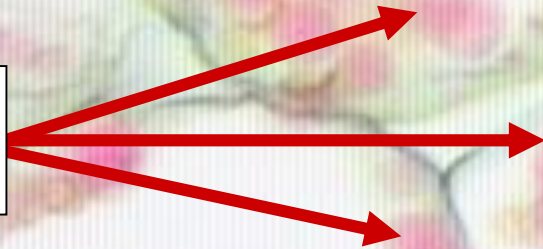


**CHROMOPLASTS
CAROTENOIDS**



**CHROMOPLASTS
ATTRACT
ANIMALS**

C.S.

CHLOROPLAST

PLASTIDS CHLOROPLAST



PIGMENTED PLASTID

PLASTIDS
CHLOROPLAST



PLASTIDS
CHLOROPLAST

PIGMENTED PLASTID

CHLOROPHYLL PIGMENTS
DOMINATE

PLASTIDS
CHLOROPLAST

PLASTIDS

CHLOROPLAST



PIGMENTED PLASTID
CHLOROPHYLL PIGMENTS
DOMINATE

CONDUCTS PHOTOSYNTHESIS

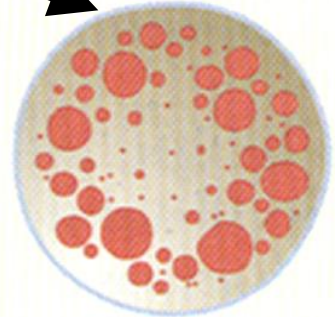
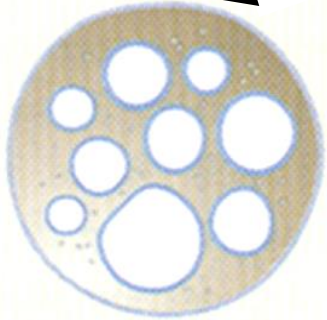
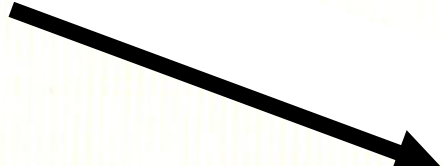
PLASTIDS

CHLOROPLAST

PLASTIDS TYPES



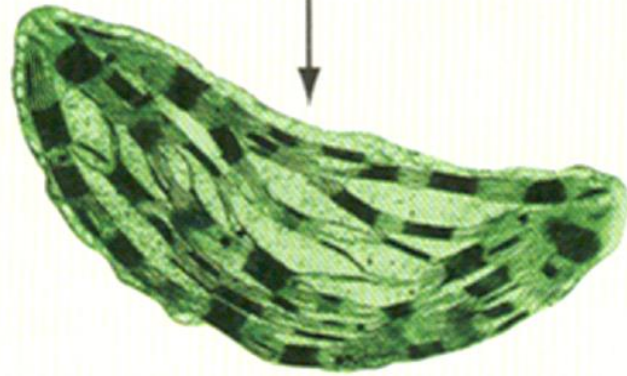
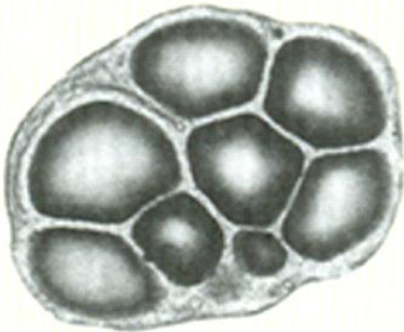
PROPLASTID



LEUCOPLAST

CHLOROPLAST

CHROMOPLAST



MAPLE LEAF



C



C

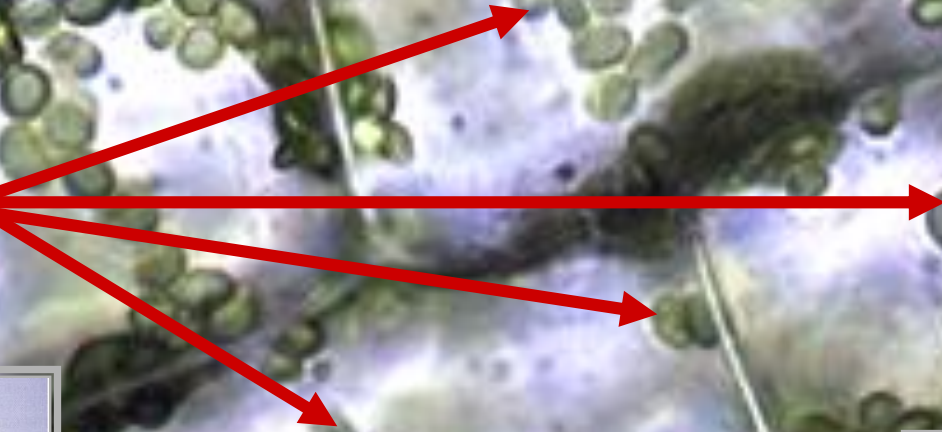
CHLOROPLASTS



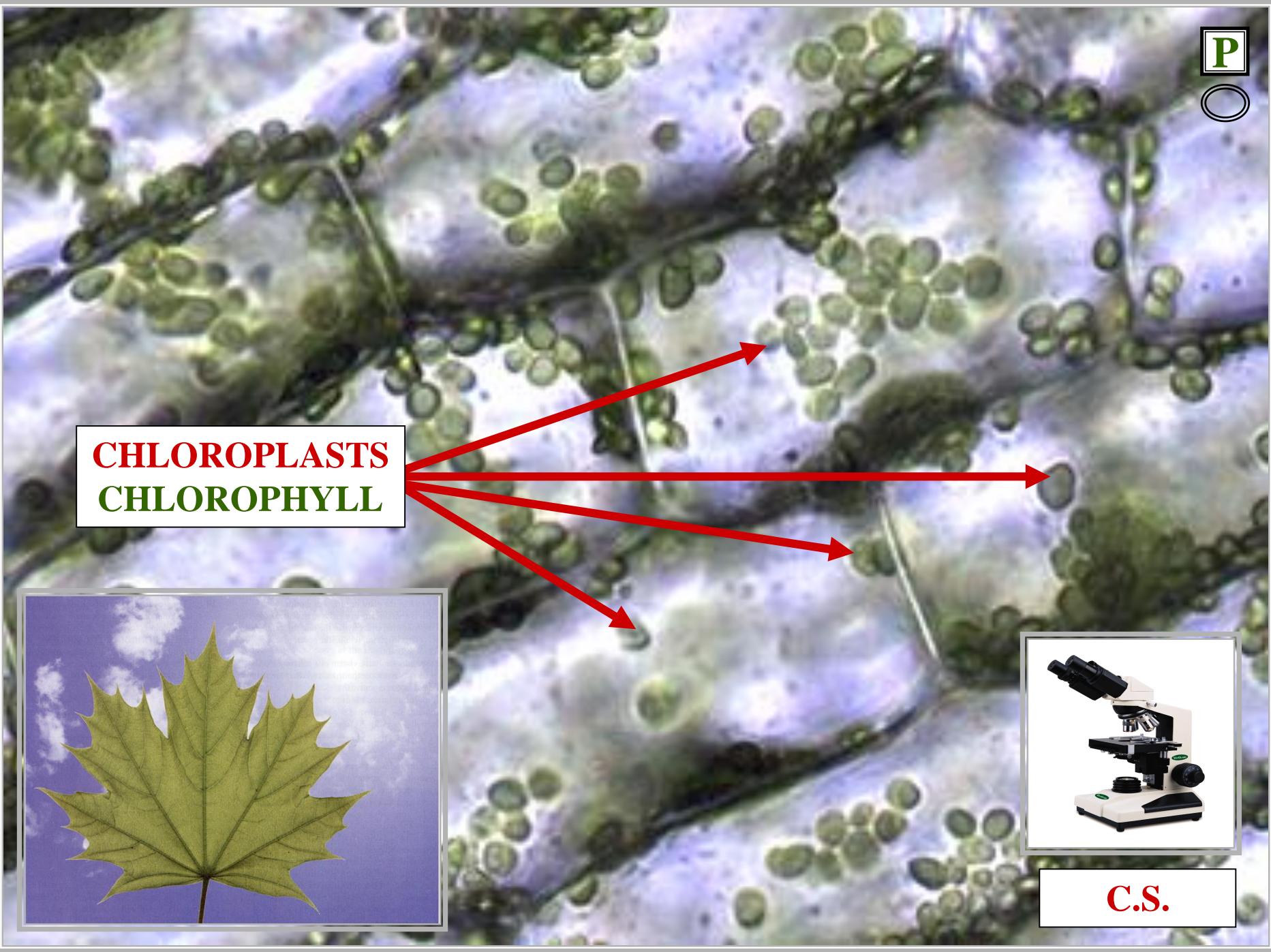
C.S.



CHLOROPLASTS
CHLOROPHYLL



C.S.



PHOTOSYNTHESIS



WATER

CO₂

LIGHT ENERGY

PHOTO

ATMOSPHERE

E-

PHOTOLYSIS

LT RXT

THYLAKOID

CHEMICAL ENERGY

DK RXT

STROMA

SYNTHESIS

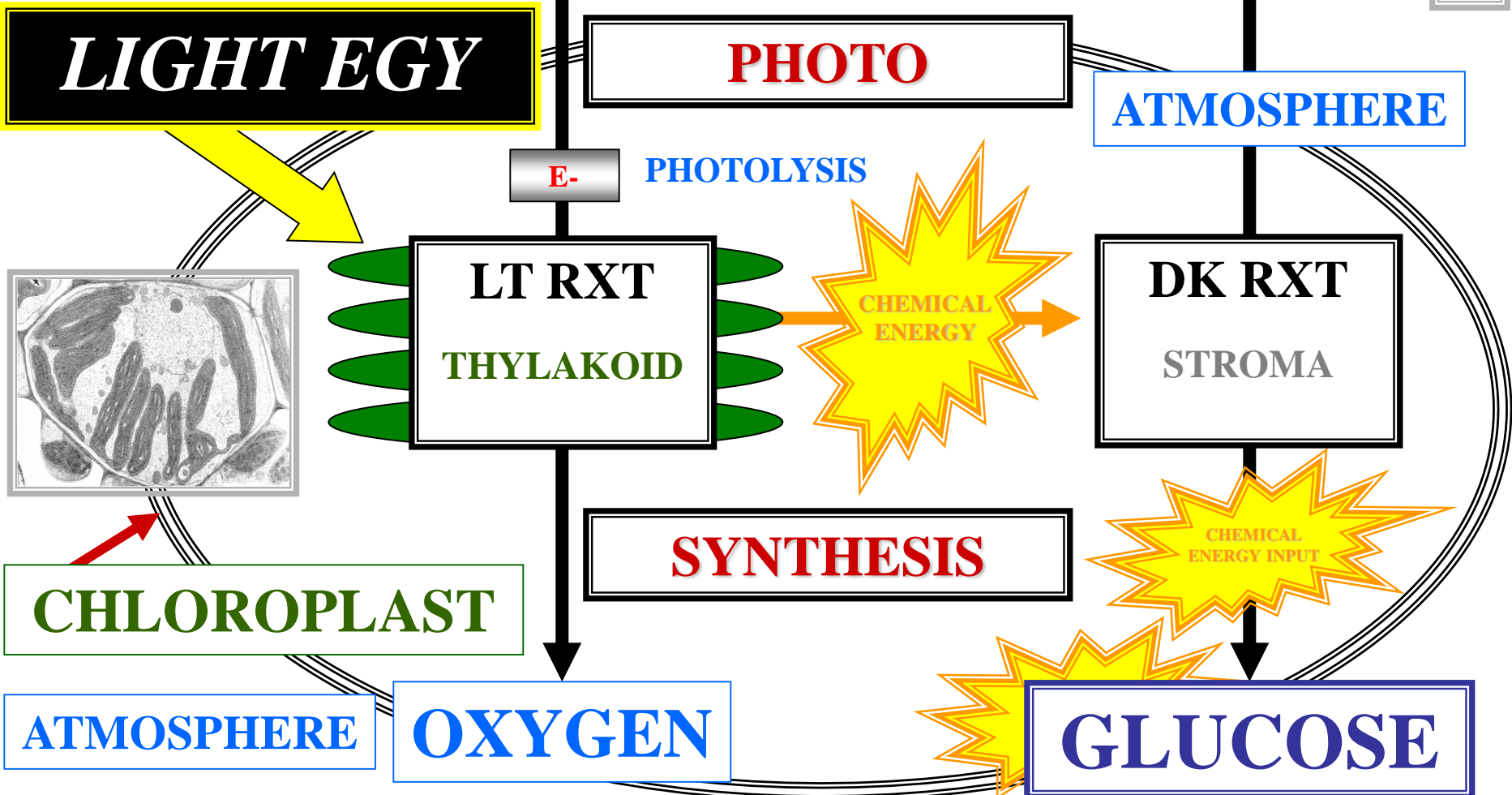
CHEMICAL ENERGY INPUT

CHLOROPLAST

ATMOSPHERE

OXYGEN

GLUCOSE





PLASTID TYPE SUMMARY

PLASTIDS TYPES



PROPLASTID

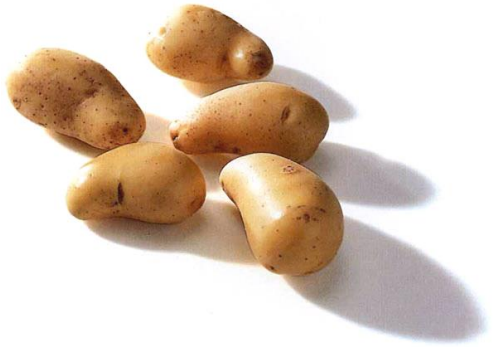
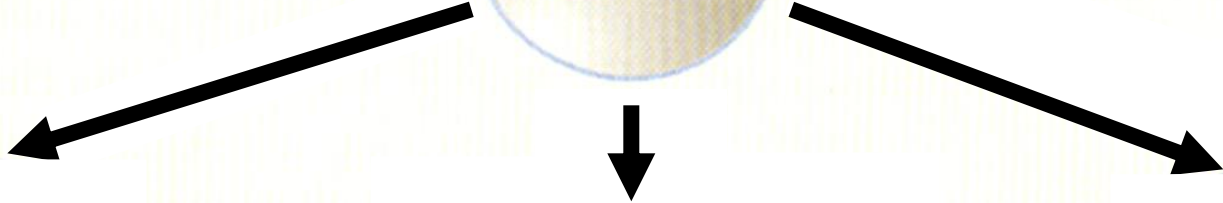
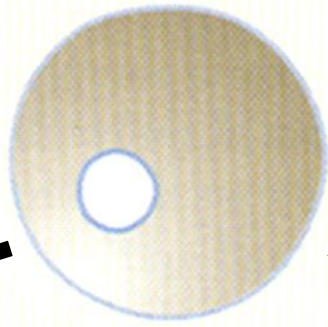


PLASTIDS TYPES

PROPLASTID



T



TUBER



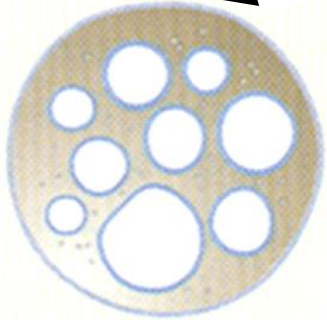
LEAF



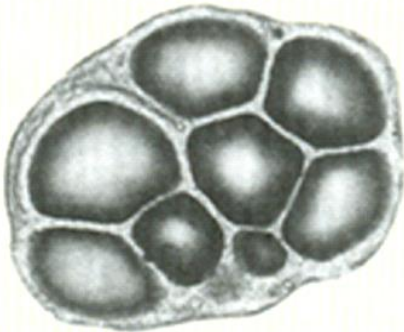
FRUIT

PLASTIDS TYPES

PROPLASTID

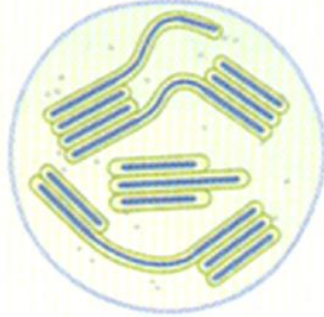
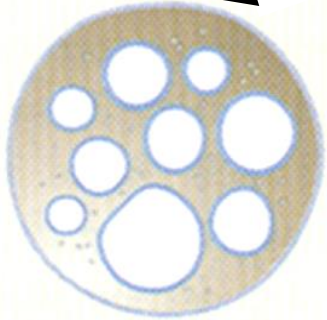


LEUCOPLAST



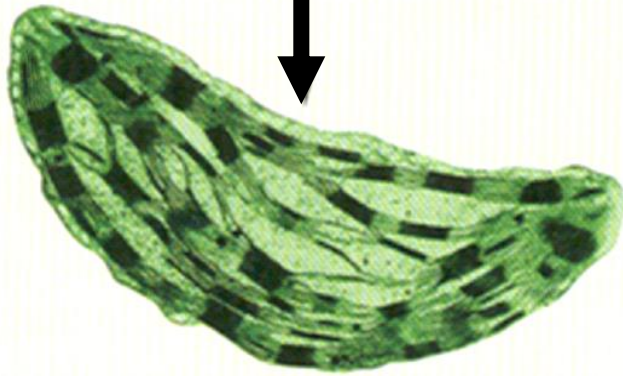
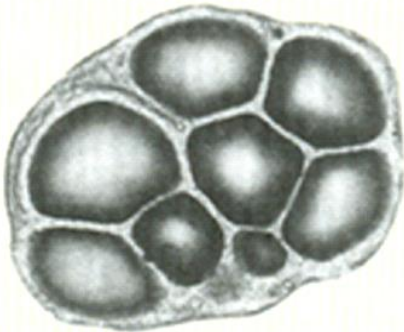
PLASTIDS TYPES

PROPLASTID



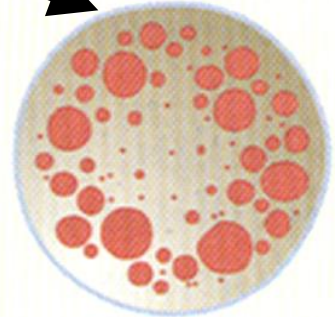
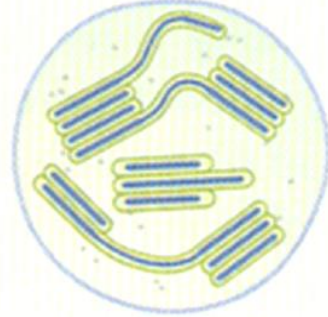
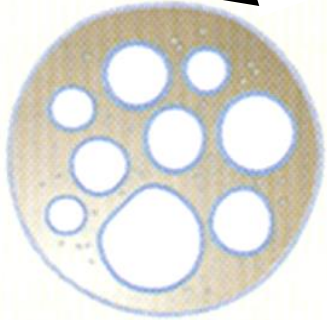
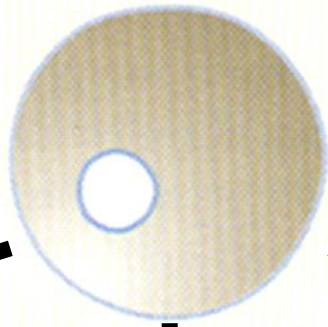
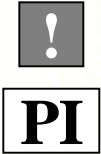
LEUCOPLAST

CHLOROPLAST



PLASTIDS TYPES

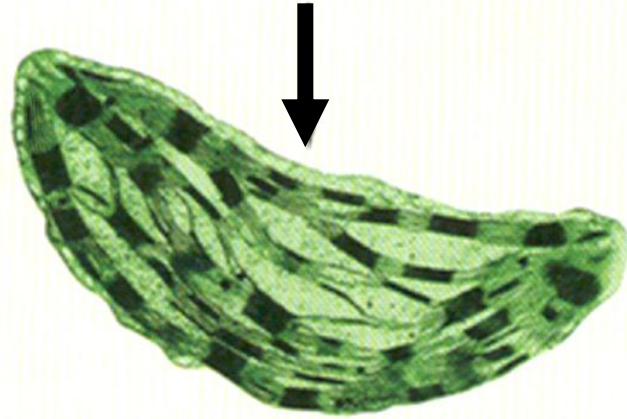
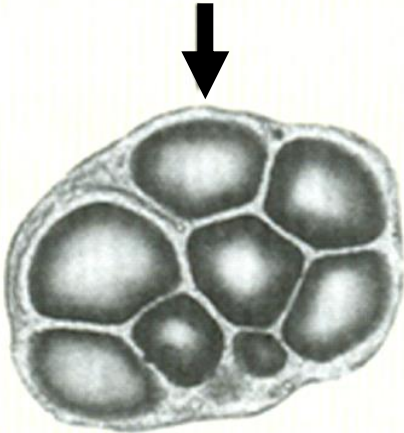
PROPLASTID



LEUCOPLAST

CHLOROPLAST

CHROMOPLAST





PLASTIDS INTERCONVERT



**PLASTIDS
INTERCONVERT**

**PLASTIDS
INTERCONVERT**

**PLASTIDS
INTERCONVERT**



PLASTIDS

INTERCONVERT

PLASTIDS

INTERCONVERT

GIVEN DIFFERENT

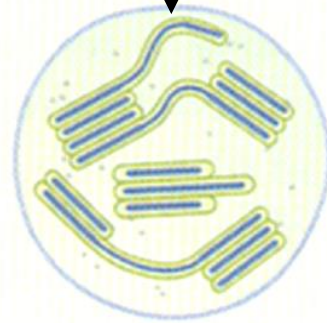
ENVIRONMENT

PLASTIDS

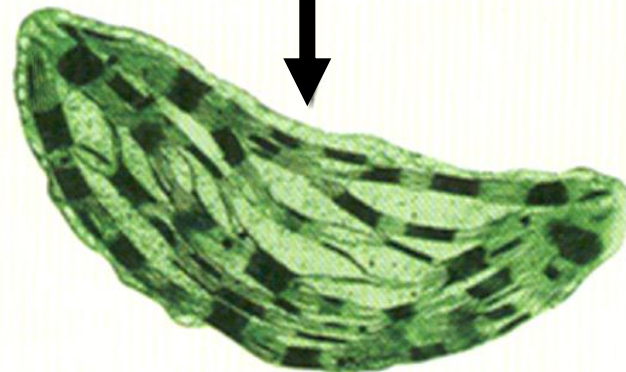
INTERCONVERT

PLASTIDS INTERCONVERT

PROPLASTID



CHLOROPLAST

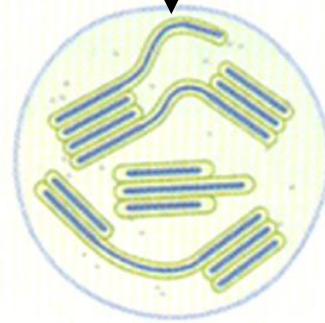


PLASTIDS INTERCONVERT

PROPLASTID

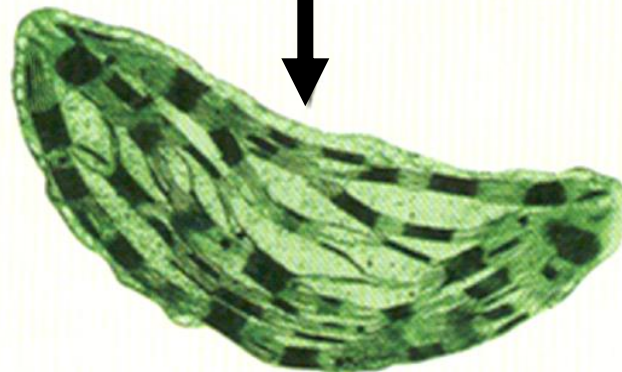


**DIFFERENT
ENVIRONMENT**



**DIFFERENT
ENVIRONMENT**

CHLOROPLAST

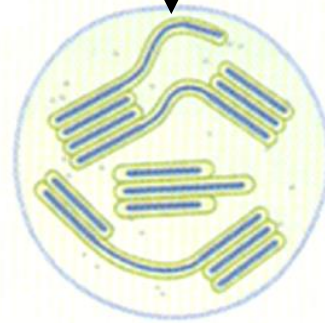


PLASTIDS INTERCONVERT

PROPLASTID



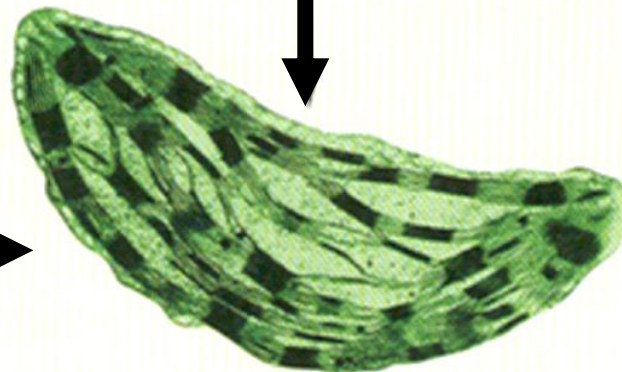
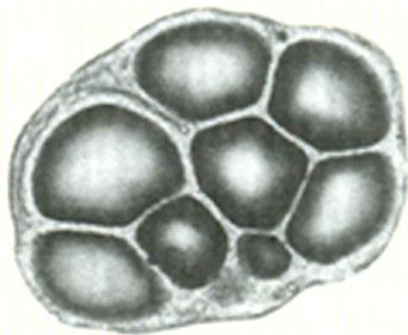
DIFFERENT ENVIRONMENT



