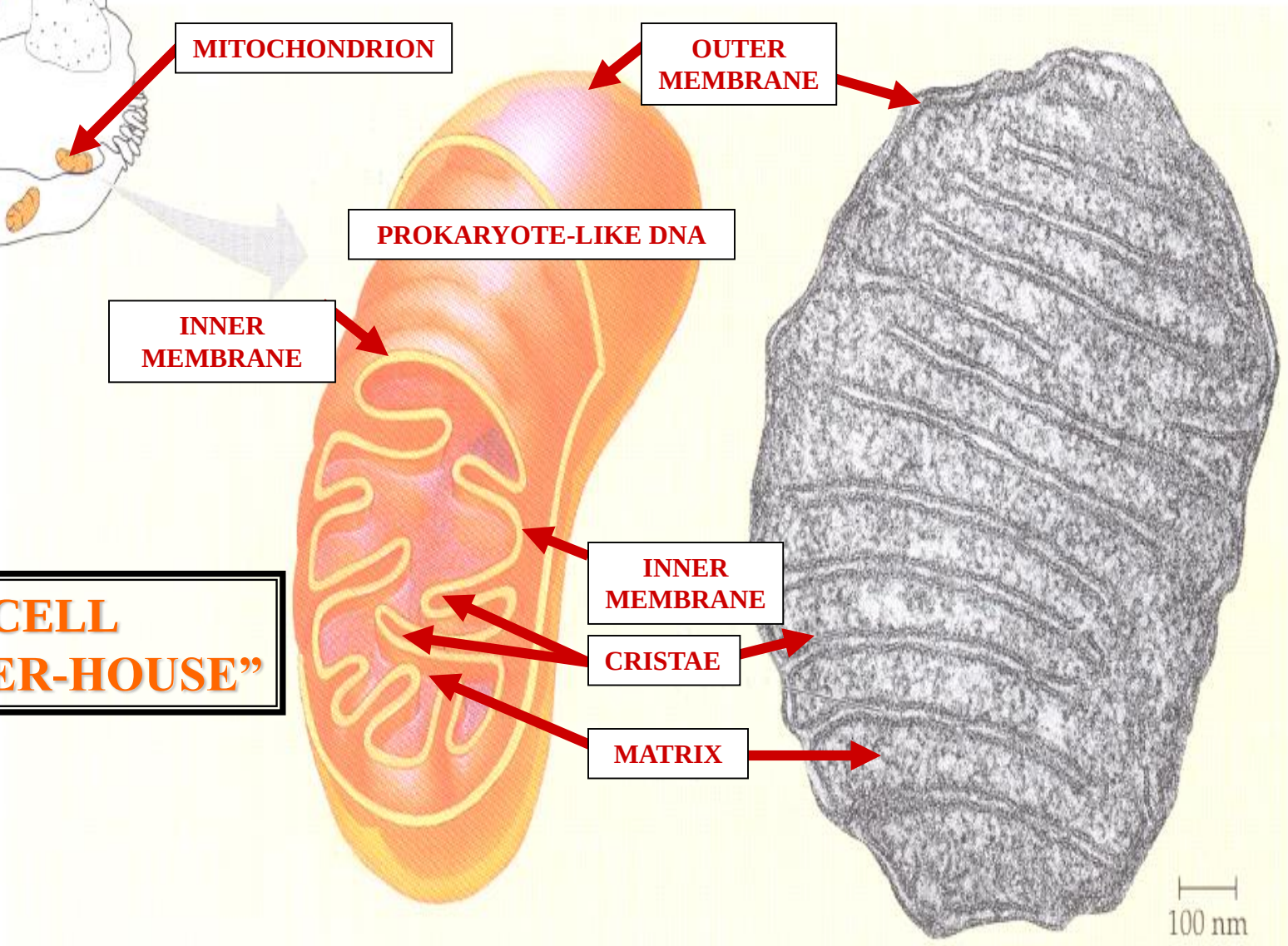
PROKARYOTE-LIKE

MITOCHONDRION DNA: HISTONE PROTEINS **ABSENT**

MITOCHONDRION ULTRASTRUCTURE

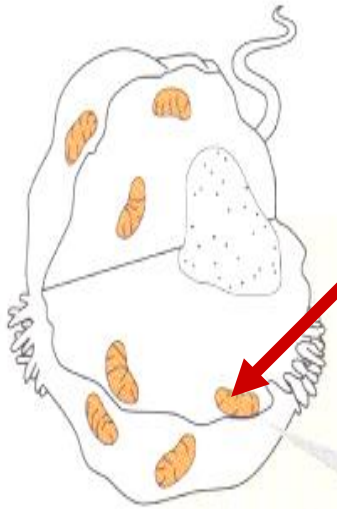
R

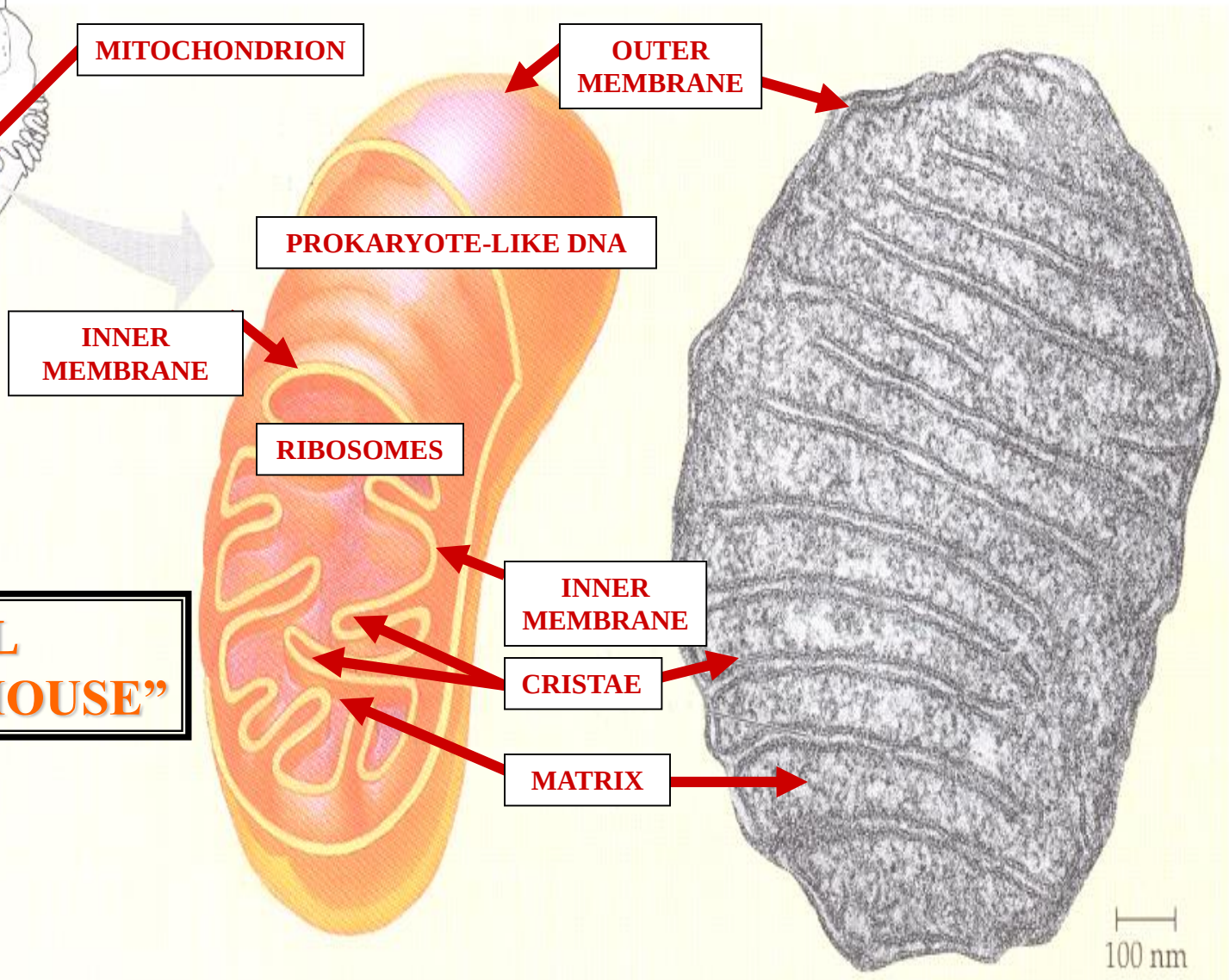




CELL "POWER-HOUSE"

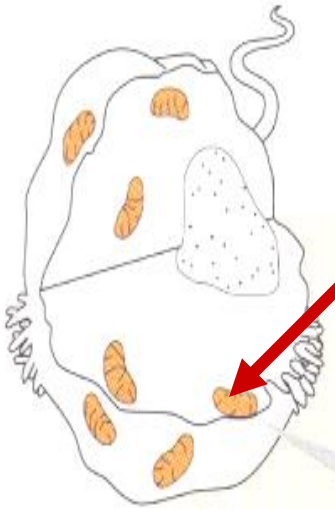
MITOCHONDRION ULTRASTRUCTURE





CELL "POWER-HOUSE"