DIFFERENT ENVIRONMENT

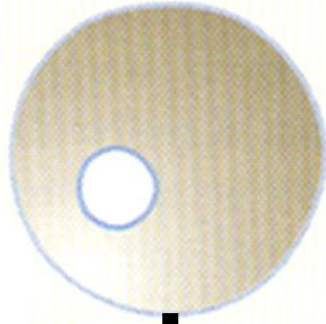
LEUCOPLAST

CHLOROPLAST

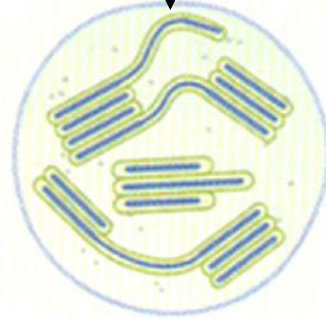


PLASTIDS INTERCONVERT

PROPLASTID



DIFFERENT ENVIRONMENT

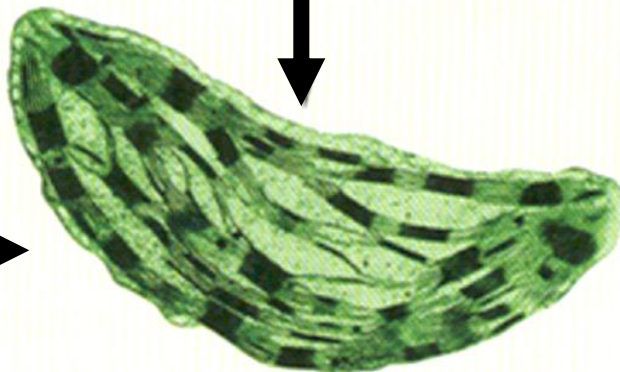
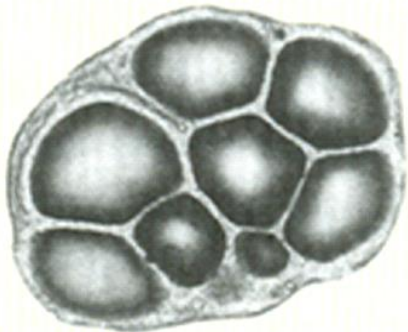


DIFFERENT ENVIRONMENT

LEUCOPLAST

CHLOROPLAST

CHROMOPLAST

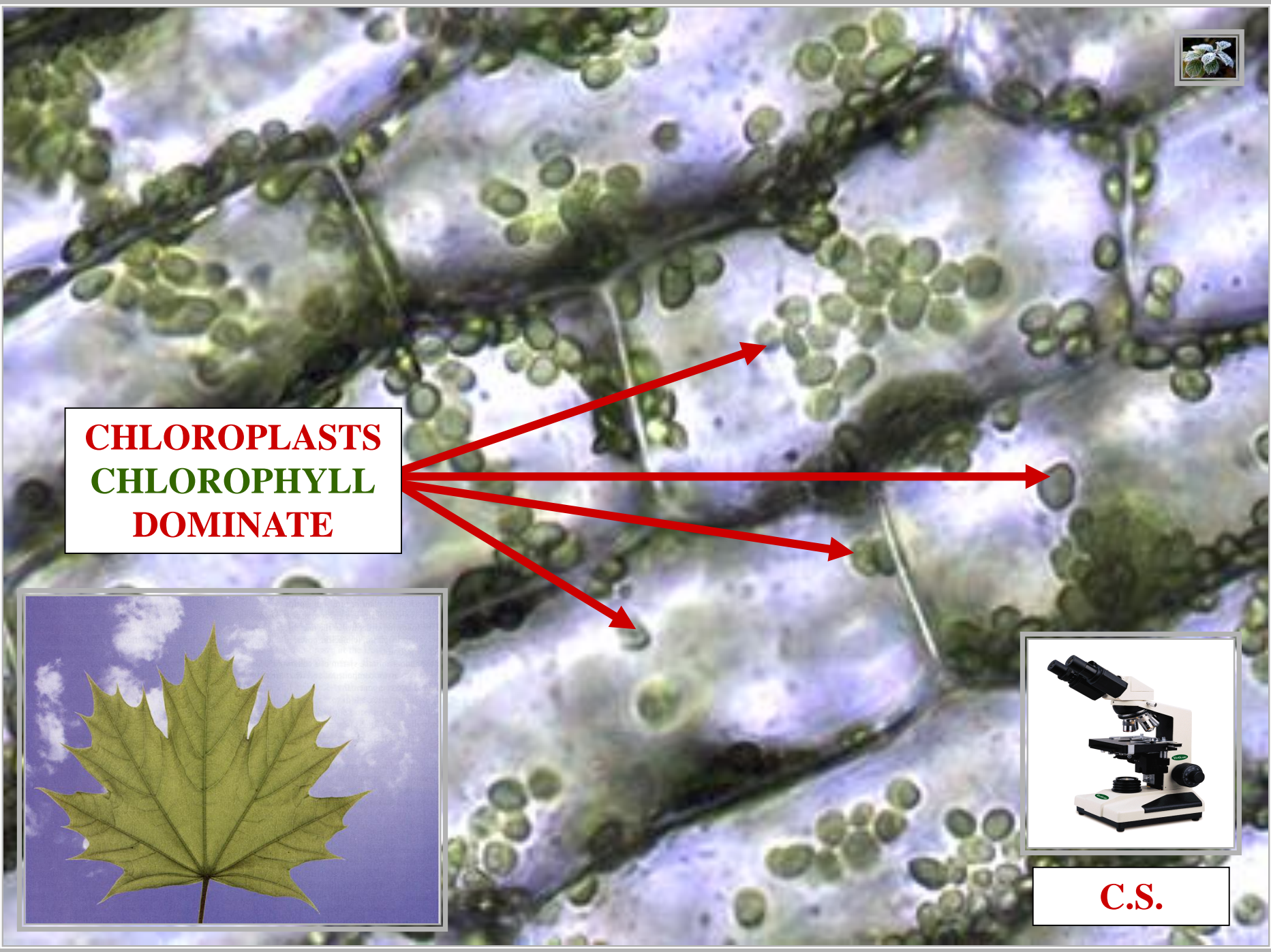




**PLASTIDS
INTERCONVERT
FALL COLORS**

SPRING





CHLOROPLASTS
CHLOROPHYLL
DOMINATE



C.S.

FALL



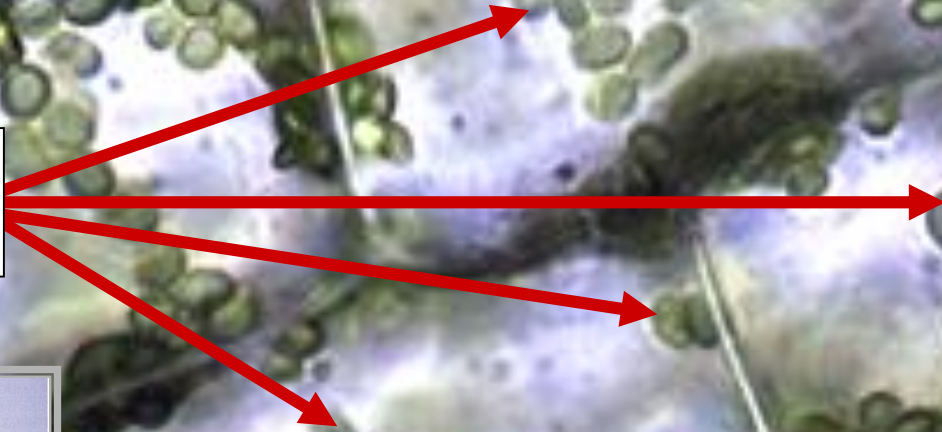
C

TEMPERATURE
DECREASES

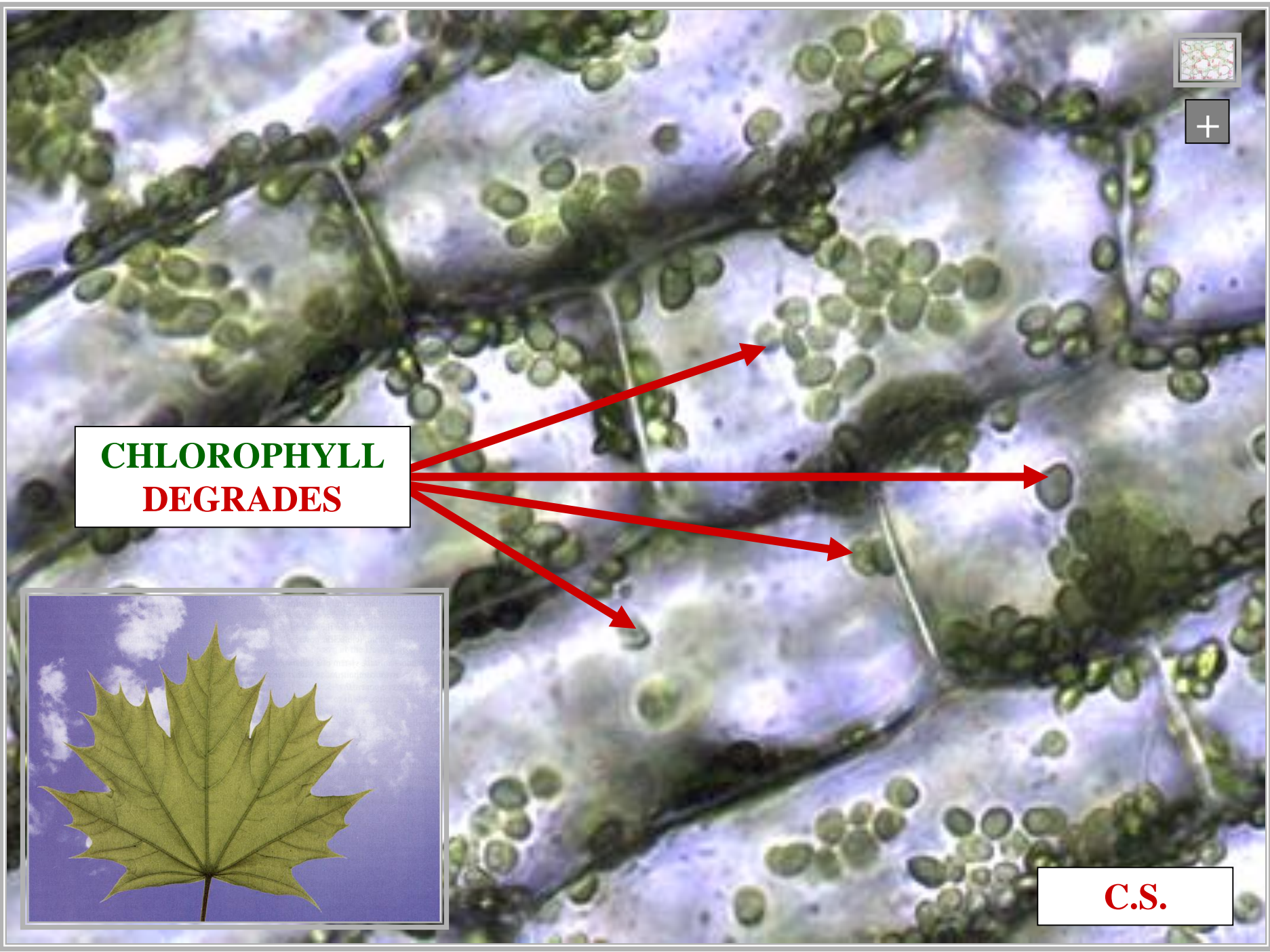
DAY LENGTH
DECREASES

DE

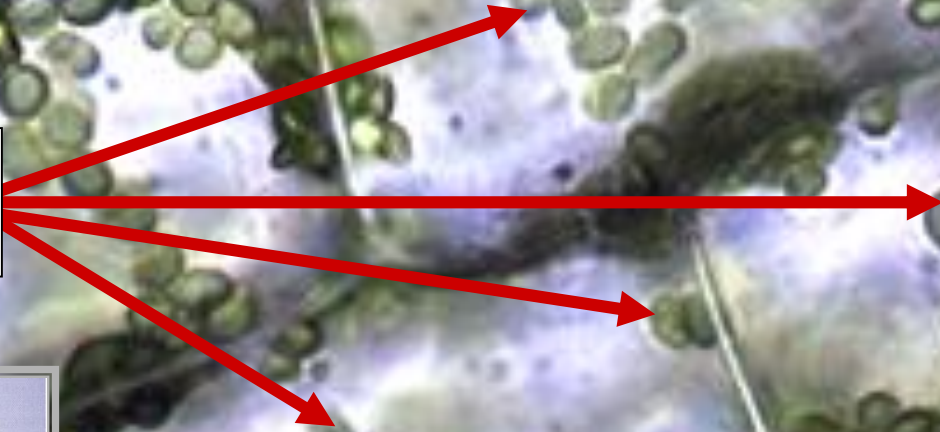
CHLOROPLASTS
CHLOROPHYLL



C.S.

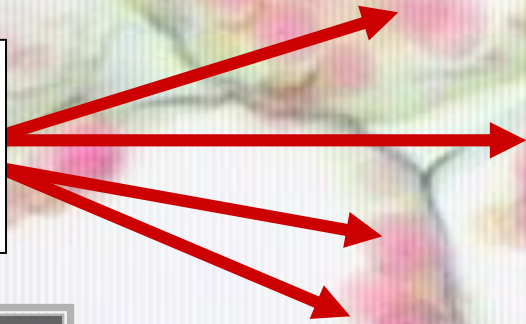


**CHLOROPHYLL
DEGRADES**



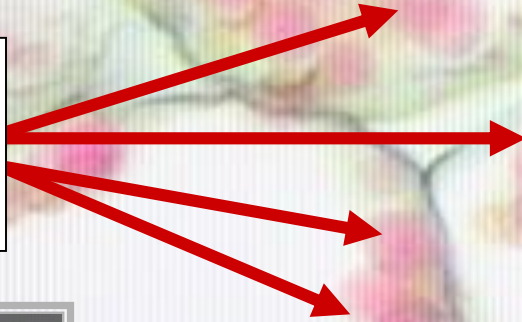
C.S.

**CHLOROPLASTS
CAROTENOIDS
DOMINATE**





**CHROMOPLASTS
CAROTENOIDS
DOMINATE**



C.S.

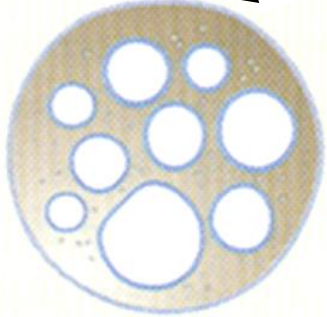
FALL



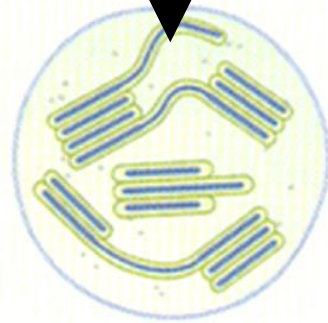
FALL COLORS ALABAMA FOREST

PLASTIDS TYPES

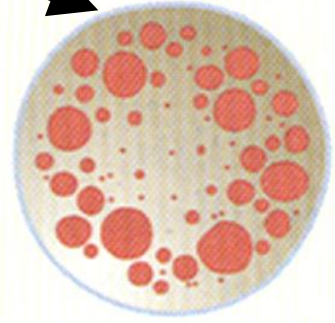
PROPLASTID



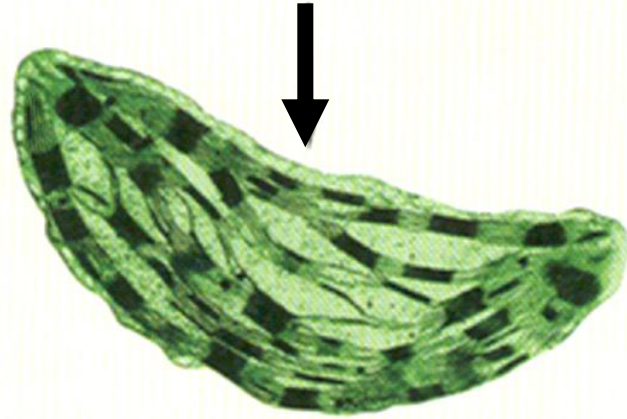
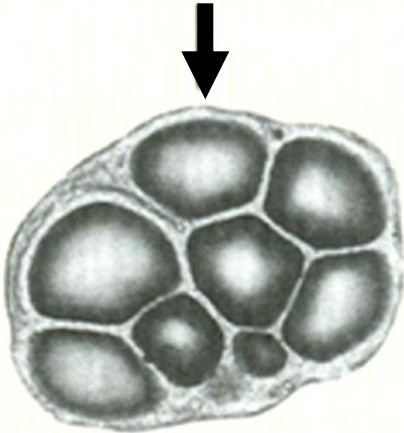
LEUCOPLAST