MITOCHONDRION ULTRASTRUCTURE



MITOCHONDRION

OUTER MEMBRANE

PROKARYOTE-LIKE DNA

INNER MEMBRANE

RIBOSOMES SMALL

INNER MEMBRANE

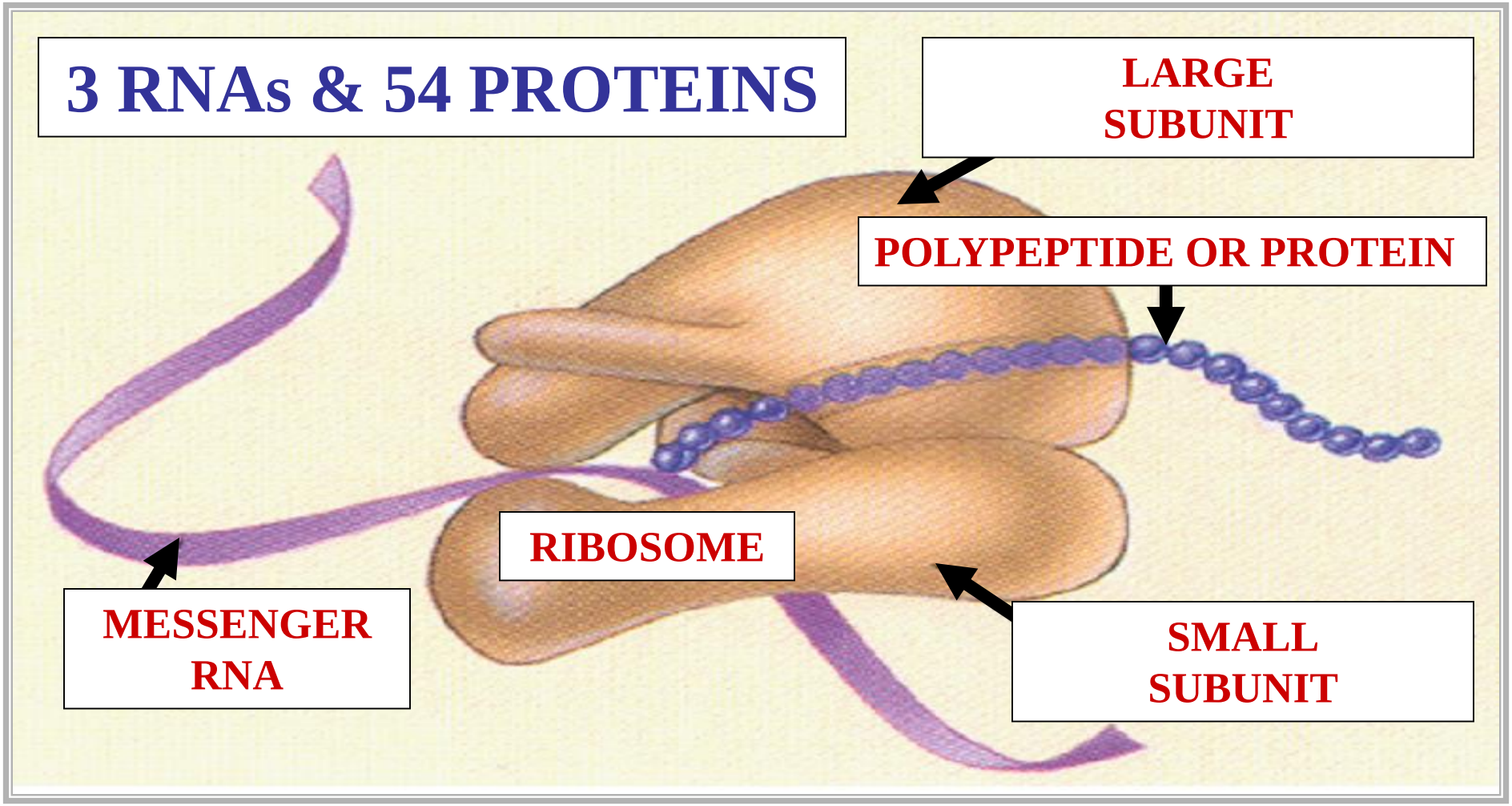
CRISTAE

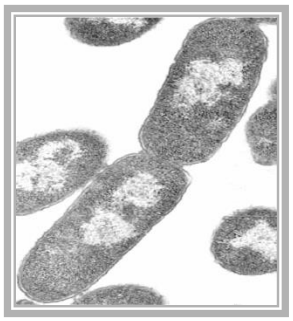
MATRIX

100 nm

CELL "POWER-HOUSE"