CHLOROPLAST



CHROMOPLAST



CHLOROPLAST

CHLOROPLAST

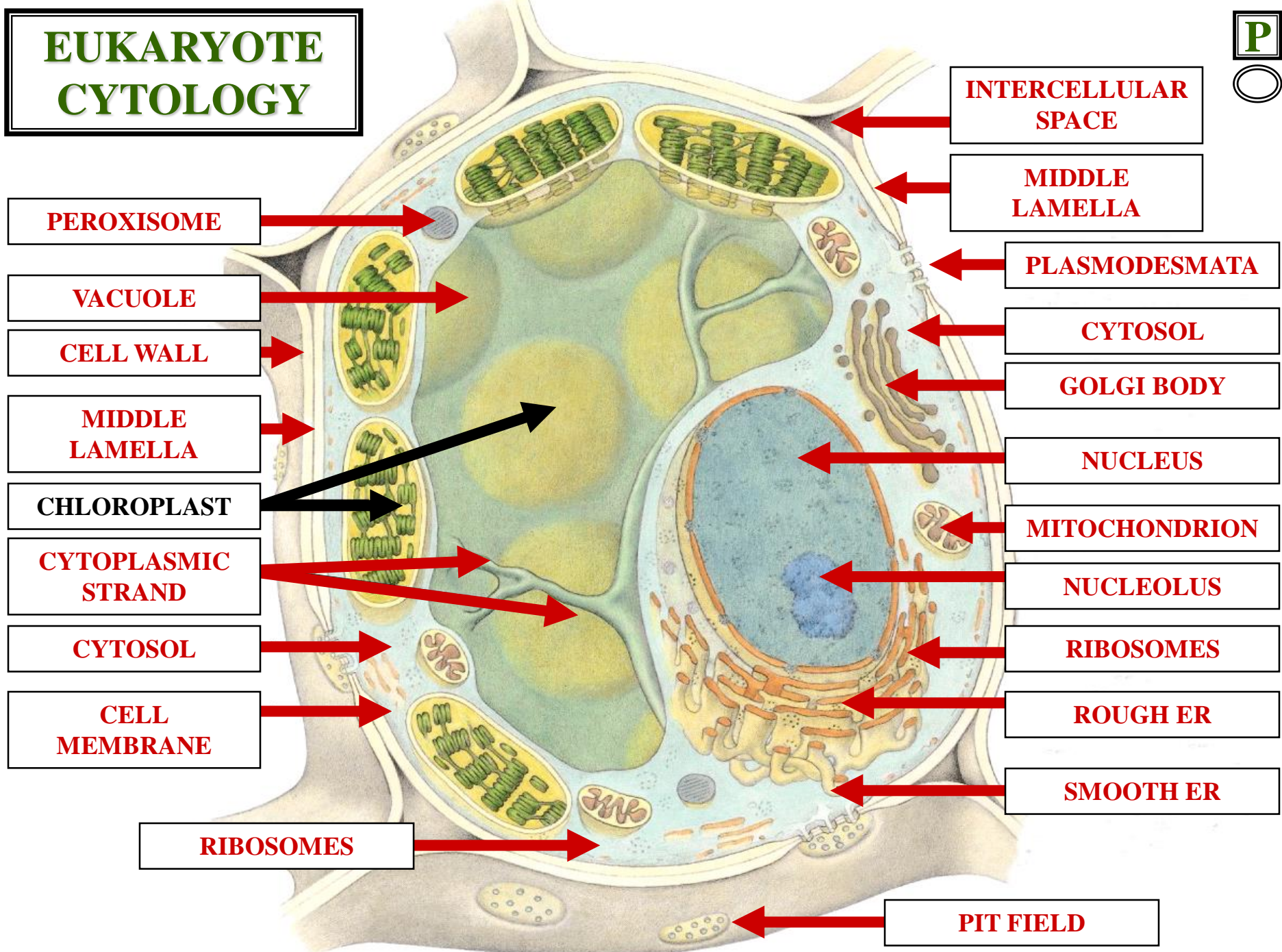


CHLOROPLAST

SITE: PHOTOSYNTHESIS

CHLOROPLAST

EUKARYOTE CYTOLOGY



PEROXISOME

VACUOLE

CELL WALL

MIDDLE LAMELLA

CHLOROPLAST

CYTOPLASMIC STRAND

CYTOSOL

CELL MEMBRANE

RIBOSOMES

INTERCELLULAR SPACE

MIDDLE LAMELLA

PLASMODESMATA

CYTOSOL

GOLGI BODY

NUCLEUS

MITOCHONDRION

NUCLEOLUS

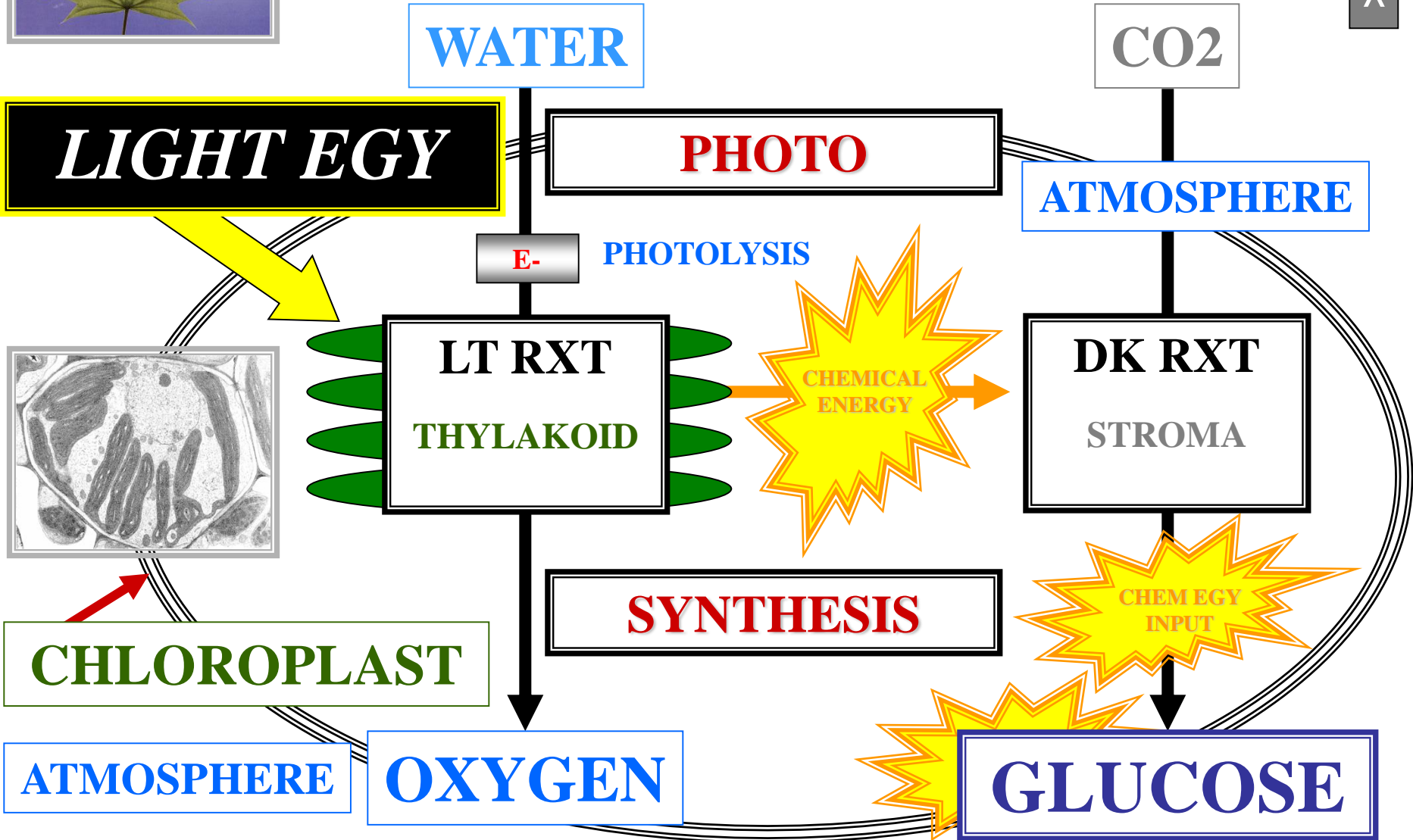
RIBOSOMES

ROUGH ER

SMOOTH ER

PIT FIELD

PHOTOSYNTHESIS



WATER

CO₂

LIGHT ENERGY

PHOTO

ATMOSPHERE

E- **PHOTOLYSIS**

LT RXT
THYLAKOID

CHEMICAL ENERGY

DK RXT
STROMA

CHLOROPLAST

SYNTHESIS

CHEMICAL ENERGY INPUT

ATMOSPHERE

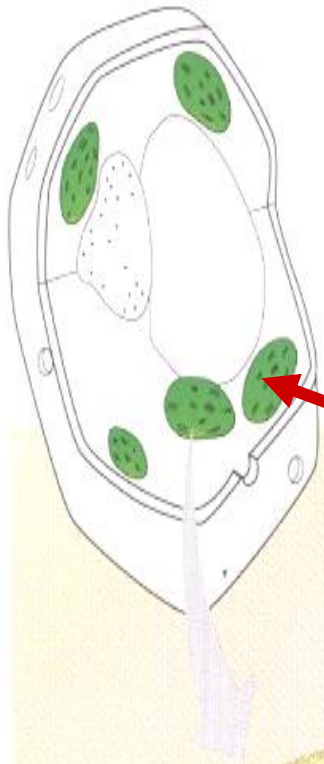
O₂

GLUCOSE

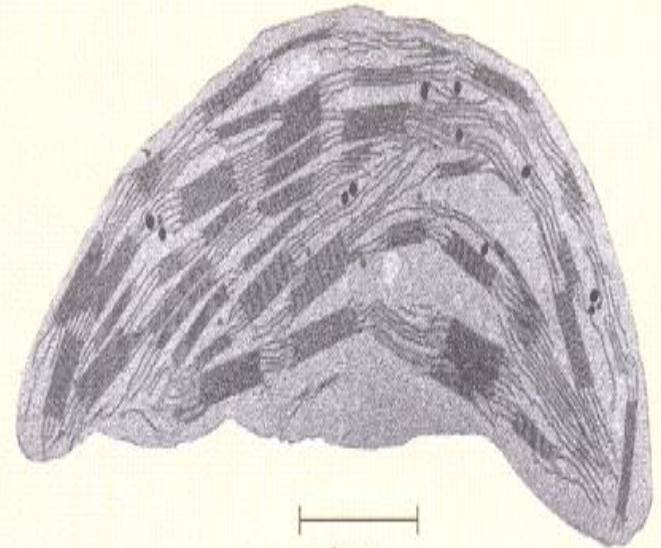


CHLOROPLAST ULTRASTRUCTURE

CHLOROPLAST ULTRASTRUCTURE

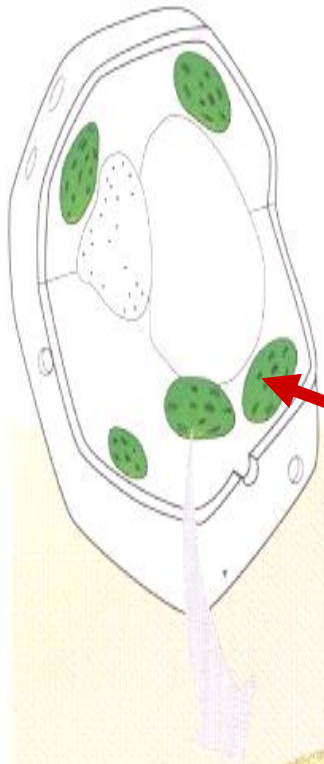


CHLOROPLAST

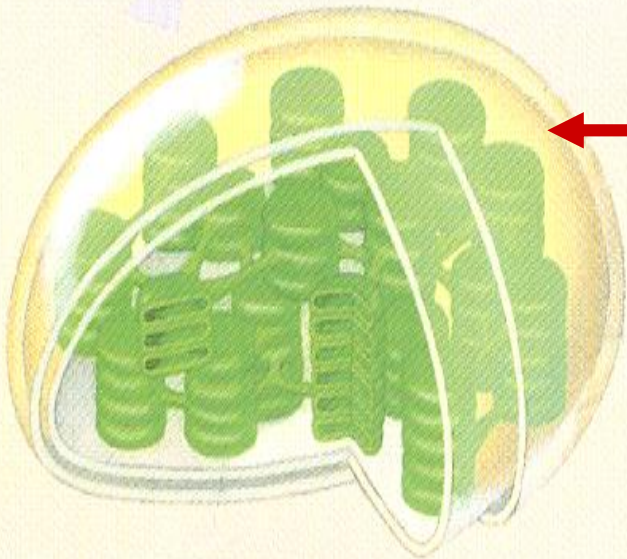


1 μ m

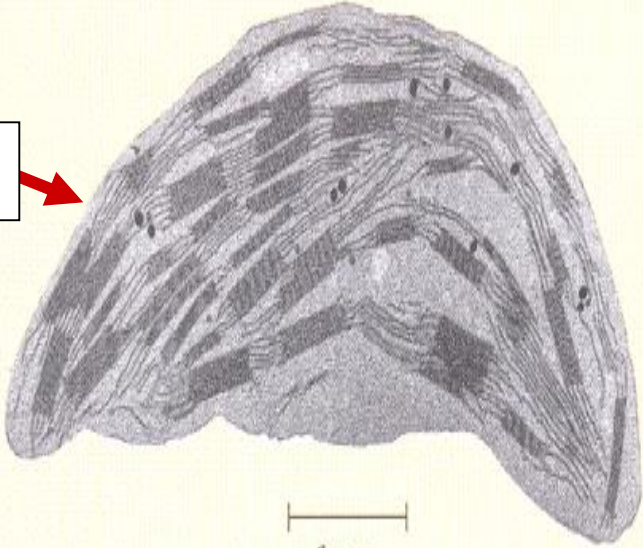
CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST

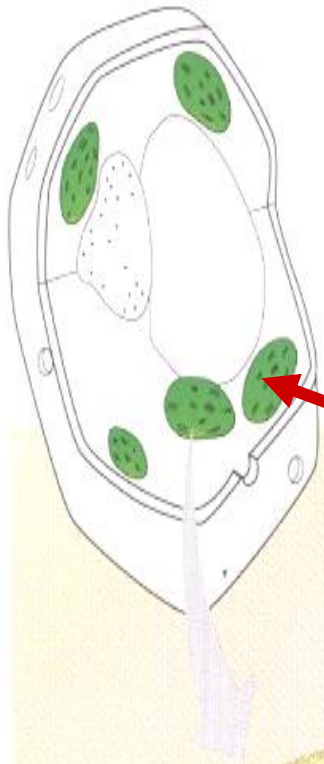


OUTER
MEMBRANE

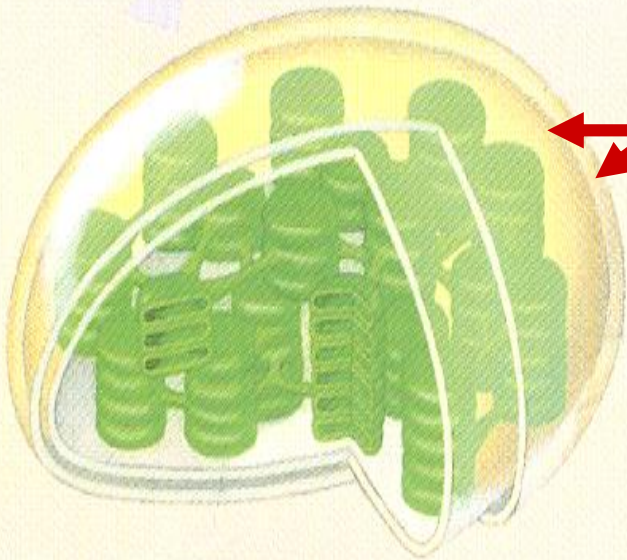


1 μ m

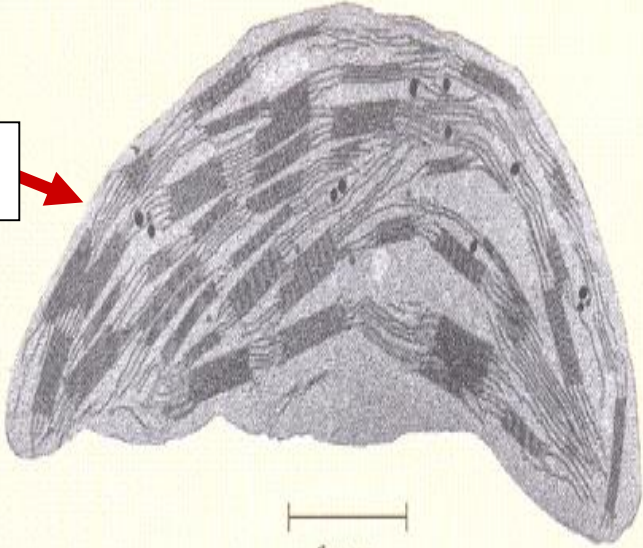
CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST



OUTER & INNER
MEMBRANE



1 μm

THYLAKOID MEMBRANE



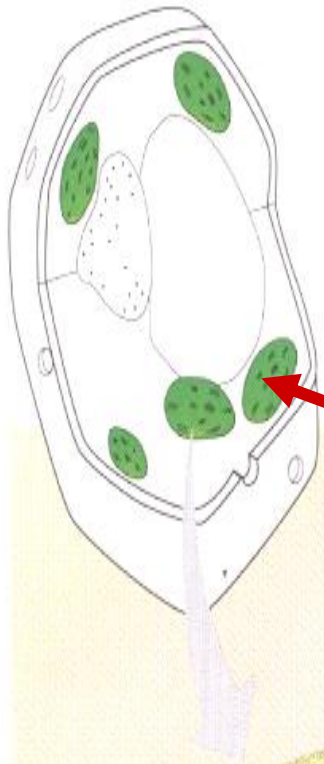
THYLAKOID MEMBRANE

CHLOROPLAST

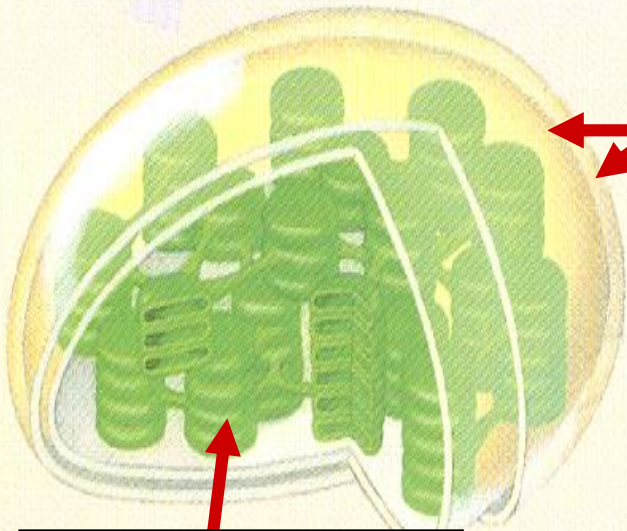
**PIGMENTED INNERMOST
MEMBRANE**

THYLAKOID MEMBRANE

CHLOROPLAST ULTRASTRUCTURE

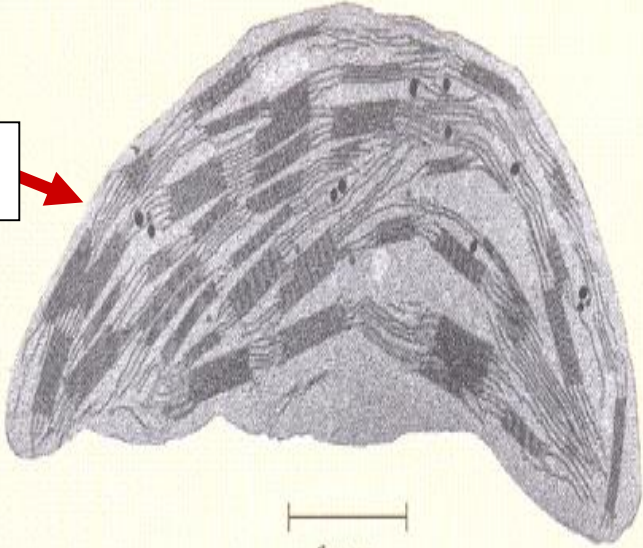


CHLOROPLAST



THYLAKOID MEMBRANE

OUTER & INNER
MEMBRANE



1 μ m

THYLAKOID VESICLES



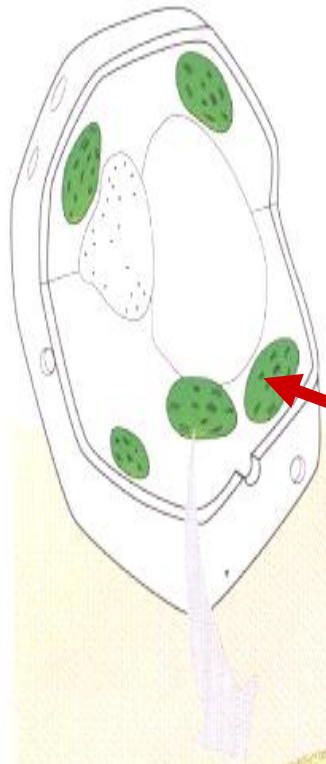
THYLAKOID VESICLES

COMPRISE

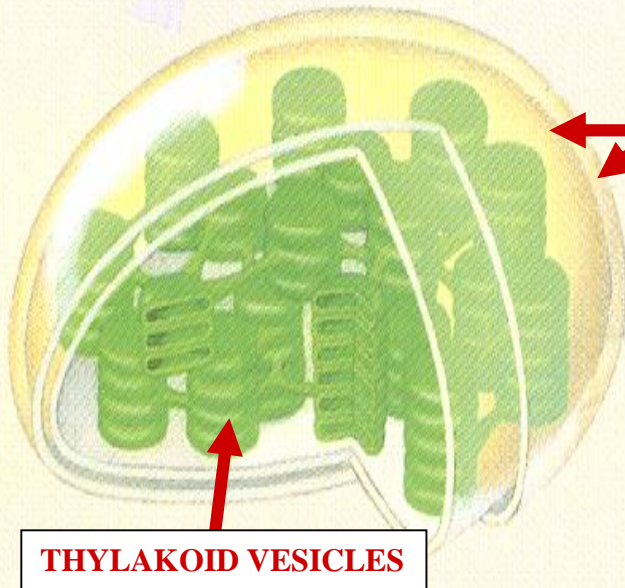
THYLAKOID MEMBRANE

THYLAKOID VESICLES

CHLOROPLAST ULTRASTRUCTURE

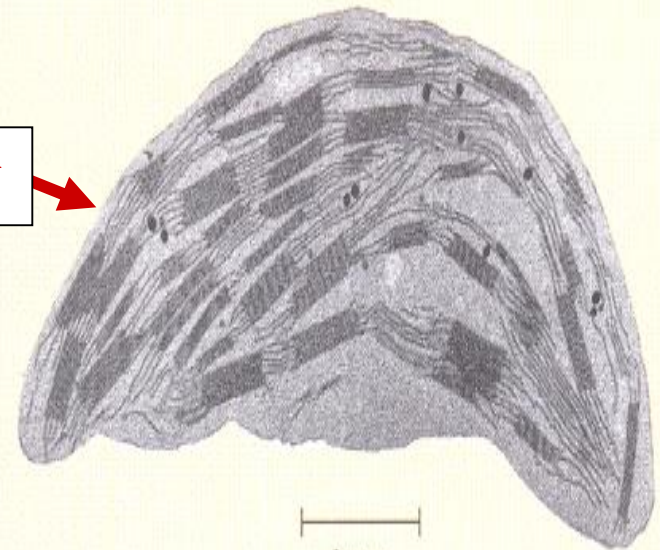


CHLOROPLAST



THYLAKOID VESICLES

OUTER & INNER
MEMBRANE



1 μ m

THYLAKOID
GRANUM / GRANA

THYLAKOID GRANUM



STACKED

THYLAKOID VESICLES

THYLAKOID GRANUM

THYLAKOID GRANUM



STACKED

THYLAKOID VESICLES

SITE: LIGHT RXT

THYLAKOID GRANUM

THYLAKOID GRANUM



G



STACKED

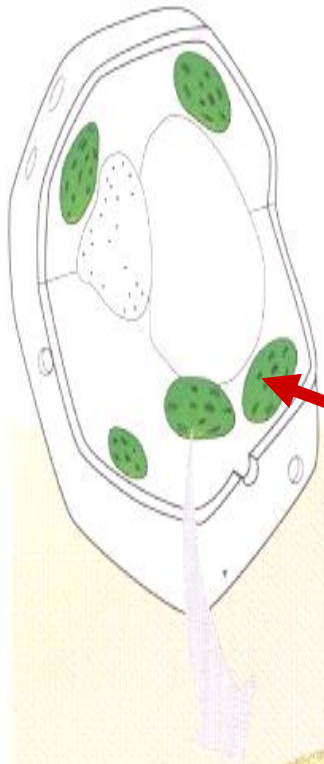
THYLAKOID VESICLES

SITE: LIGHT RXT

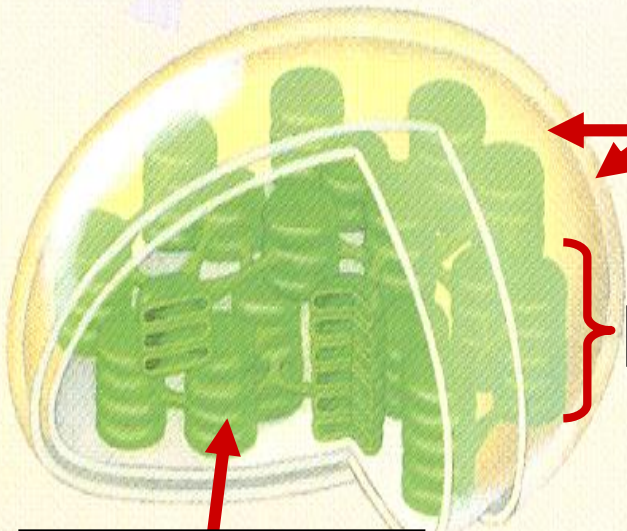
DERIVES ATP

THYLAKOID GRANUM

CHLOROPLAST ULTRASTRUCTURE



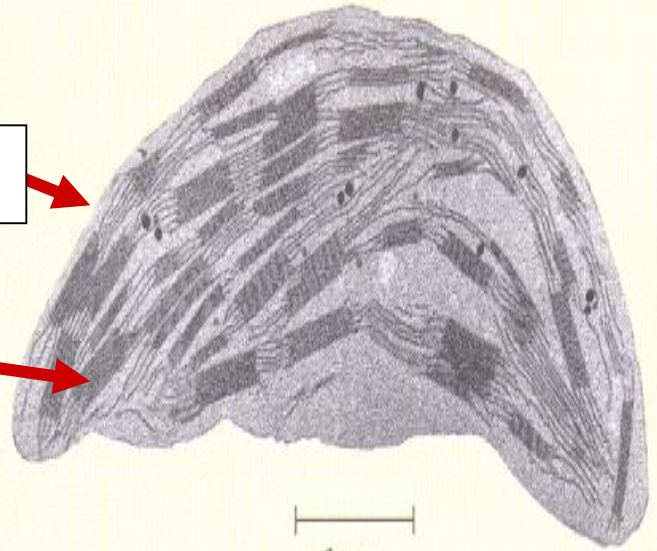
CHLOROPLAST



THYLAKOID VESICLES

OUTER & INNER
MEMBRANE

GRANUM



1 μm



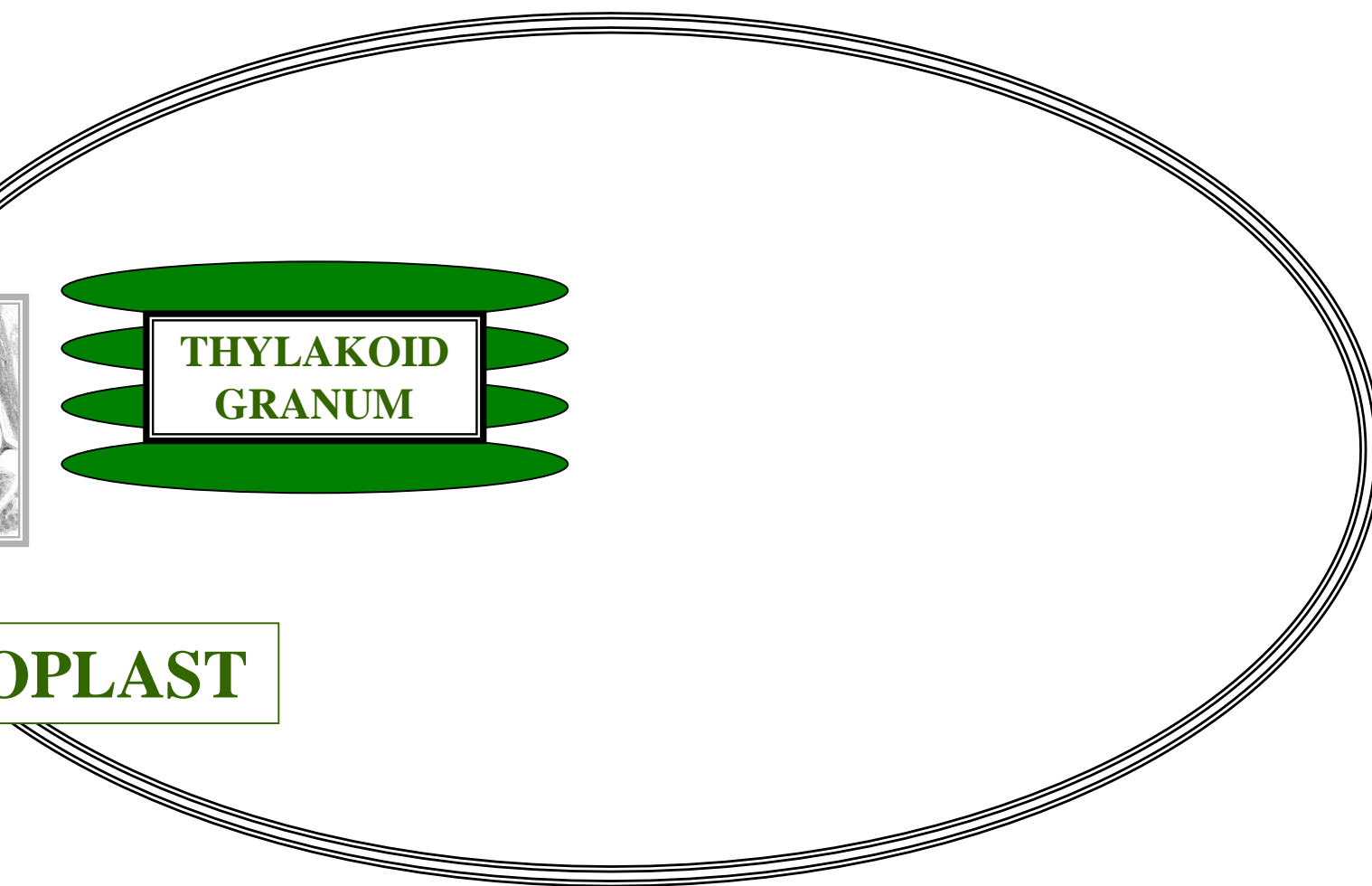
LIGHT REACTION

PHOTOSYNTHESIS

LR

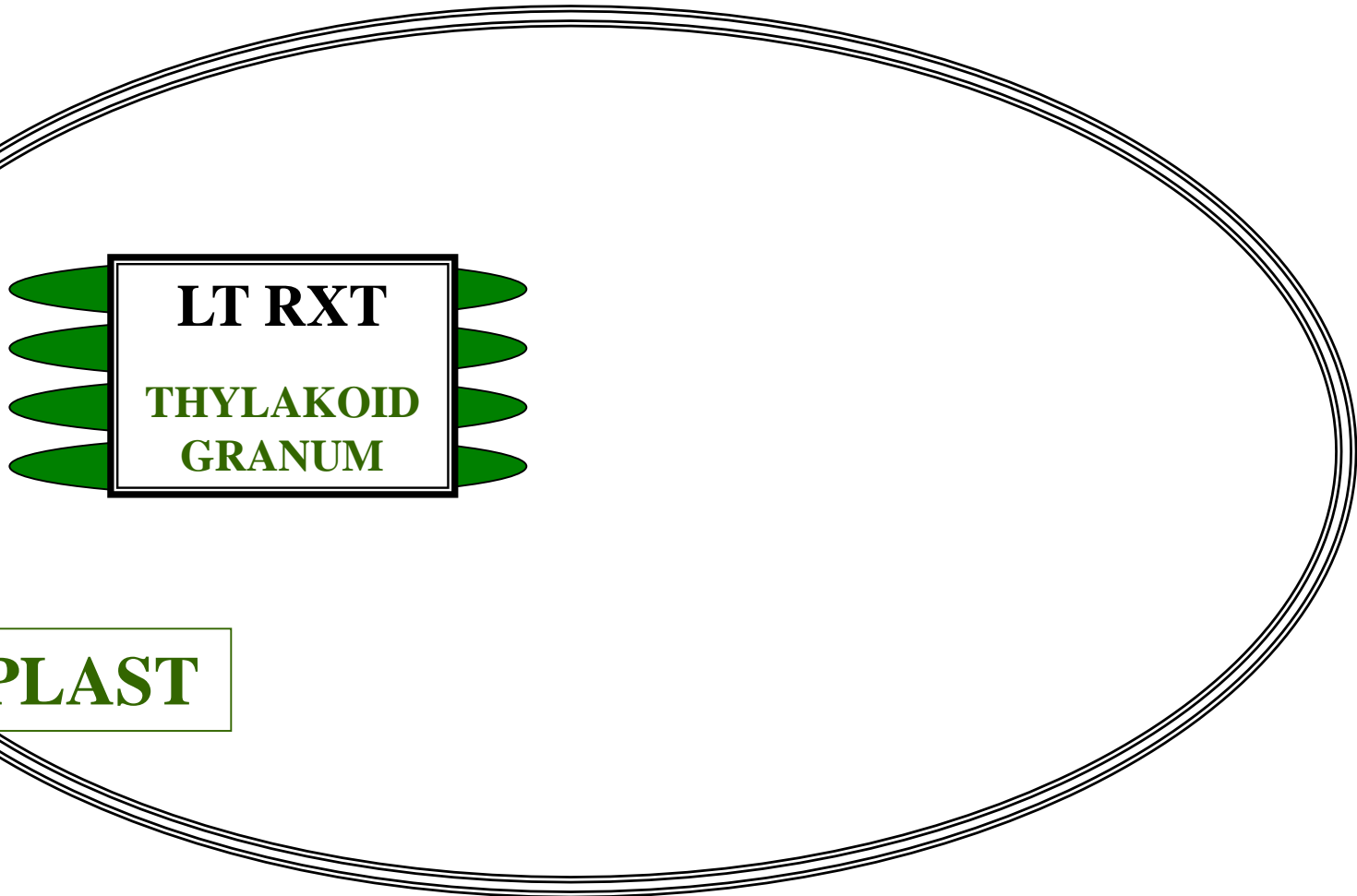


CHLOROPLAST



PHOTOSYNTHESIS

LT



LT RXT
**THYLAKOID
GRANUM**

CHLOROPLAST

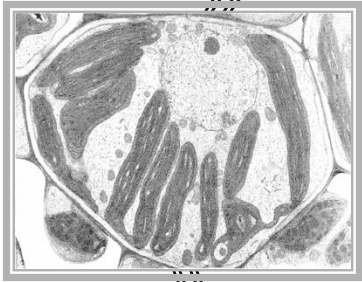
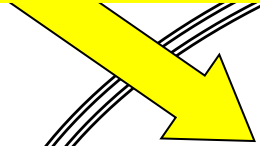
PHOTOSYNTHESIS