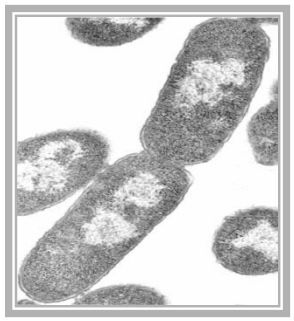
MITOCHONDRION
RIBOSOME
SMALL





PROKARYOTE-LIKE

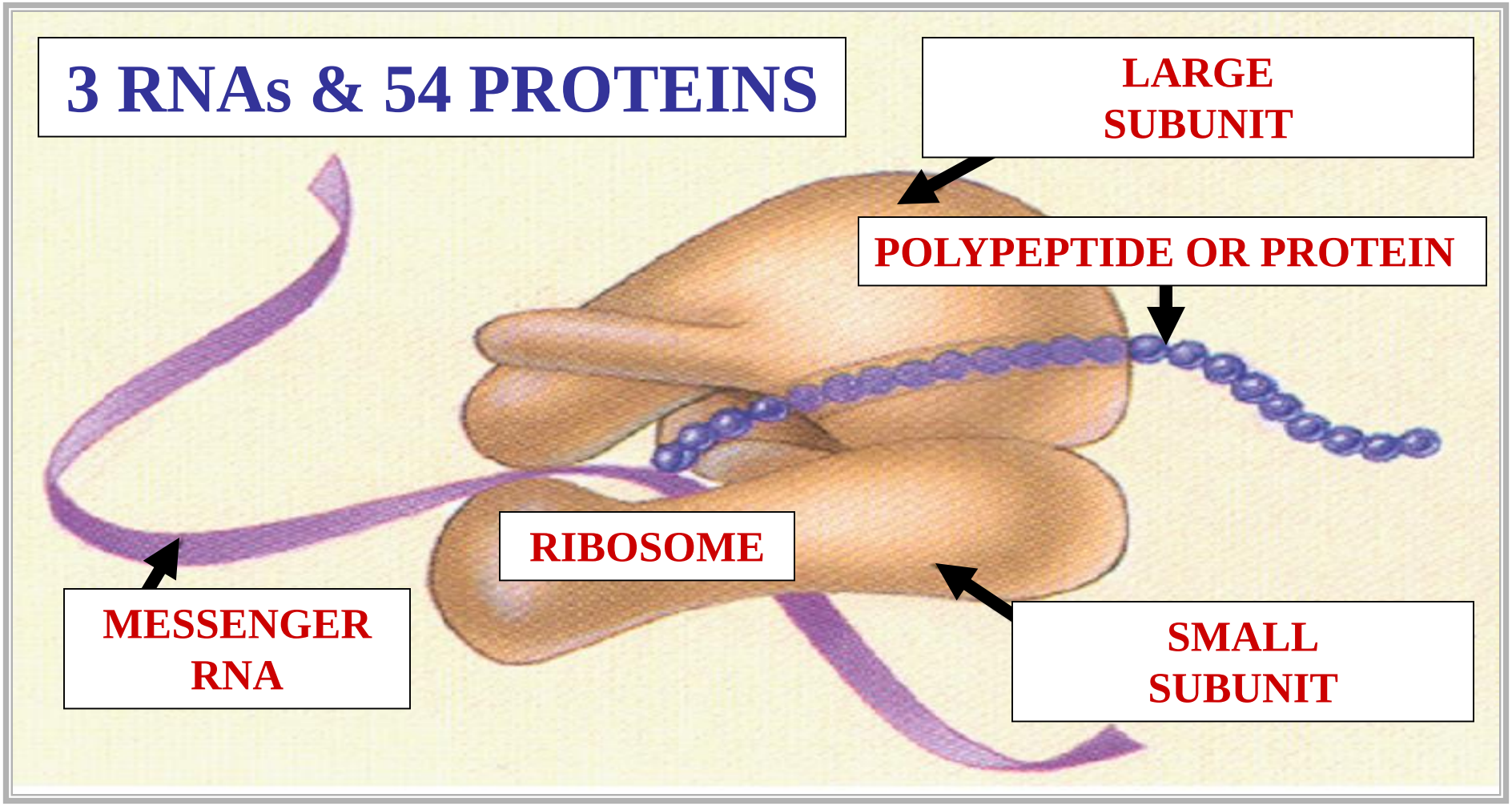