C



LIGHT ENERGY



**THYLAKOID
GRANUM**

CHLOROPLAST



PHOTOSYNTHESIS

I



WATER

LIGHT ENERGY

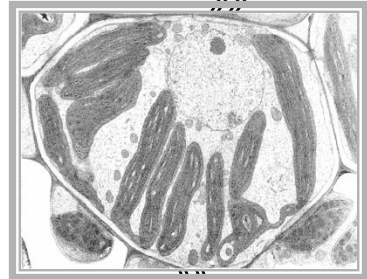
E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

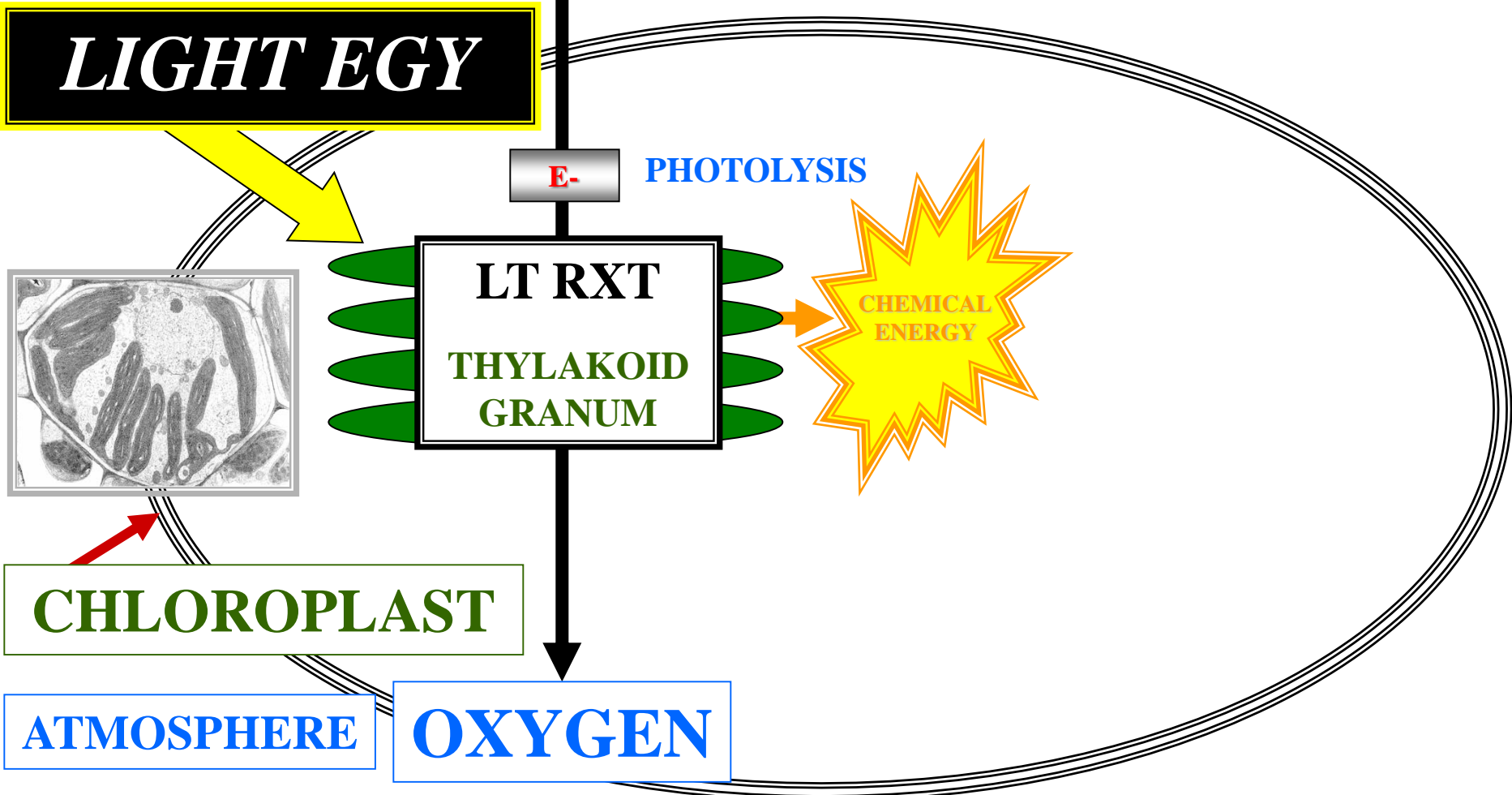
CHEMICAL
ENERGY



CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS



WATER

LIGHT ENERGY

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

CHEMICAL
ENERGY

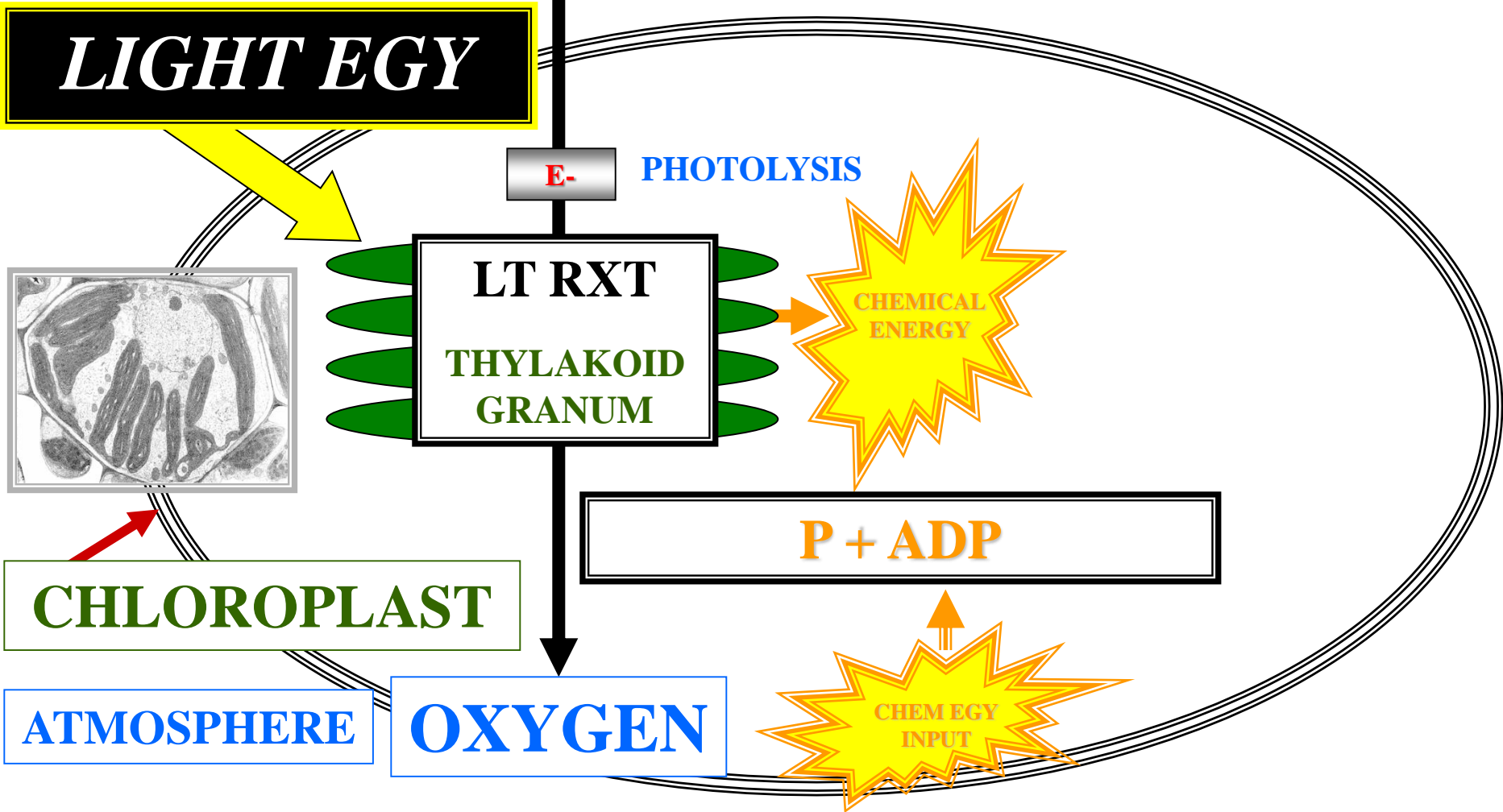
P + ADP

CHLOROPLAST

ATMOSPHERE

OXYGEN

CHEMICAL
INPUT



PHOTOSYNTHESIS

P



WATER

LIGHT ENERGY

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

CHEMICAL
ENERGY

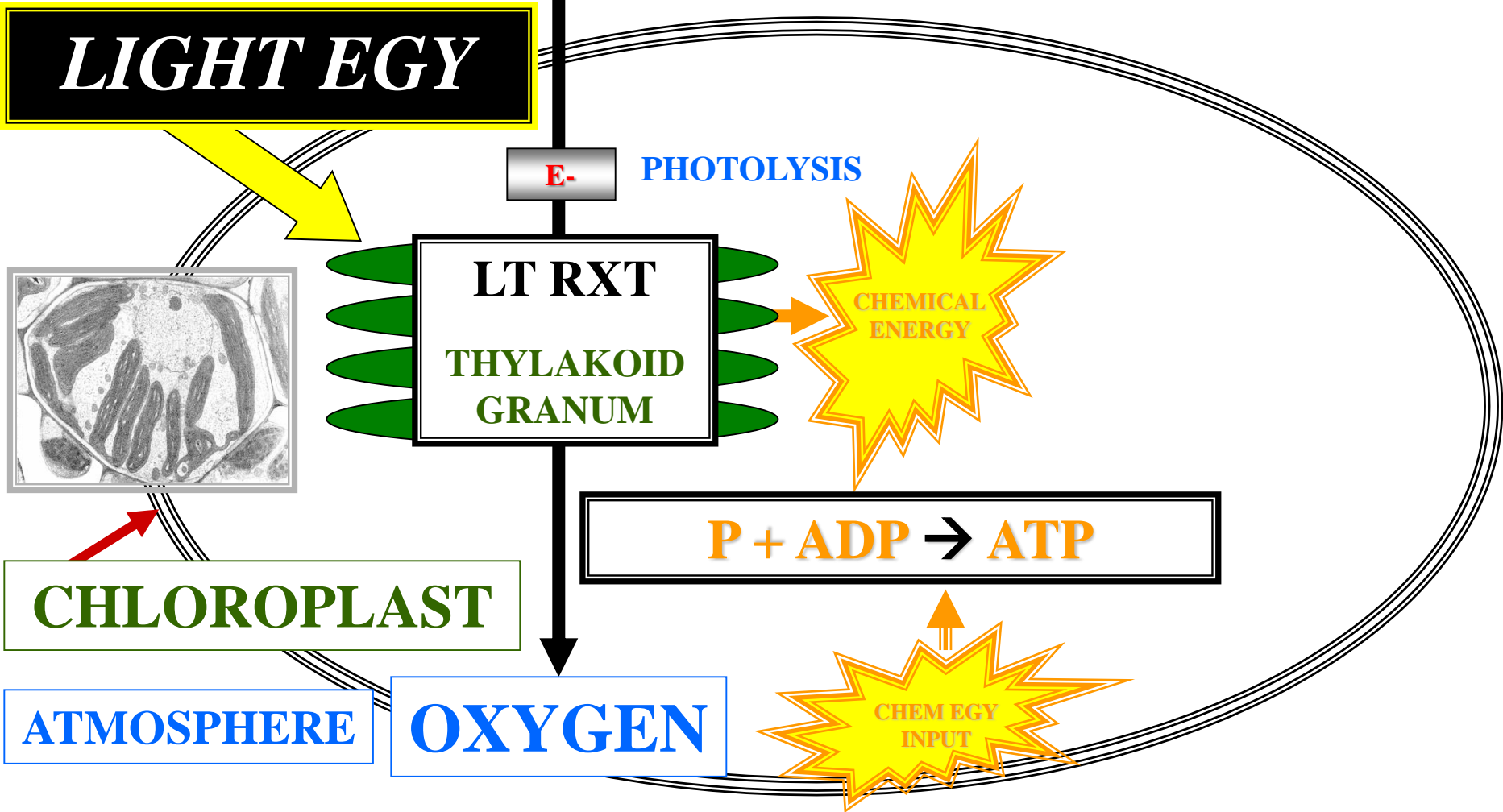
$P + ADP \rightarrow ATP$

CHLOROPLAST

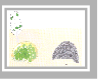
ATMOSPHERE

OXYGEN

CHEMICAL
INPUT



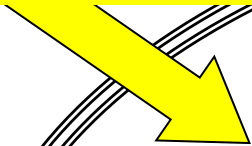
PHOTOSYNTHESIS



F

WATER

LIGHT ENERGY



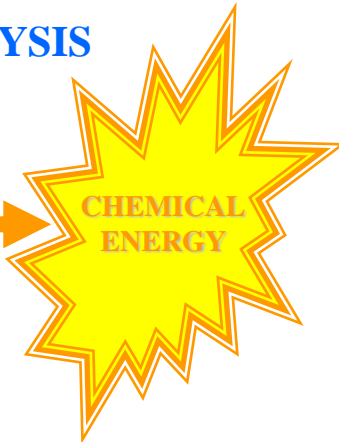
E-

PHOTOLYSIS

LIGHT REACTION

THYLAKOID GRANUM

CHEMICAL ENERGY



PHOSPHORYLATION



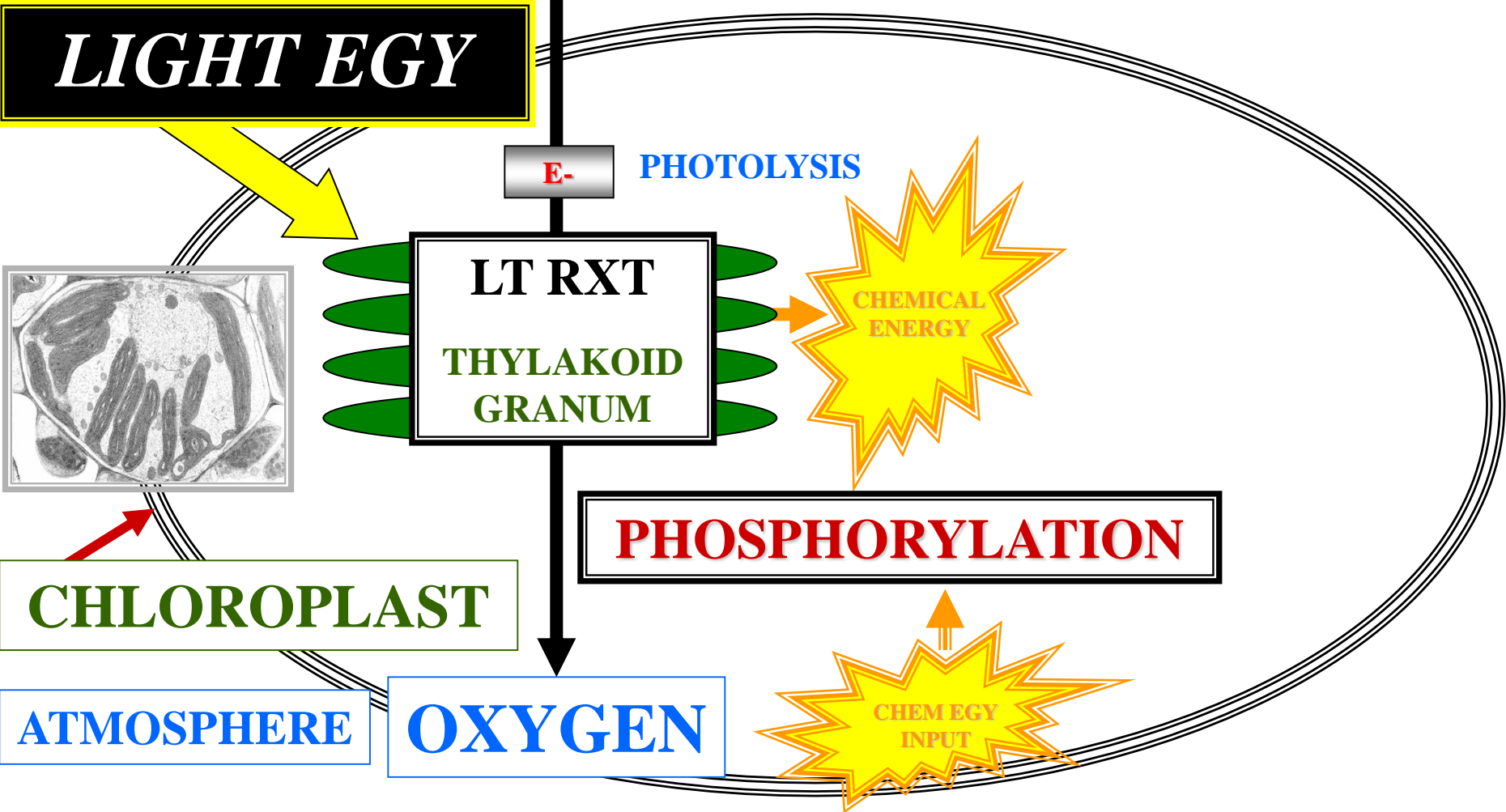
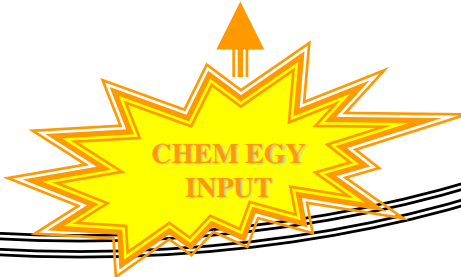
CHLOROPLAST



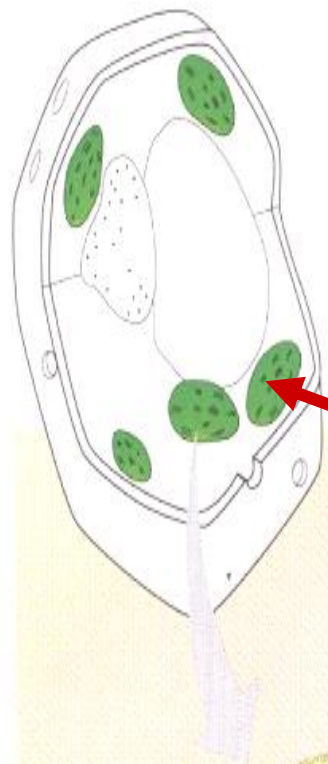
ATMOSPHERE

OXYGEN

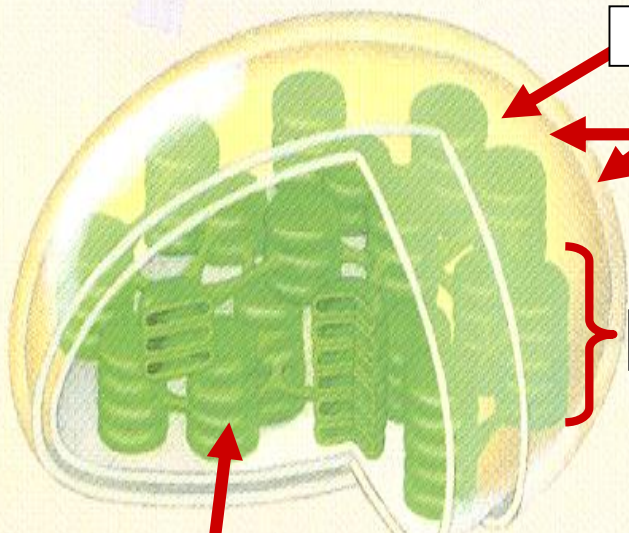
CHEMICAL ENERGY INPUT



CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST

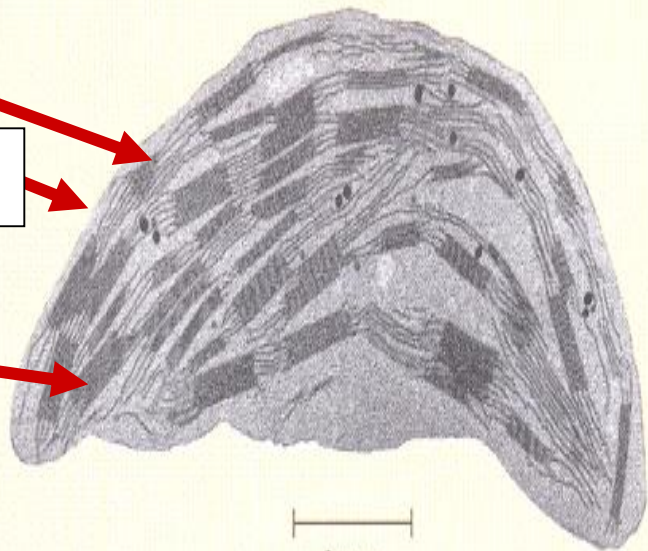


FLUID

OUTER & INNER
MEMBRANE

GRANUM

THYLAKOID MEMBRANE



1 μ m

STROMA



STROMA

**CHLOROPLAST
FLUID MATRIX**

STROMA



STROMA

**CHLOROPLAST
FLUID MATRIX**

SITE: DARK RXT

STROMA



STROMA

CHLOROPLAST

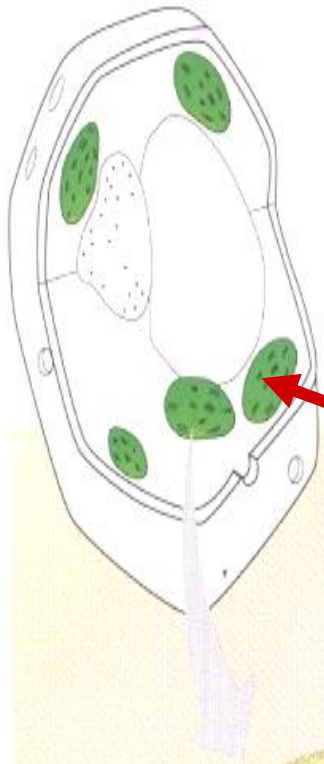
FLUID MATRIX

SITE: DARK RXT

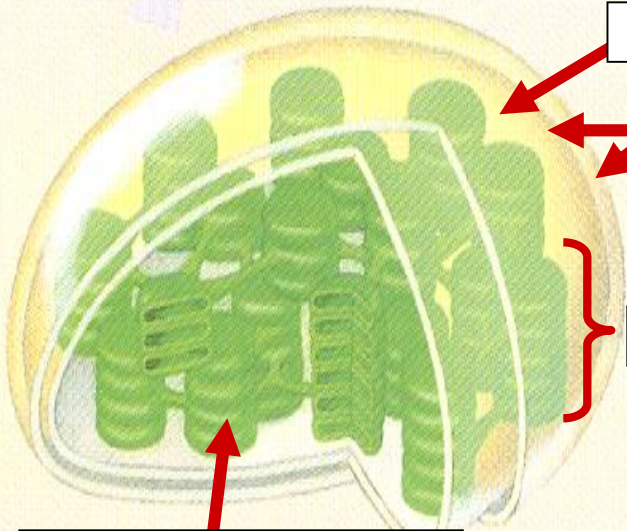
DERIVES GLUCOSE

STROMA

CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST

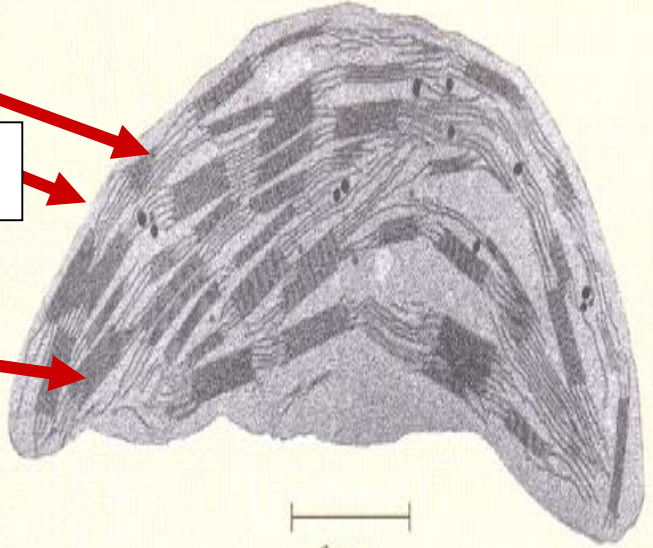


STROMA

OUTER & INNER
MEMBRANE

GRANUM

THYLAKOID MEMBRANE



1 μ m



DARK REACTION

PHOTOSYNTHESIS

DR



WATER

LIGHT ENERGY

E-

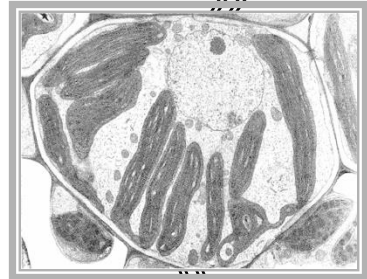
PHOTOLYSIS

LT RXT

THYLAKOID

ATP

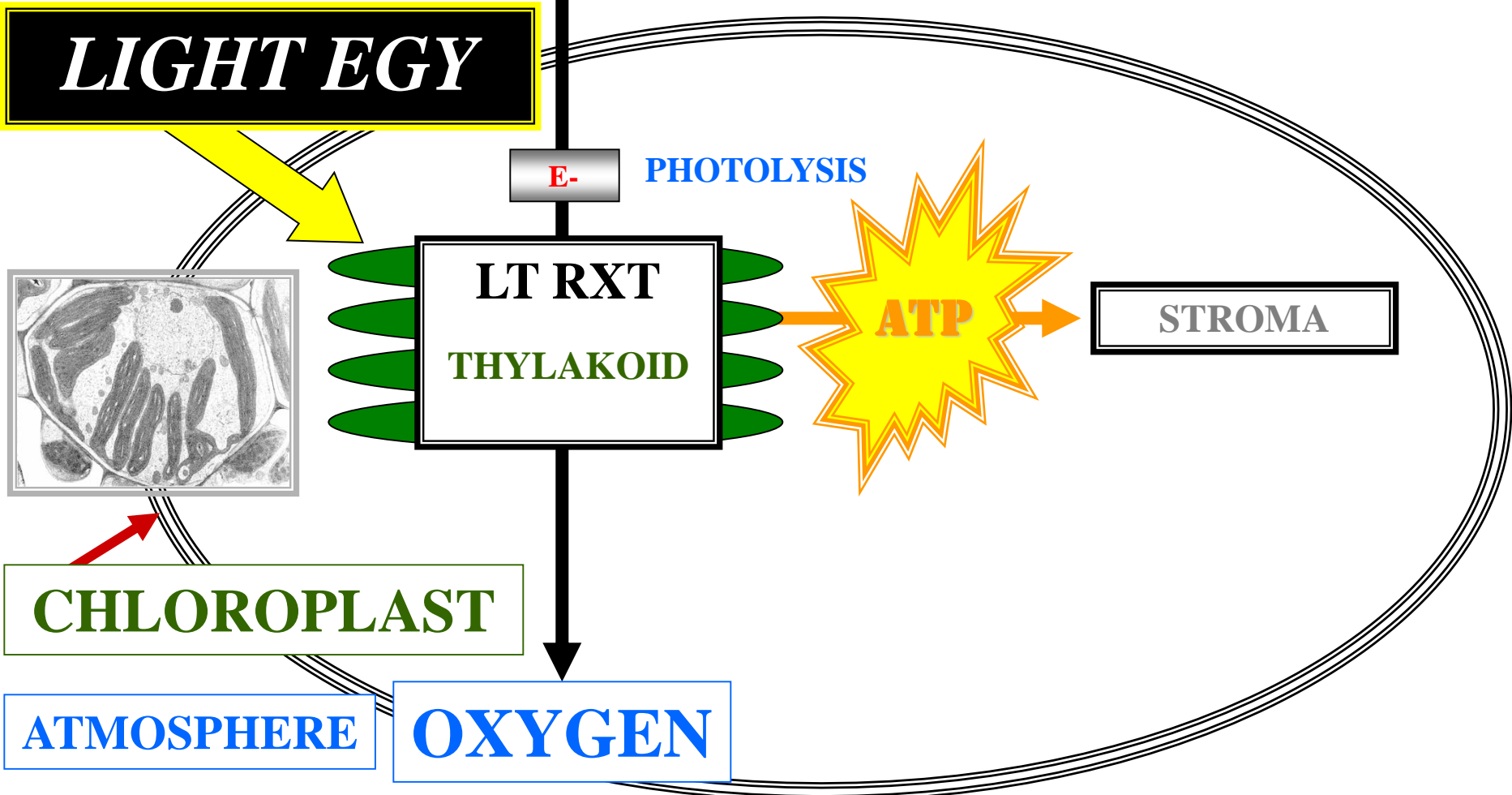
STROMA



CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS



?

C

WATER

LIGHT ENERGY

E-

PHOTOLYSIS

LT RXT

THYLAKOID

ATP

DK RXT

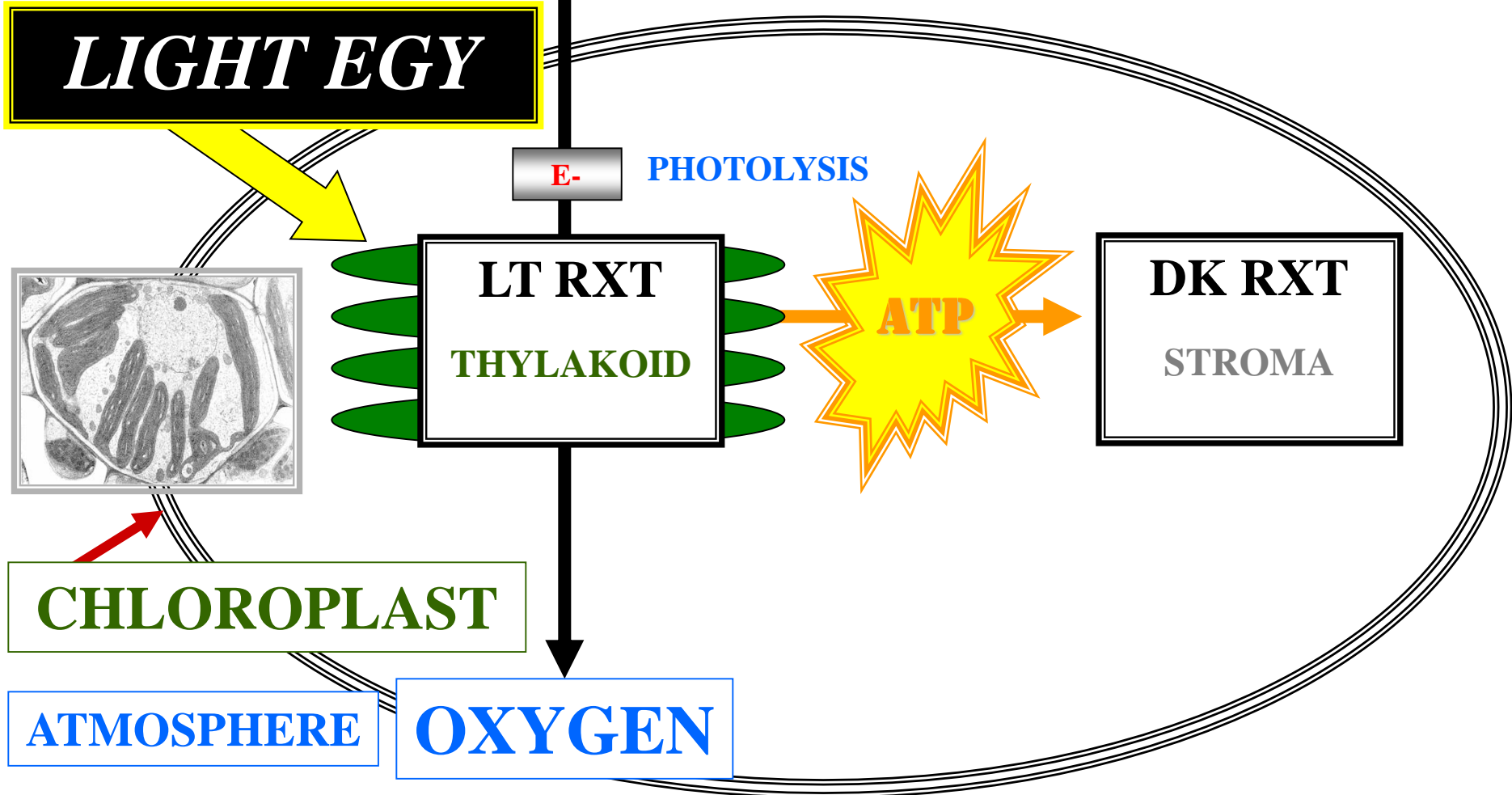
STROMA



CHLOROPLAST

ATMOSPHERE

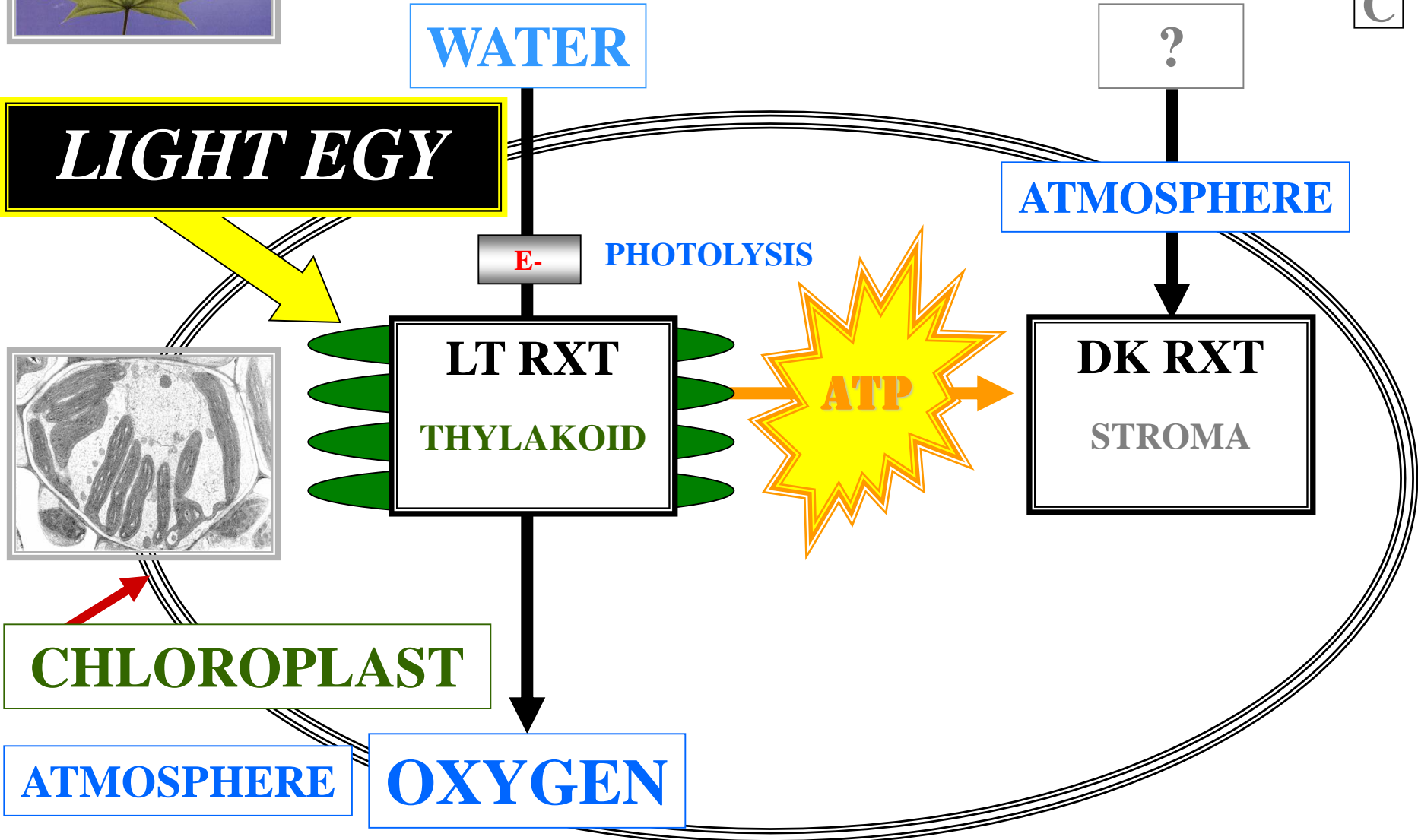
OXYGEN



PHOTOSYNTHESIS



C



PHOTOSYNTHESIS



WATER

CO₂

LIGHT ENERGY

ATMOSPHERE

E- PHOTOLYSIS



LT RXT
THYLAKOID

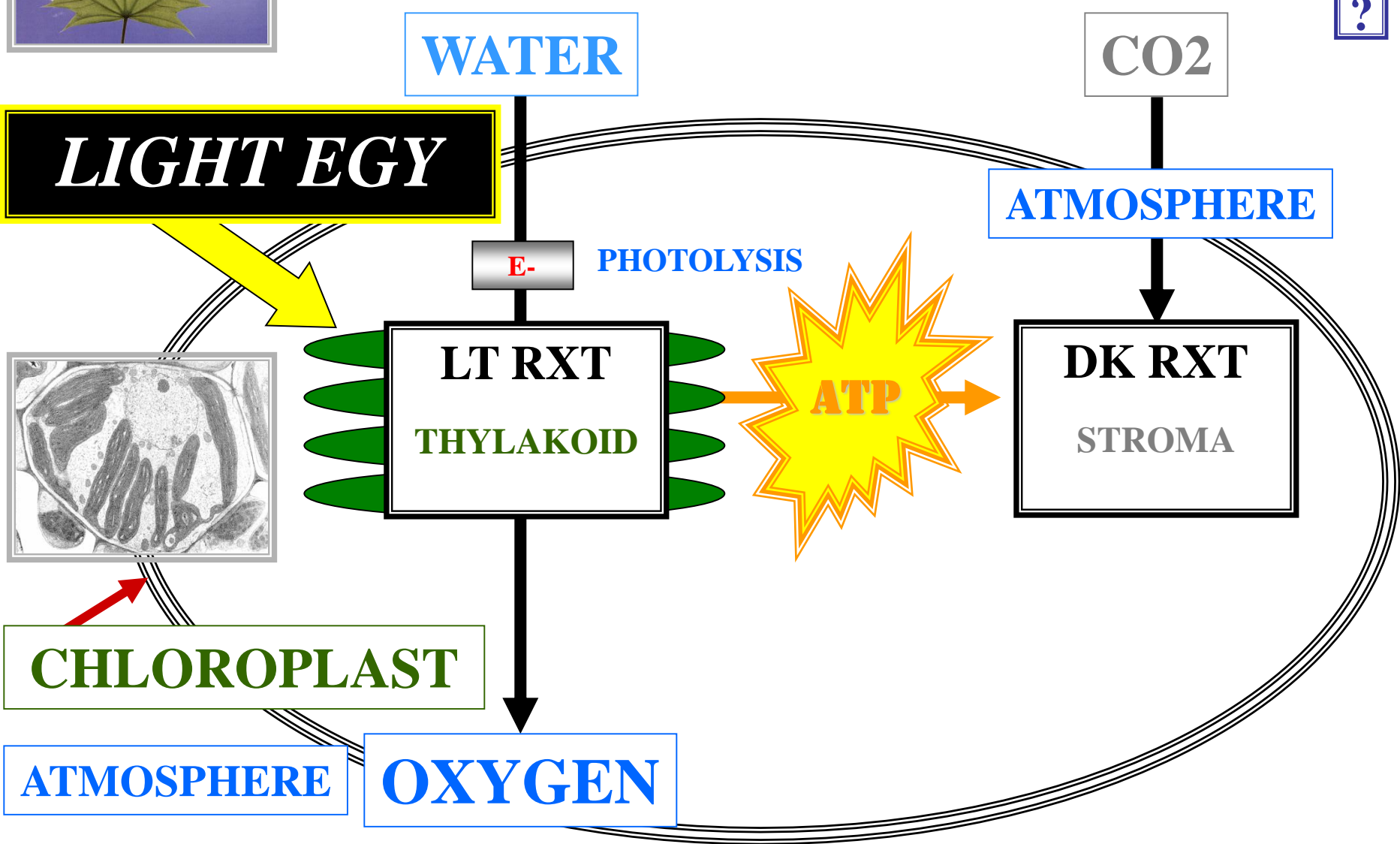


DK RXT
STROMA

CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS

G



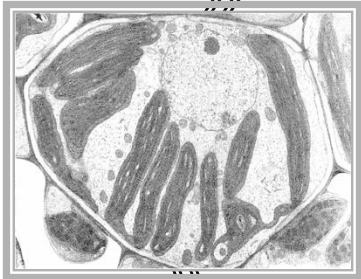
WATER

CO₂

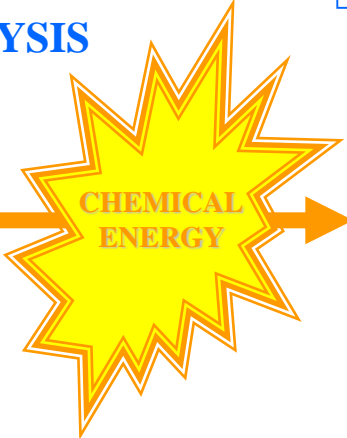
LIGHT ENERGY

ATMOSPHERE

E- PHOTOLYSIS



LT RXT
THYLAKOID



DK RXT
STROMA

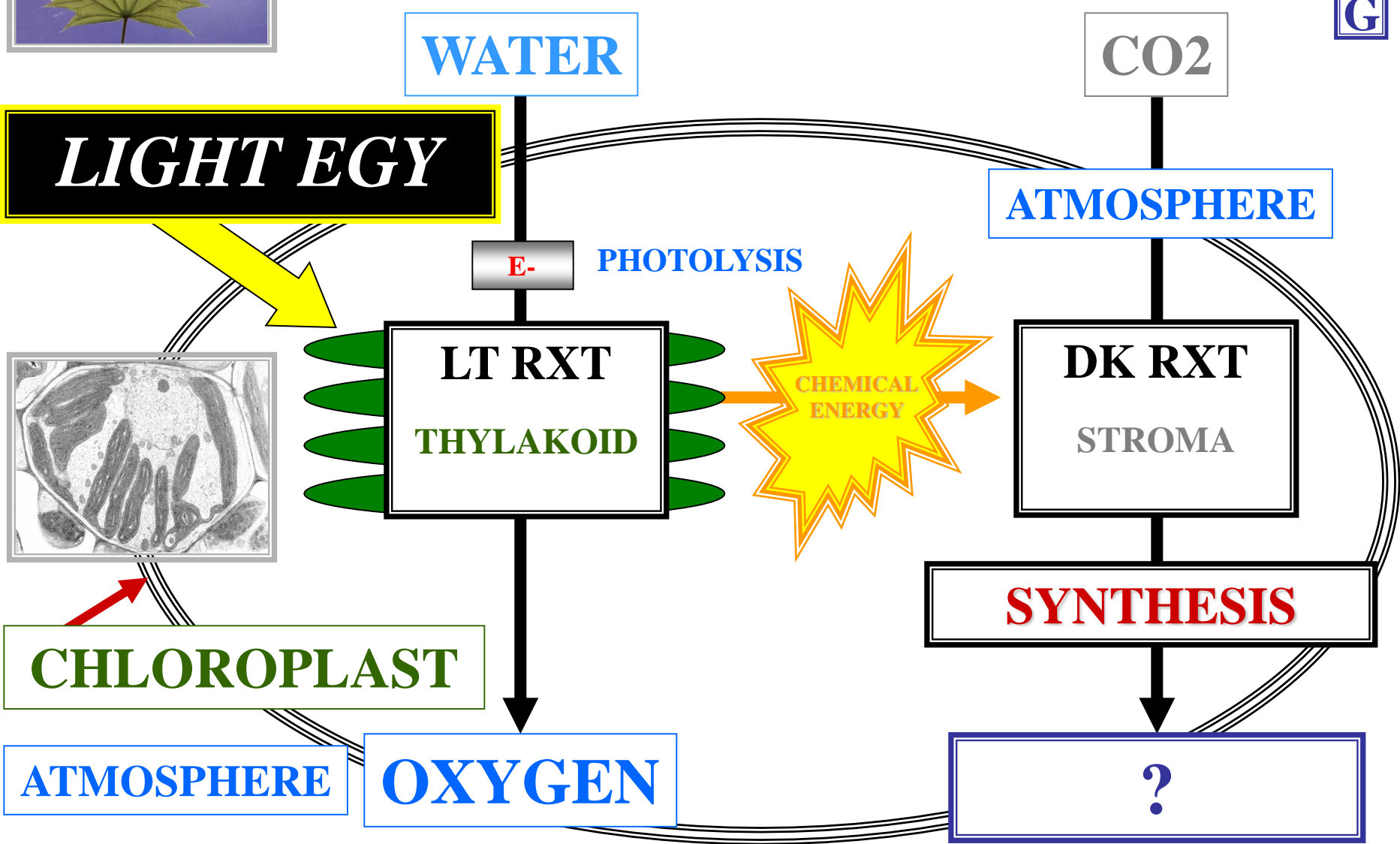
SYNTHESIS

CHLOROPLAST

ATMOSPHERE

OXYGEN

?