MITOCHONDRION
RIBOSOME
SMALL



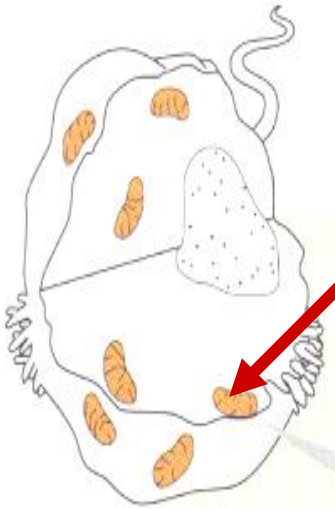
PROKARYOTE-LIKE

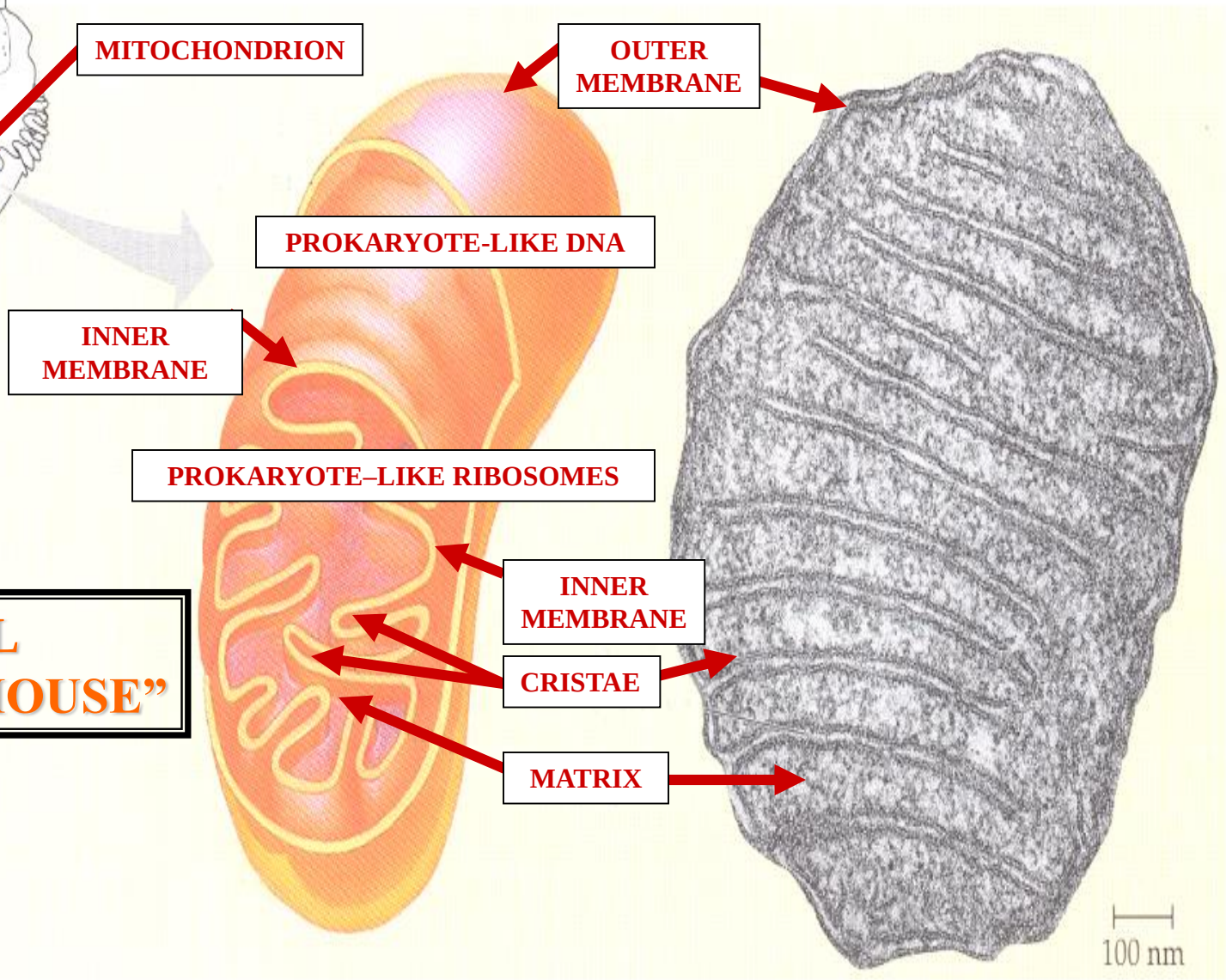