PHOTOSYNTHESIS



WATER

CO₂

LIGHT ENERGY

PHOTO

ATMOSPHERE

E-

PHOTOLYSIS

LT RXT

THYLAKOID

CHEMICAL ENERGY

DK RXT

STROMA

SYNTHESIS

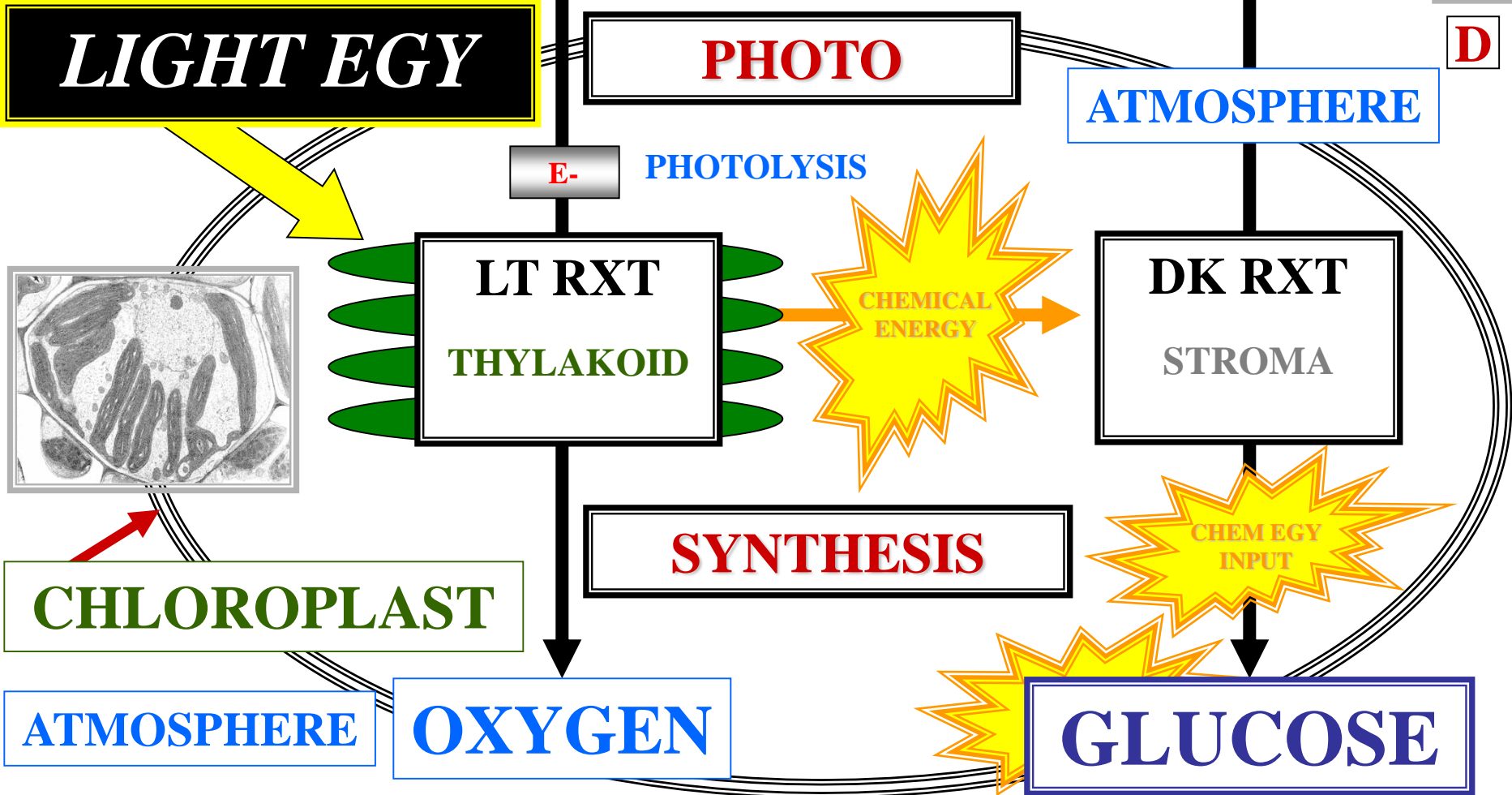
CHEMICAL ENERGY INPUT

CHLOROPLAST

ATMOSPHERE

OXYGEN

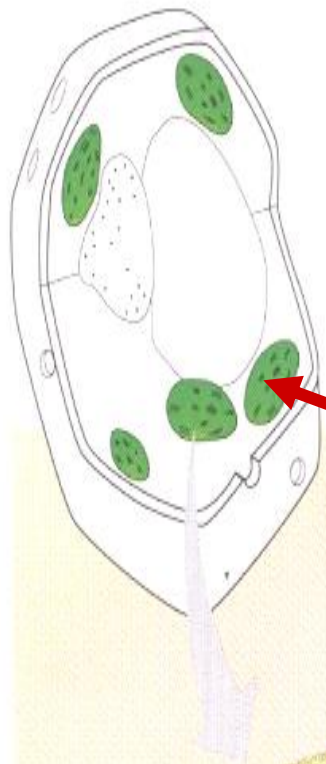
GLUCOSE



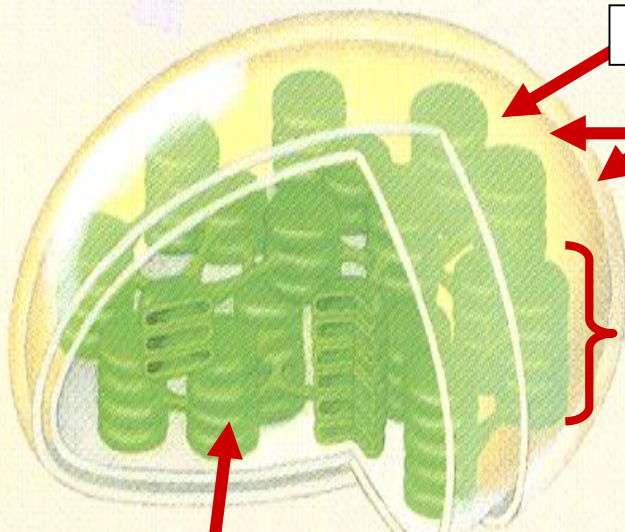


D

CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST

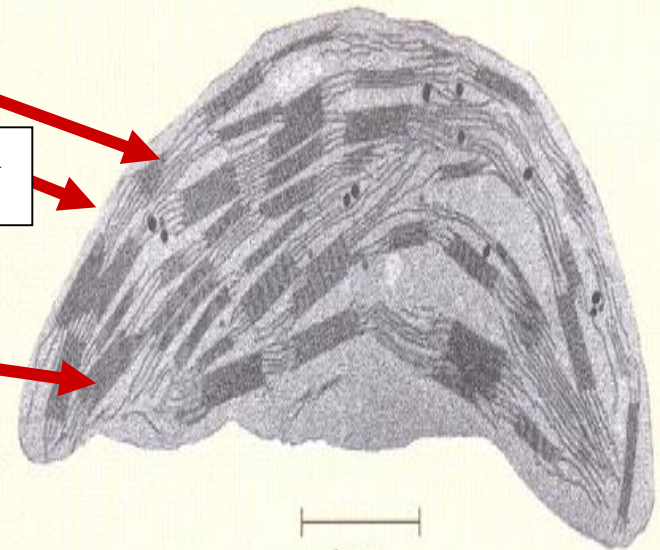


STROMA

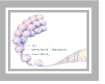
**OUTER & INNER
MEMBRANE**

GRANUM

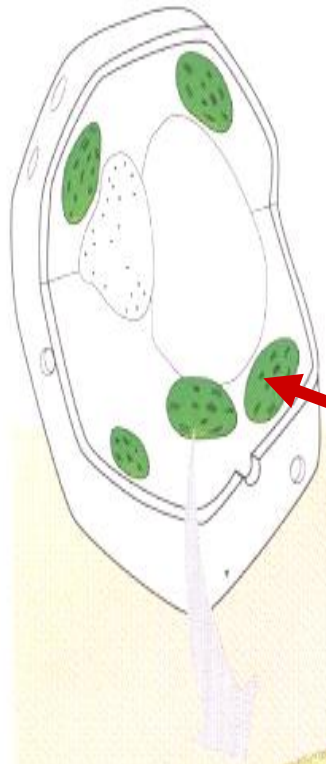
THYLAKOID MEMBRANE



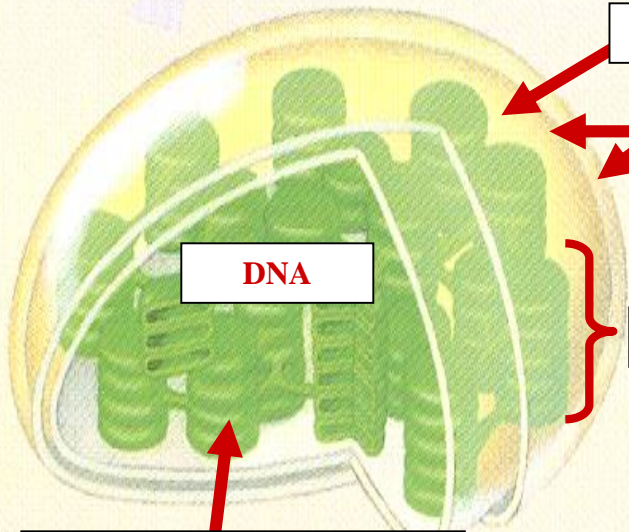
1 μ m



CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST

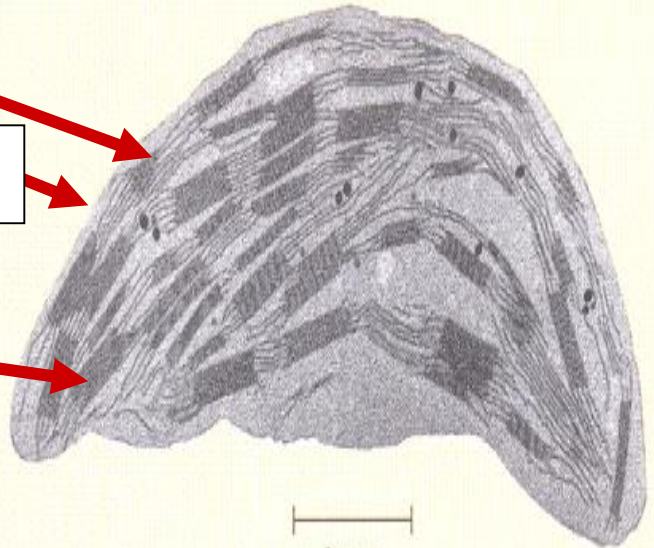


THYLAKOID MEMBRANE

STROMA

OUTER & INNER
MEMBRANE

GRANUM

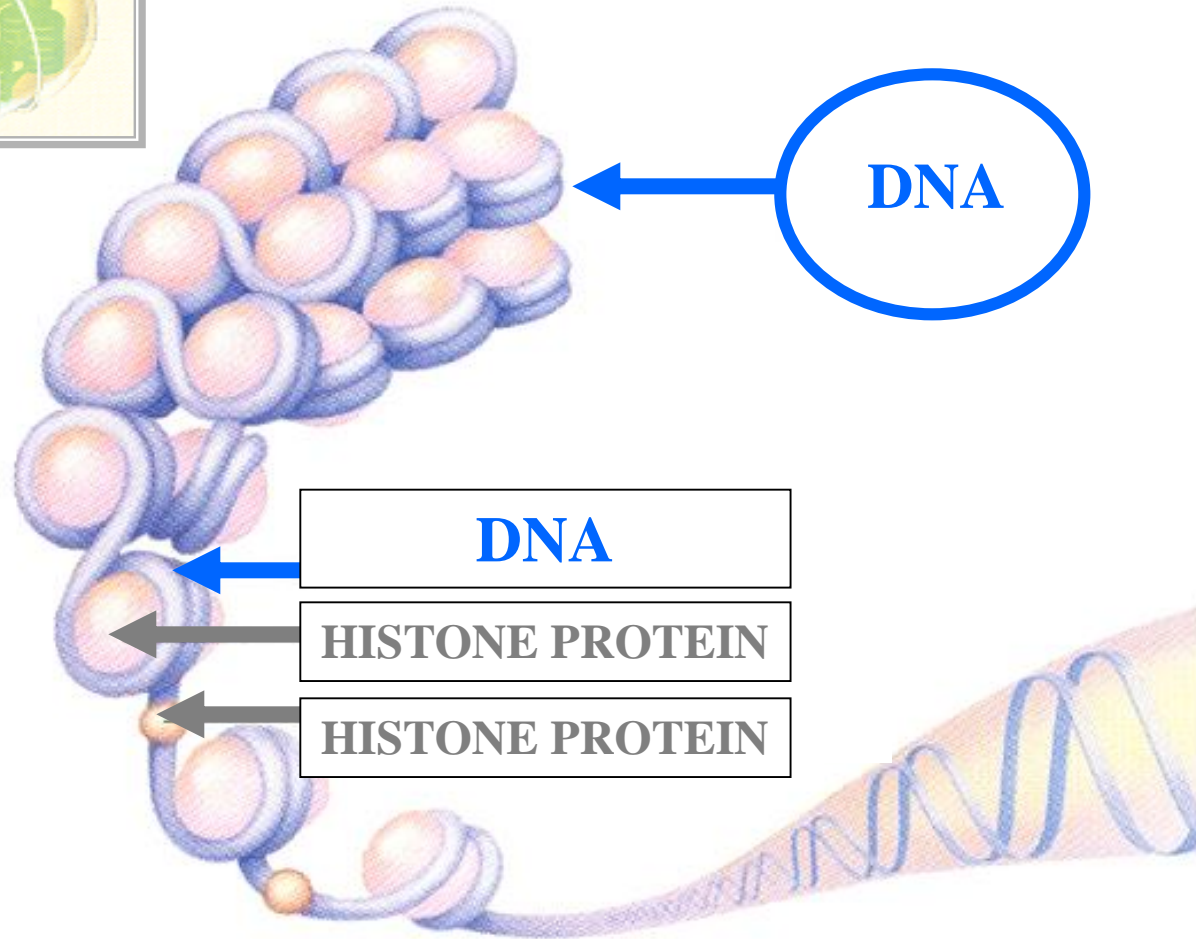


1 μm

CHLOROPLAST DNA

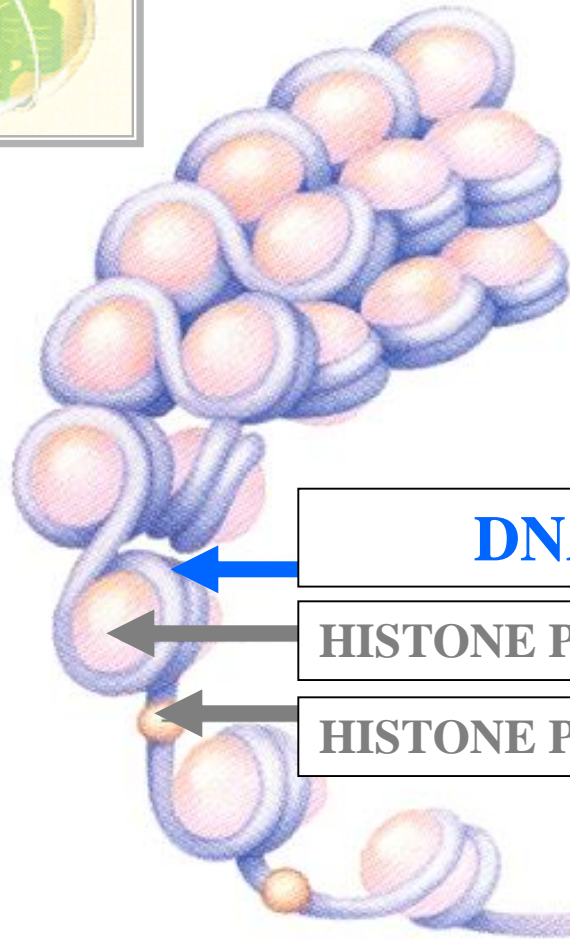


P



CHLOROPLAST DNA: HISTONE PROTEINS ABSENT

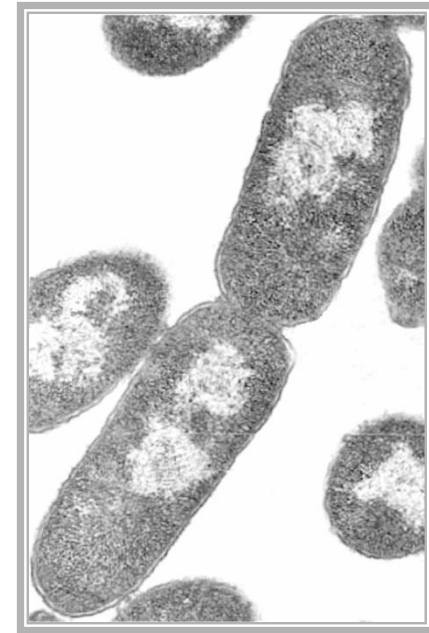
CHLOROPLAST DNA



DNA

HISTONE PROTEIN

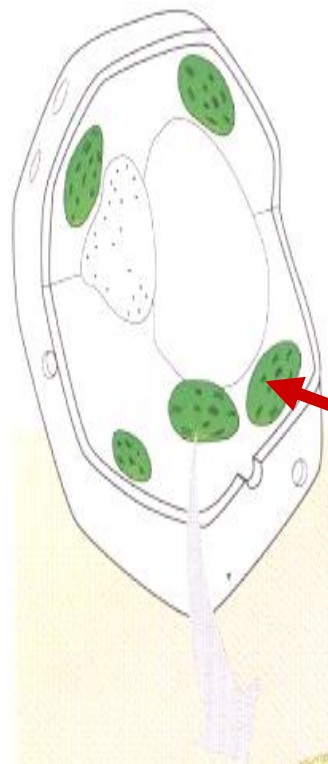
HISTONE PROTEIN



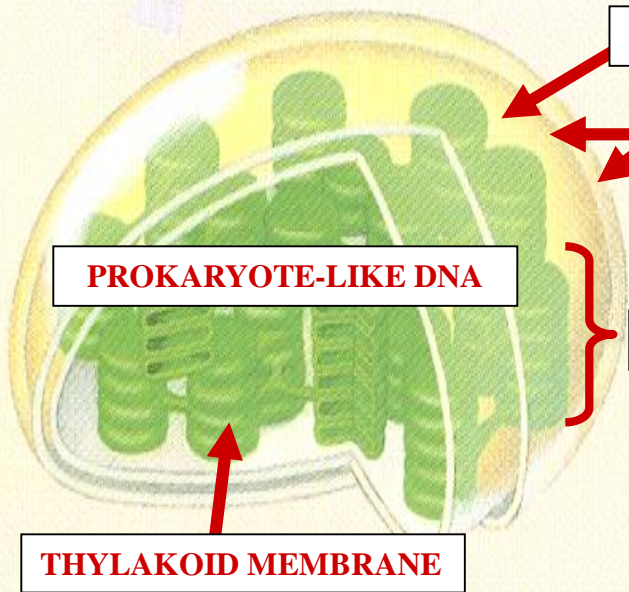
PROKARYOTE-LIKE

CHLOROPLAST DNA: HISTONE PROTEINS **ABSENT**

CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST



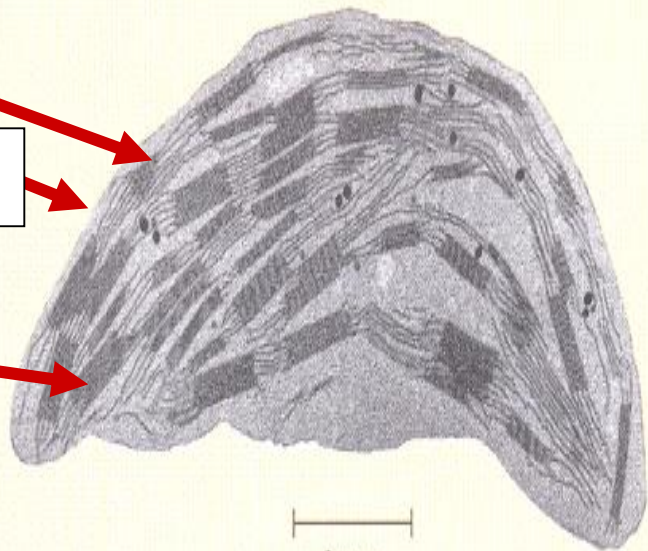
STROMA

OUTER & INNER
MEMBRANE

PROKARYOTE-LIKE DNA

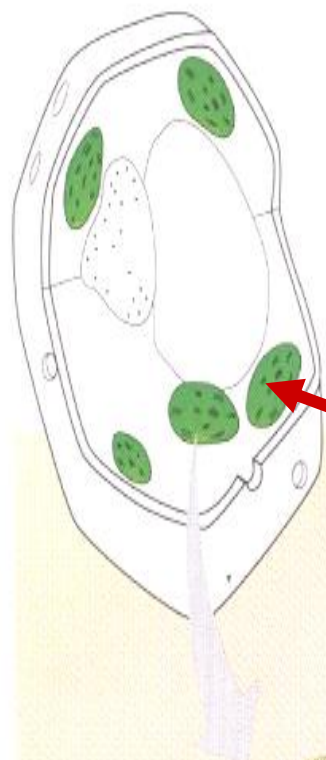
GRANUM

THYLAKOID MEMBRANE

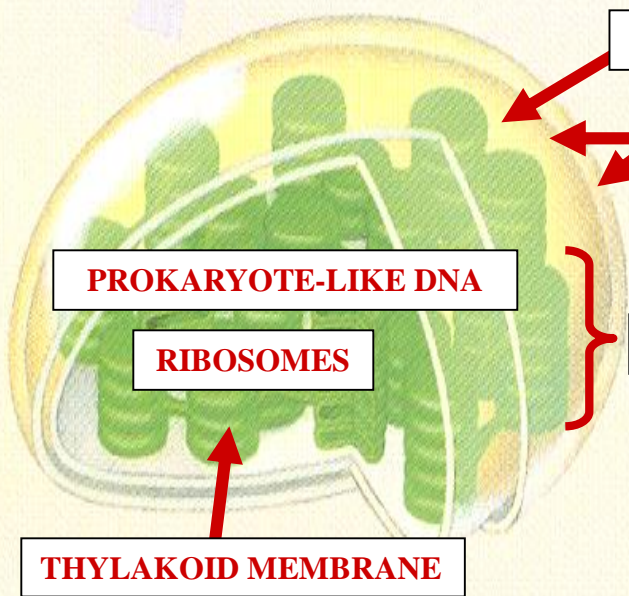


1 μm

CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST



STROMA

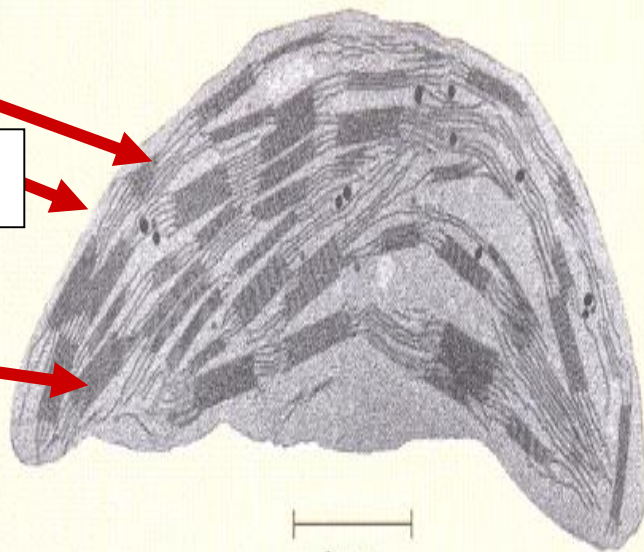
OUTER & INNER
MEMBRANE

PROKARYOTE-LIKE DNA

RIBOSOMES

GRANUM

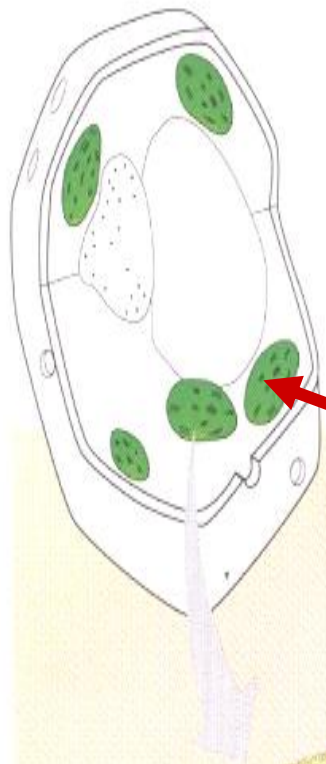
THYLAKOID MEMBRANE



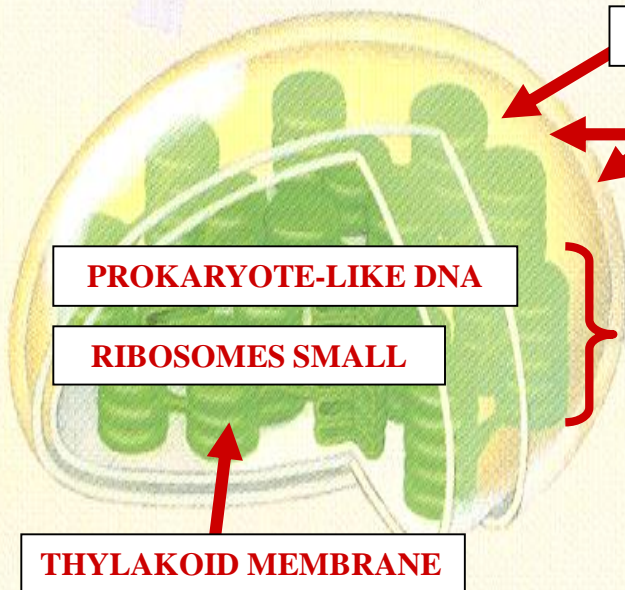
1 μ m



CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST



STROMA

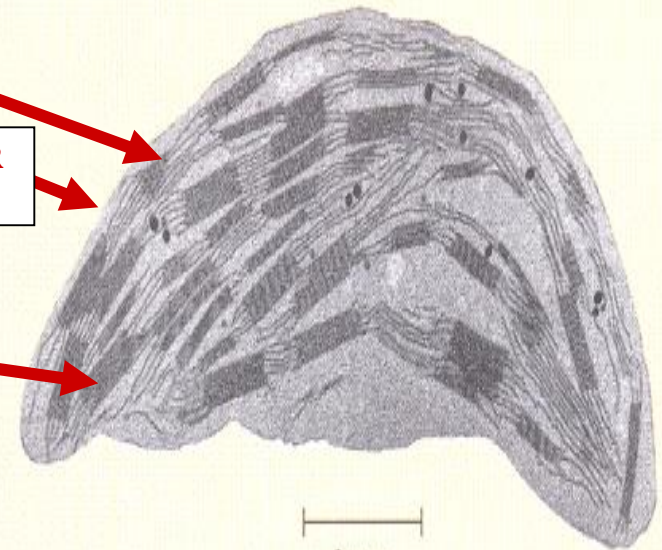
OUTER & INNER
MEMBRANE

PROKARYOTE-LIKE DNA

RIBOSOMES SMALL

GRANUM

THYLAKOID MEMBRANE



1 μ m

CHLOROPLAST RIBOSOME SMALL



3 RNAs & 54 PROTEINS

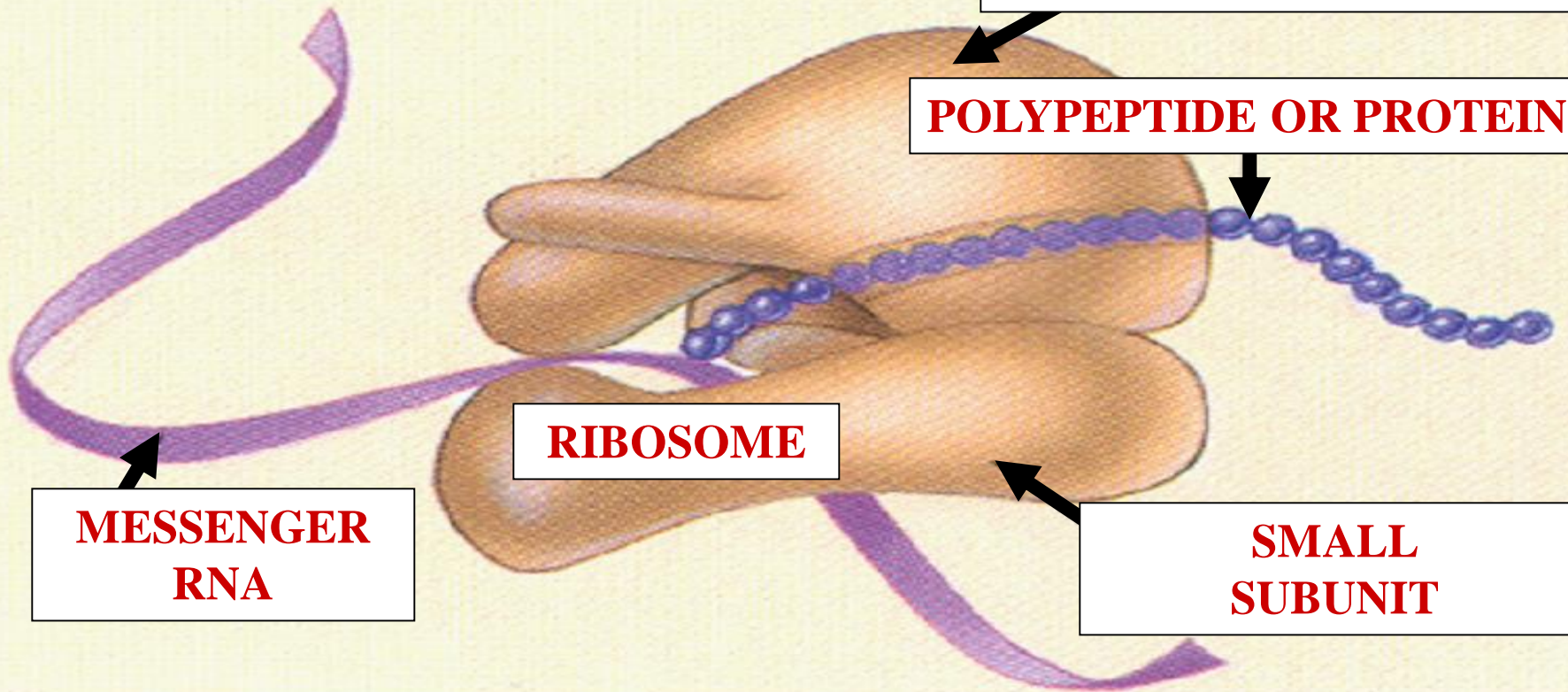
**LARGE
SUBUNIT**

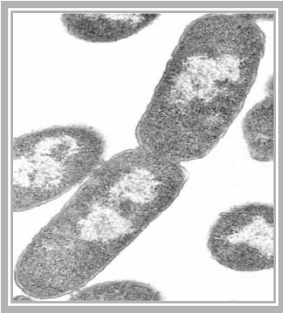
POLYPEPTIDE OR PROTEIN

RIBOSOME

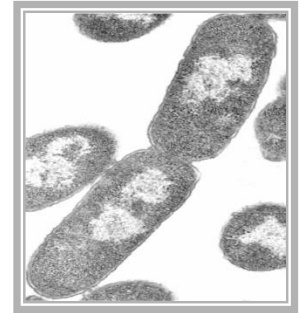
**MESSENGER
RNA**

**SMALL
SUBUNIT**





CHLOROPLAST RIBOSOME SMALL



\$

+

PROKARYOTE-LIKE

PROKARYOTE-LIKE

3 RNAs & 54 PROTEINS

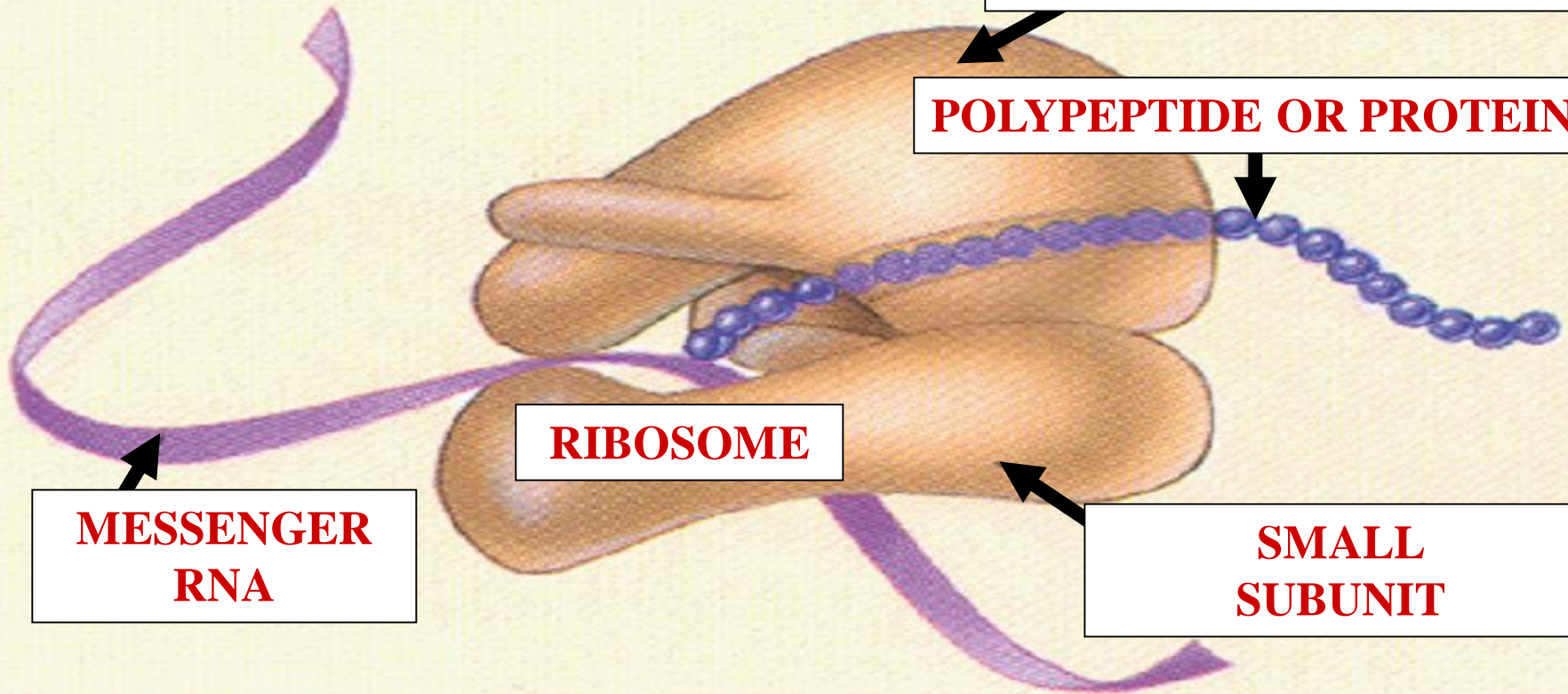
**LARGE
SUBUNIT**

POLYPEPTIDE OR PROTEIN

RIBOSOME

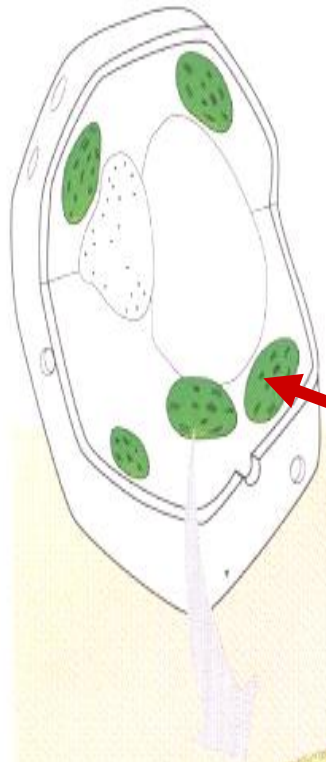
**MESSENGER
RNA**

**SMALL
SUBUNIT**

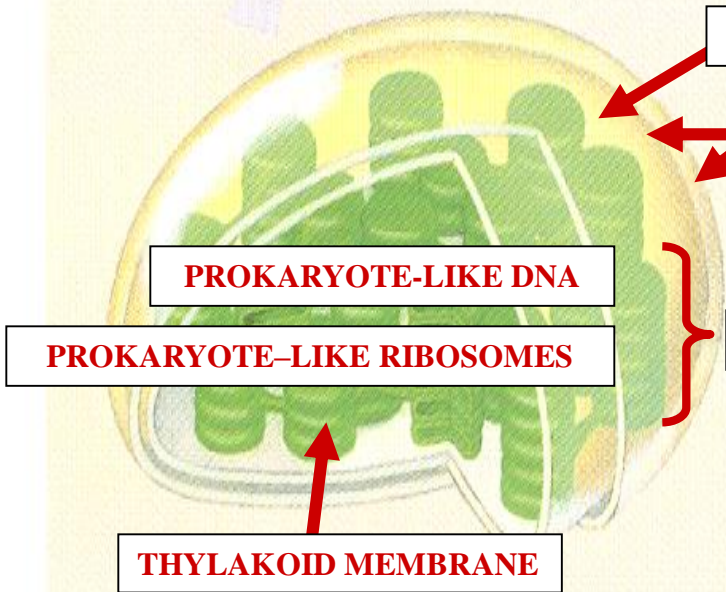




CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST



STROMA

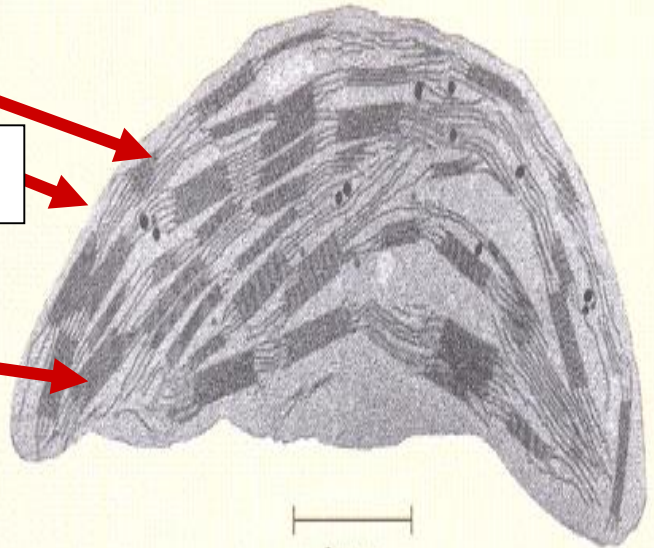
OUTER & INNER
MEMBRANE

PROKARYOTE-LIKE DNA

PROKARYOTE-LIKE RIBOSOMES

THYLAKOID MEMBRANE

GRANUM



1 μ m



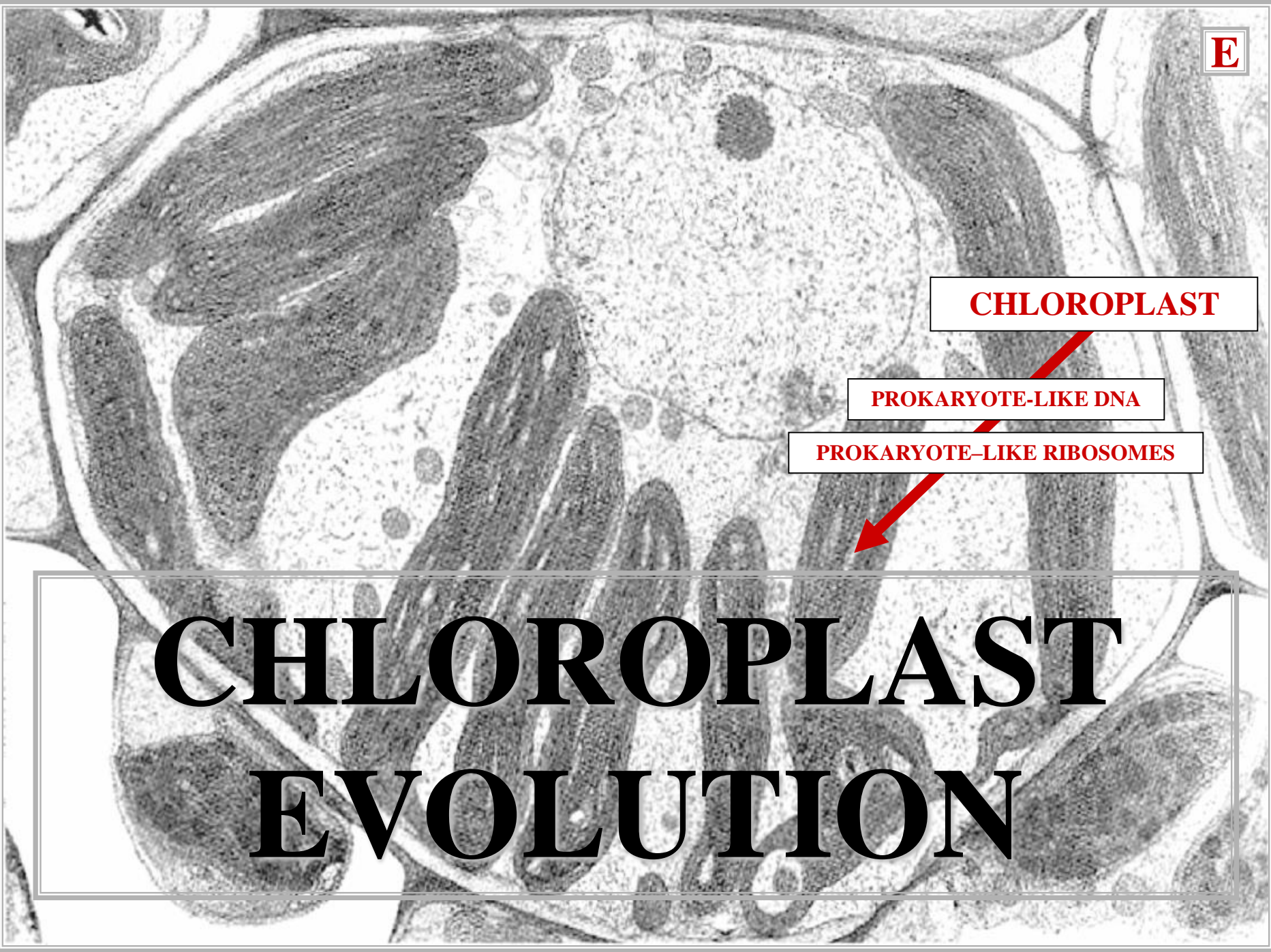
CHLOROPLAST EVOLUTION

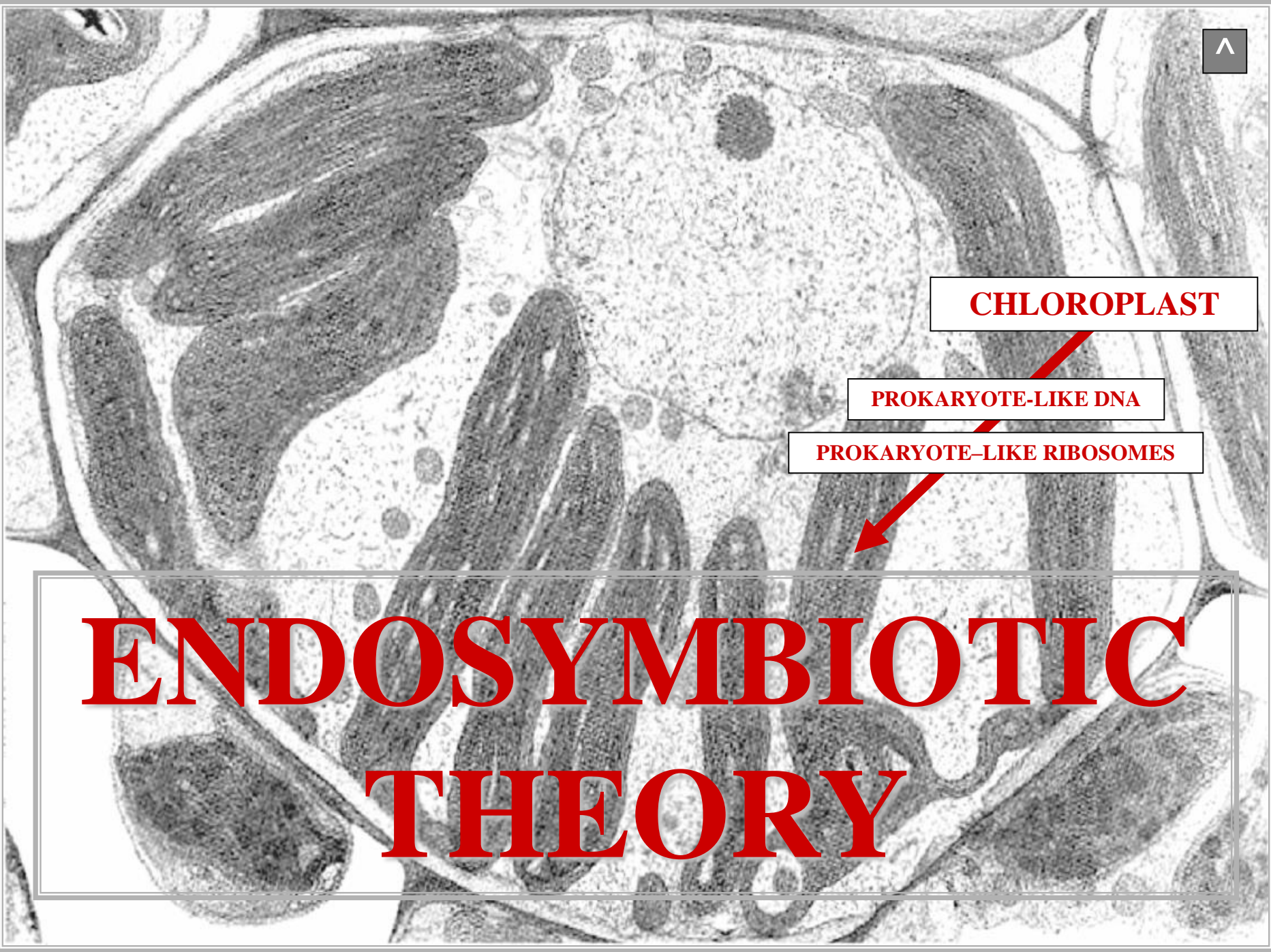
CHLOROPLAST

PROKARYOTE-LIKE DNA

PROKARYOTE-LIKE RIBOSOMES

CHLOROPLAST EVOLUTION





CHLOROPLAST

PROKARYOTE-LIKE DNA

PROKARYOTE-LIKE RIBOSOMES