S

+



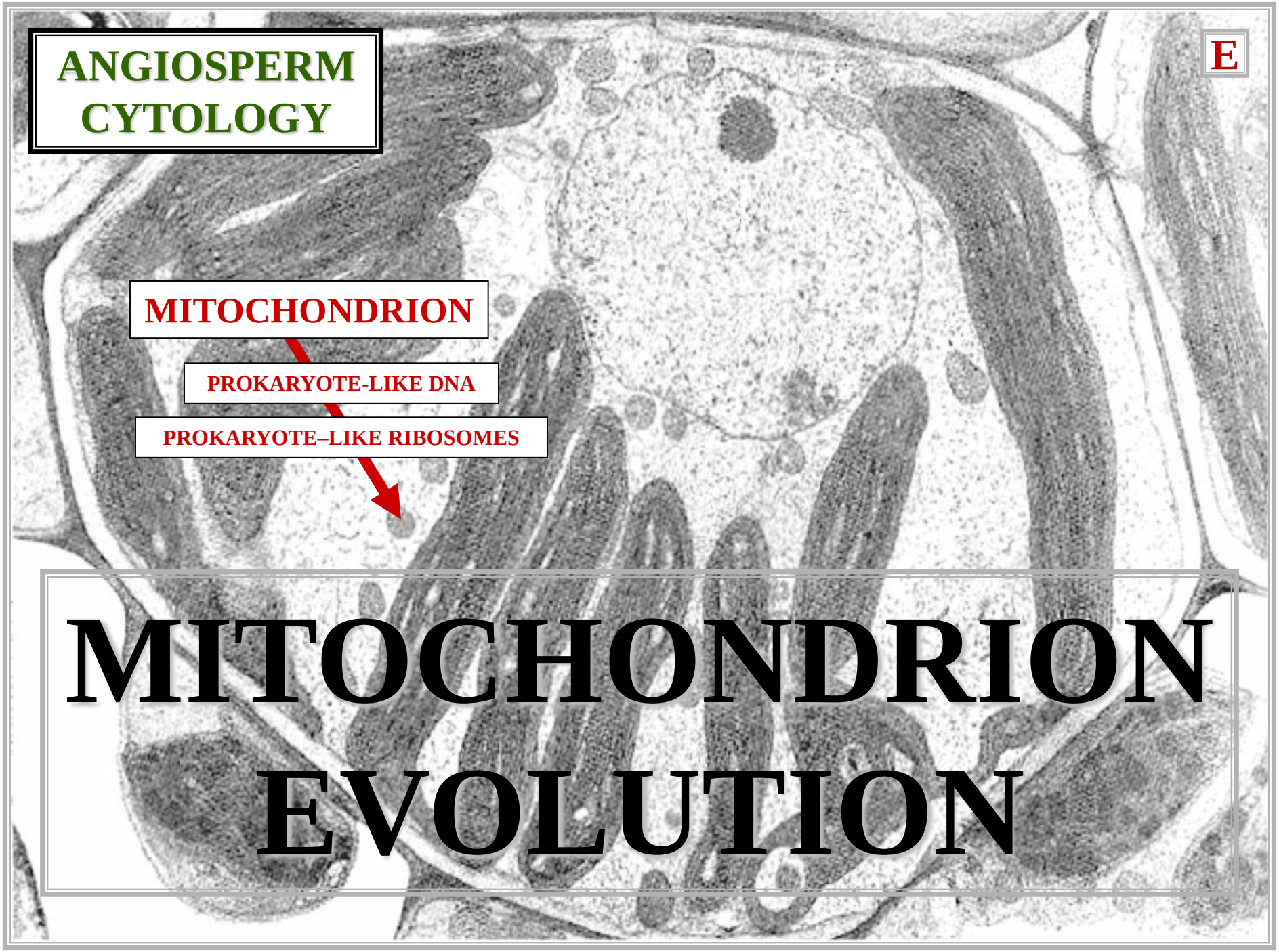
MITOCHONDRION ULTRASTRUCTURE





CELL "POWER-HOUSE"

MITOCHONDRION EVOLUTION



ANGIOSPERM CYTOLOGY

E

MITOCHONDRION

PROKARYOTE-LIKE DNA

PROKARYOTE–LIKE RIBOSOMES

MITOCHONDRION EVOLUTION