ENDOSYMBIOTIC THEORY

MITOCHONDRION

MITOCHONDRION



MITOCHONDRION

**KNOWN ALL
EUKARYOTE CELLS**

MITOCHONDRION



MITOCHONDRION

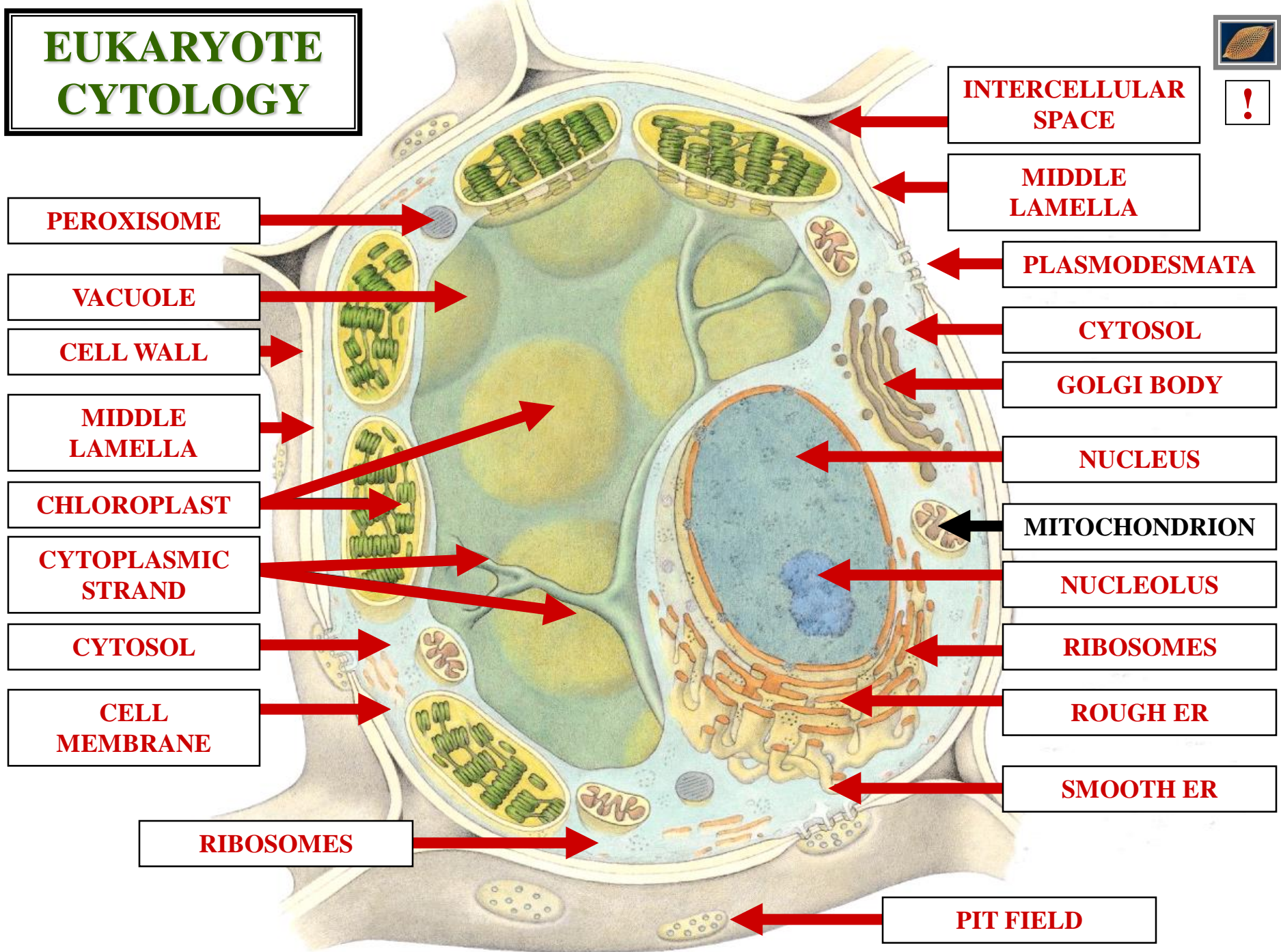
**KNOWN ALL
EUKARYOTE CELLS**

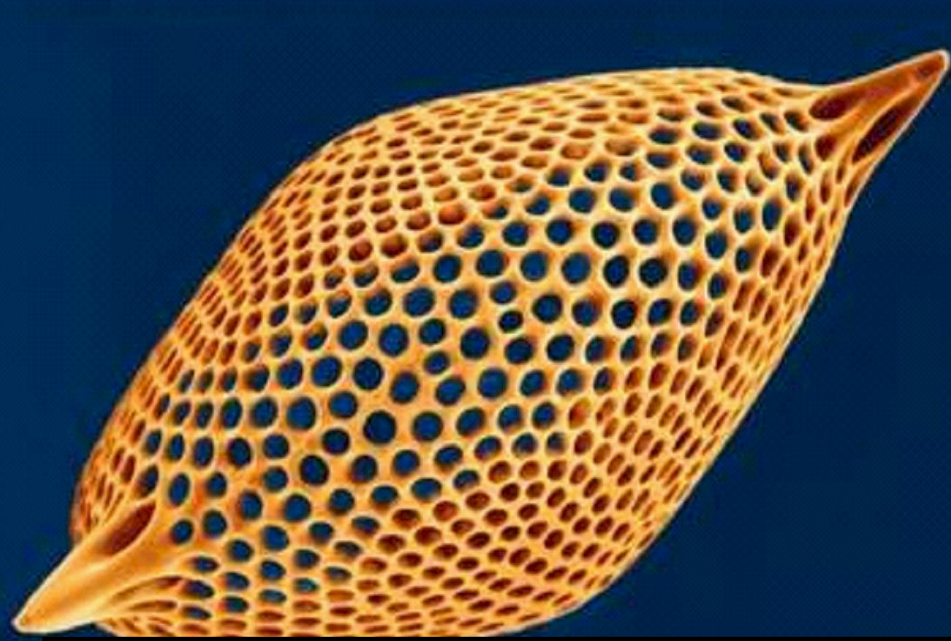
SITE

AEROBIC RESPIRATION

MITOCHONDRION

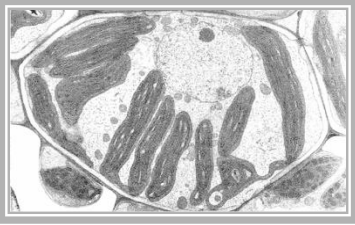
EUKARYOTE CYTOLOGY



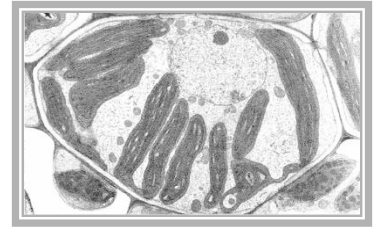


KNOWN ALL EUKARYOTES





AEROBIC RESPIRATION



GLYCOLYSIS



KREBS CYCLE

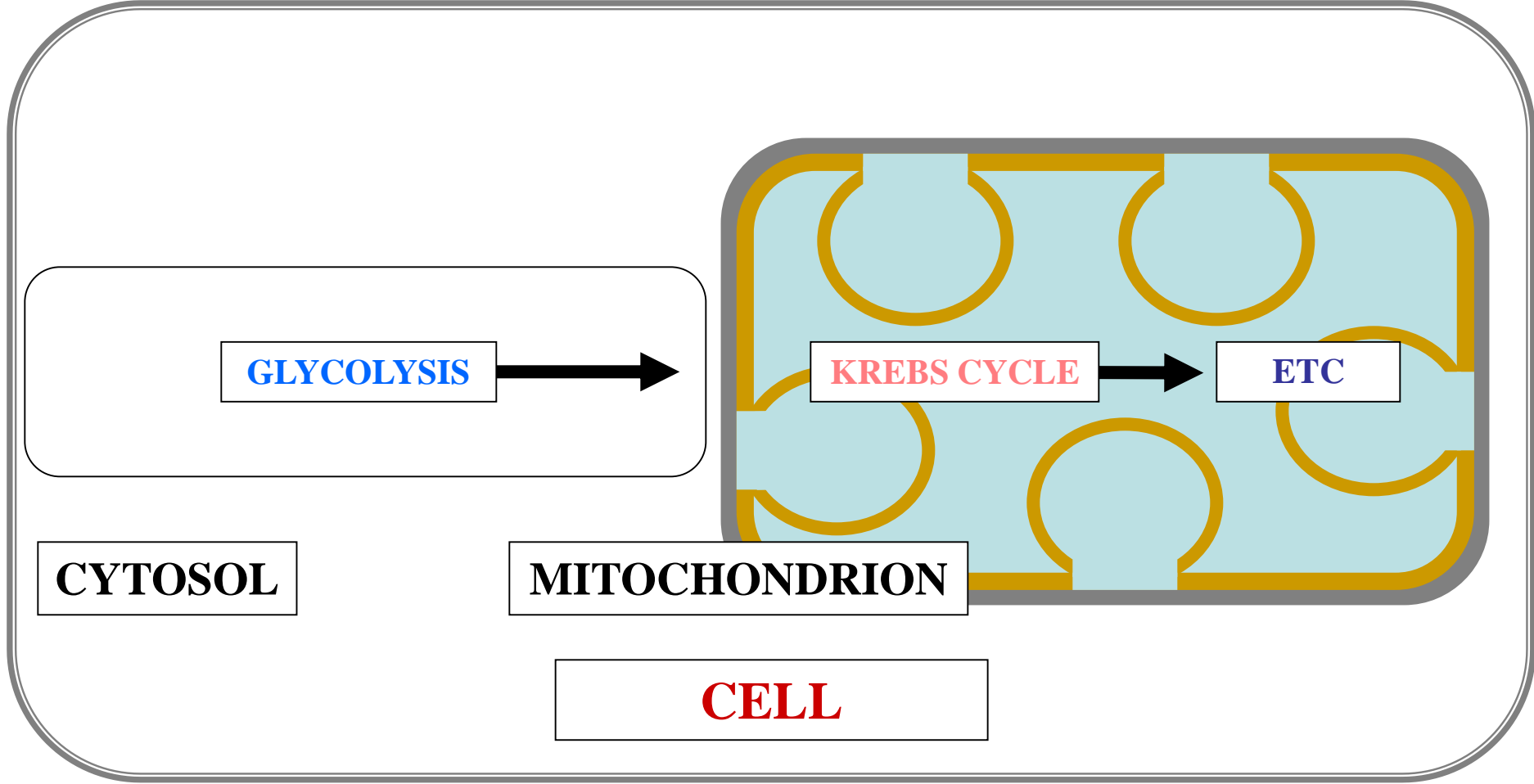


ETC

CYTOSOL

MITOCHONDRION

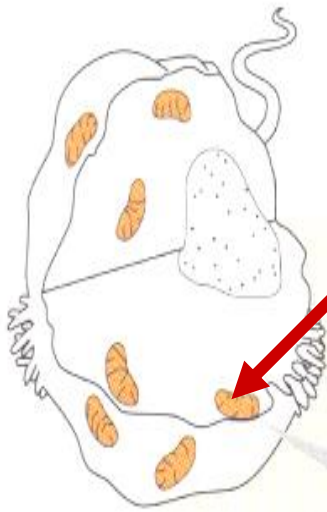
CELL



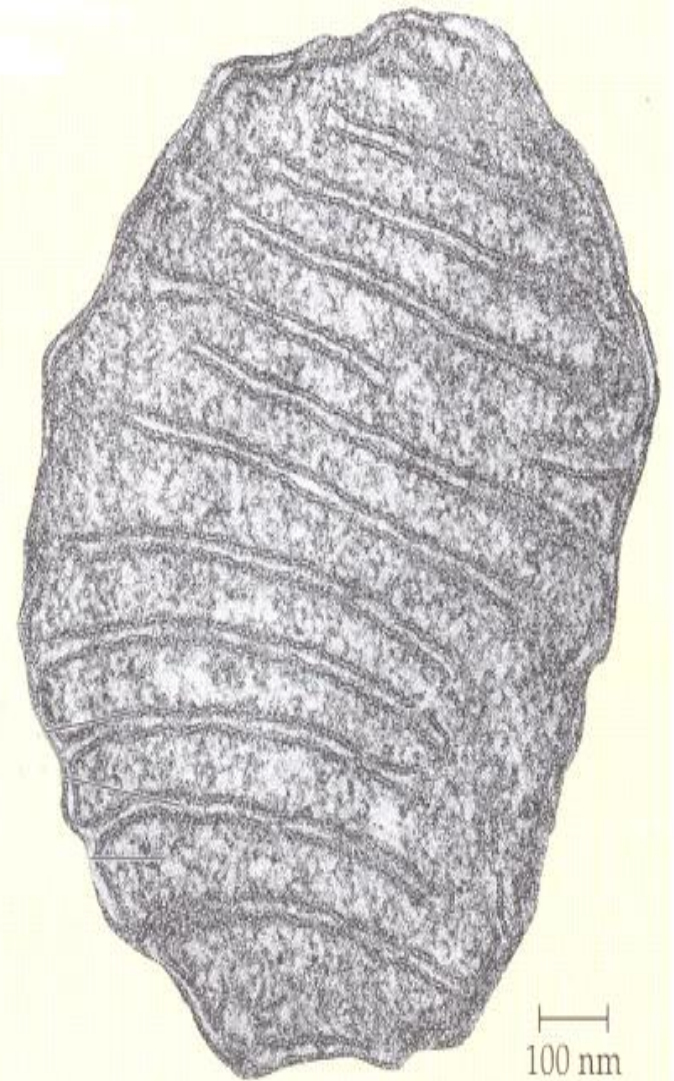
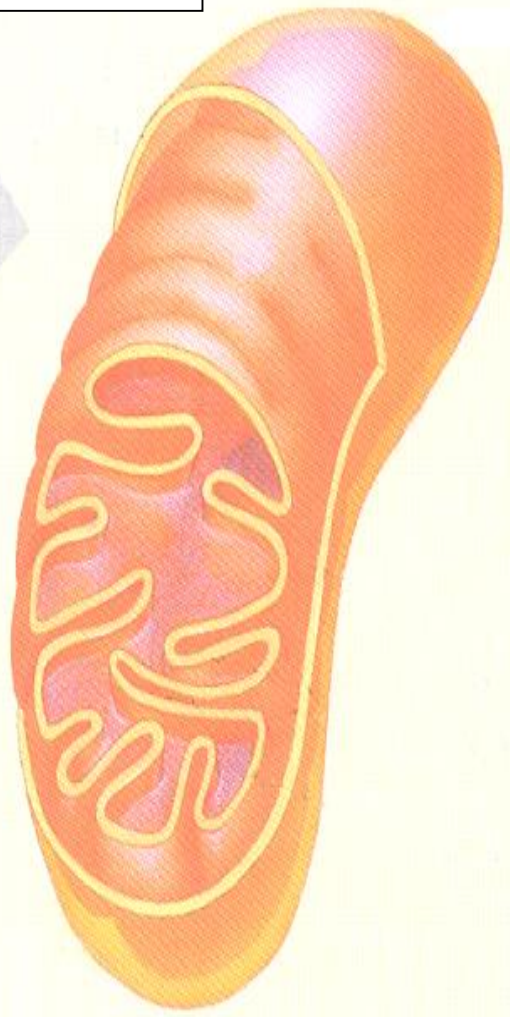


MITOCHONDRION ULTRASTRUCTURE

MITOCHONDRION ULTRASTRUCTURE

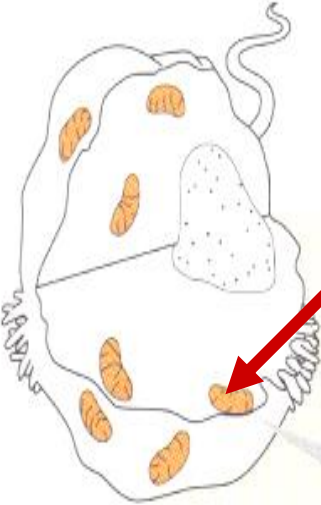


MITOCHONDRION



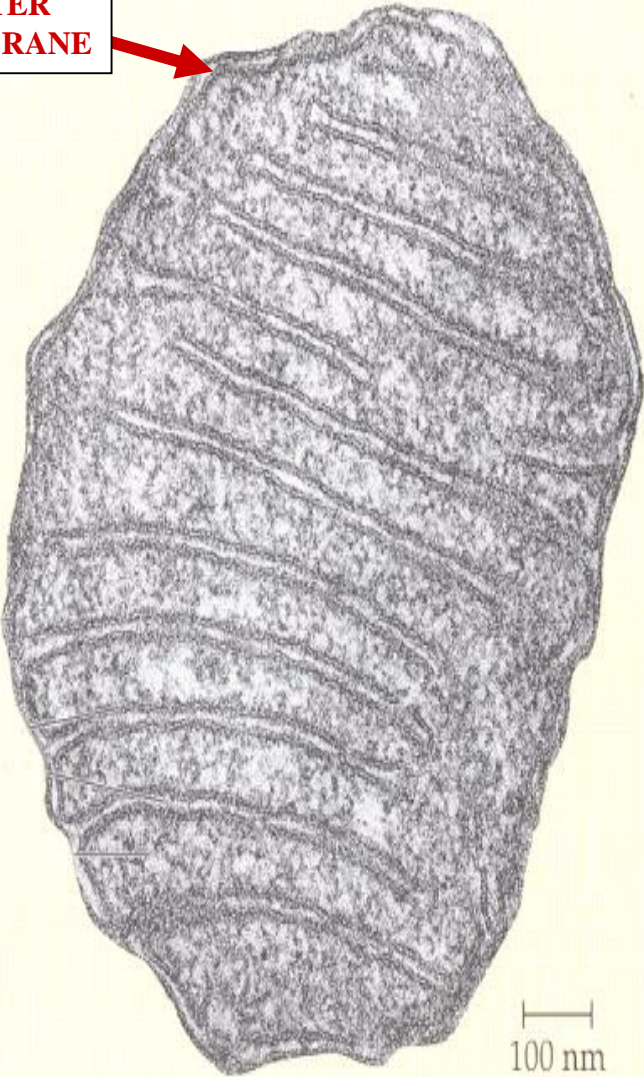
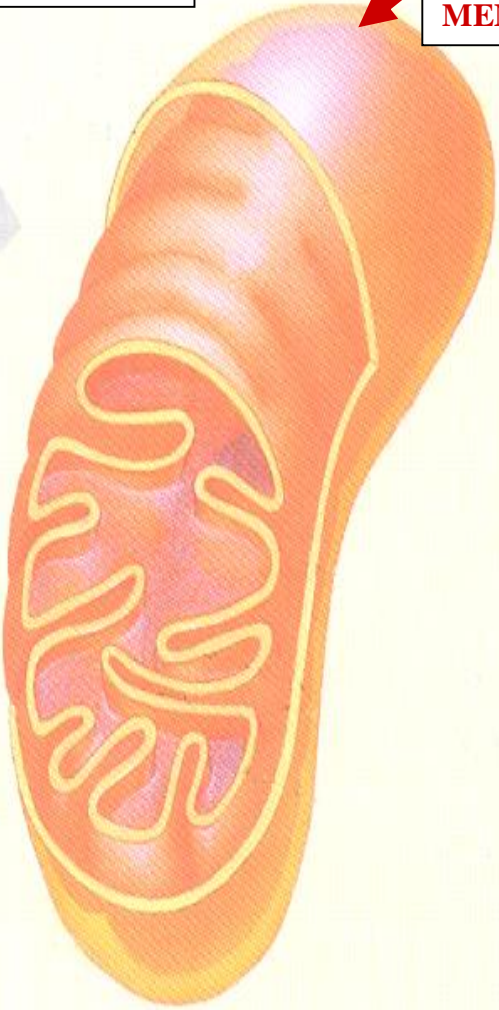
100 nm

MITOCHONDRION ULTRASTRUCTURE



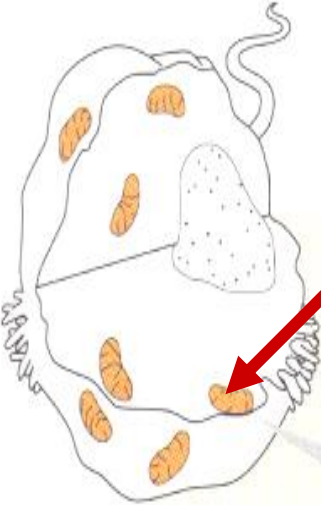
MITOCHONDRION

OUTER
MEMBRANE



100 nm

MITOCHONDRION ULTRASTRUCTURE

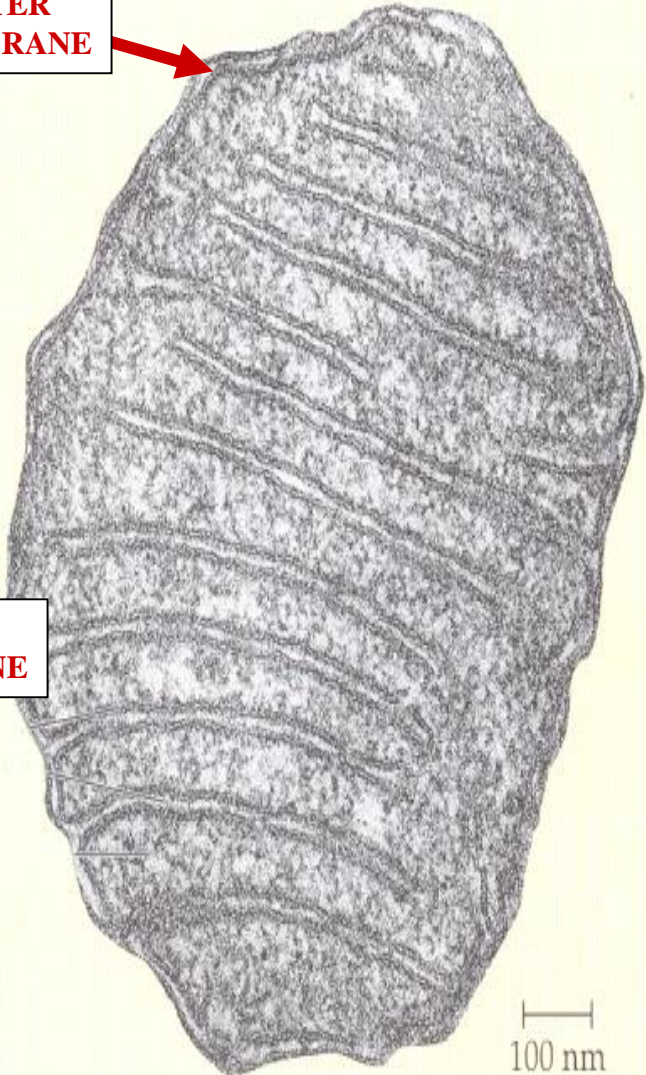
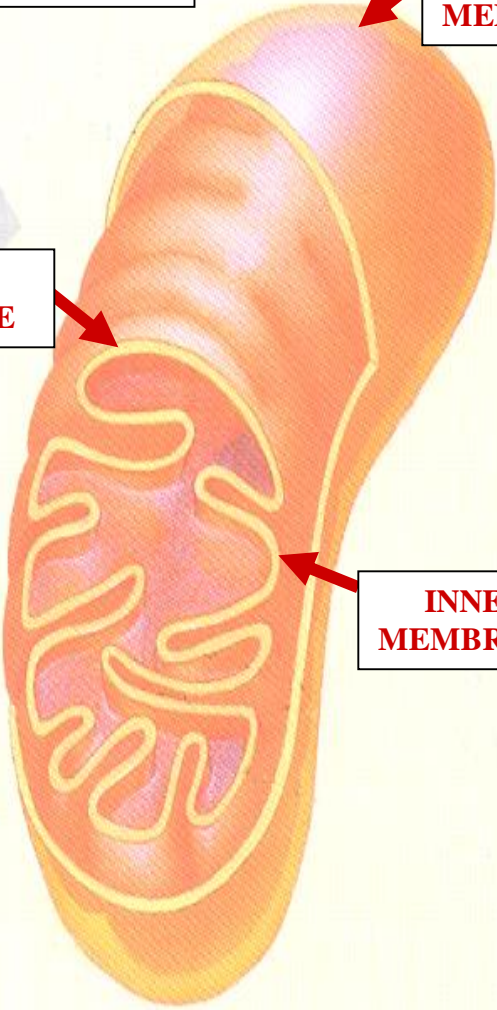


MITOCHONDRION

OUTER
MEMBRANE

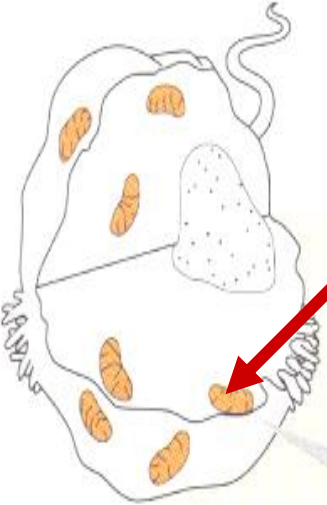
INNER
MEMBRANE

INNER
MEMBRANE



100 nm

MITOCHONDRION ULTRASTRUCTURE



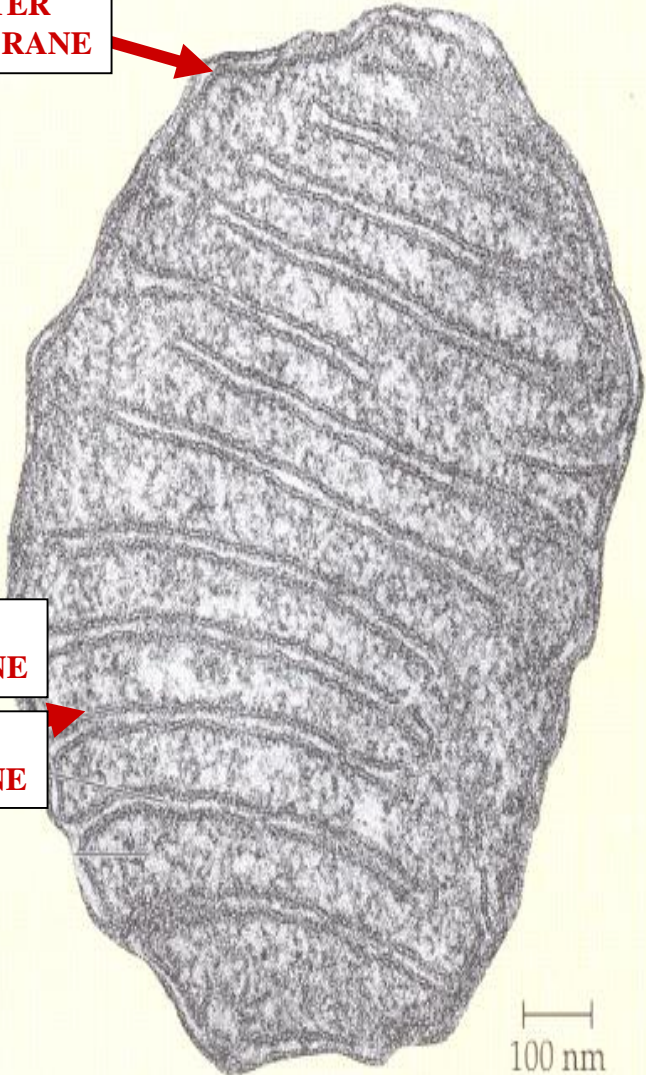
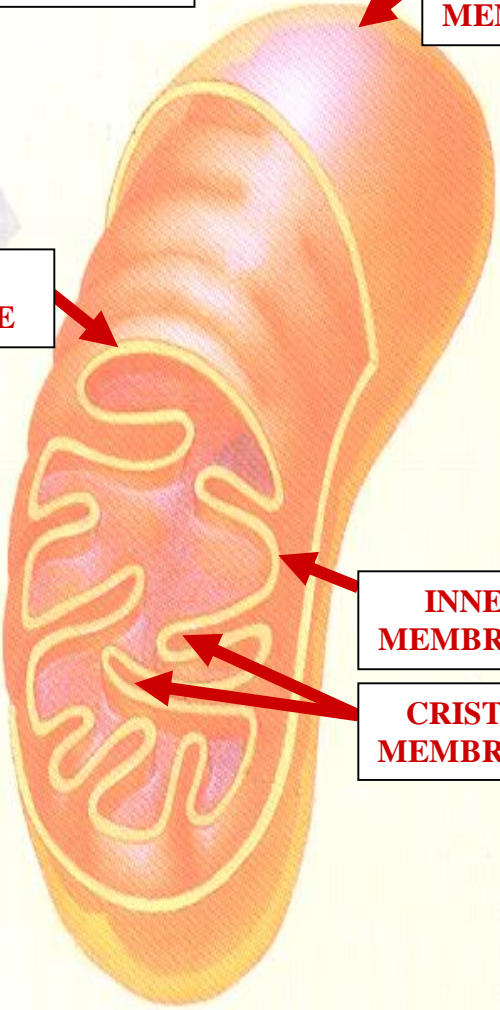
MITOCHONDRION

**OUTER
MEMBRANE**

**INNER
MEMBRANE**

**INNER
MEMBRANE**

**CRISTAE
MEMBRANE**



100 nm

INNER

MEMBRANE

SYNONYMOUS

CRISTAE

MEMBRANE