

PHOTOSYNTHESIS

P+



WATER

LIGHT ENERGY

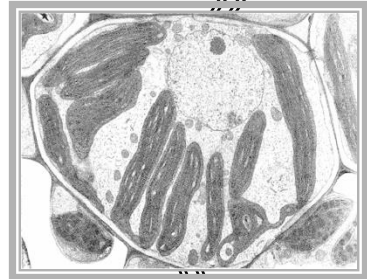
E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

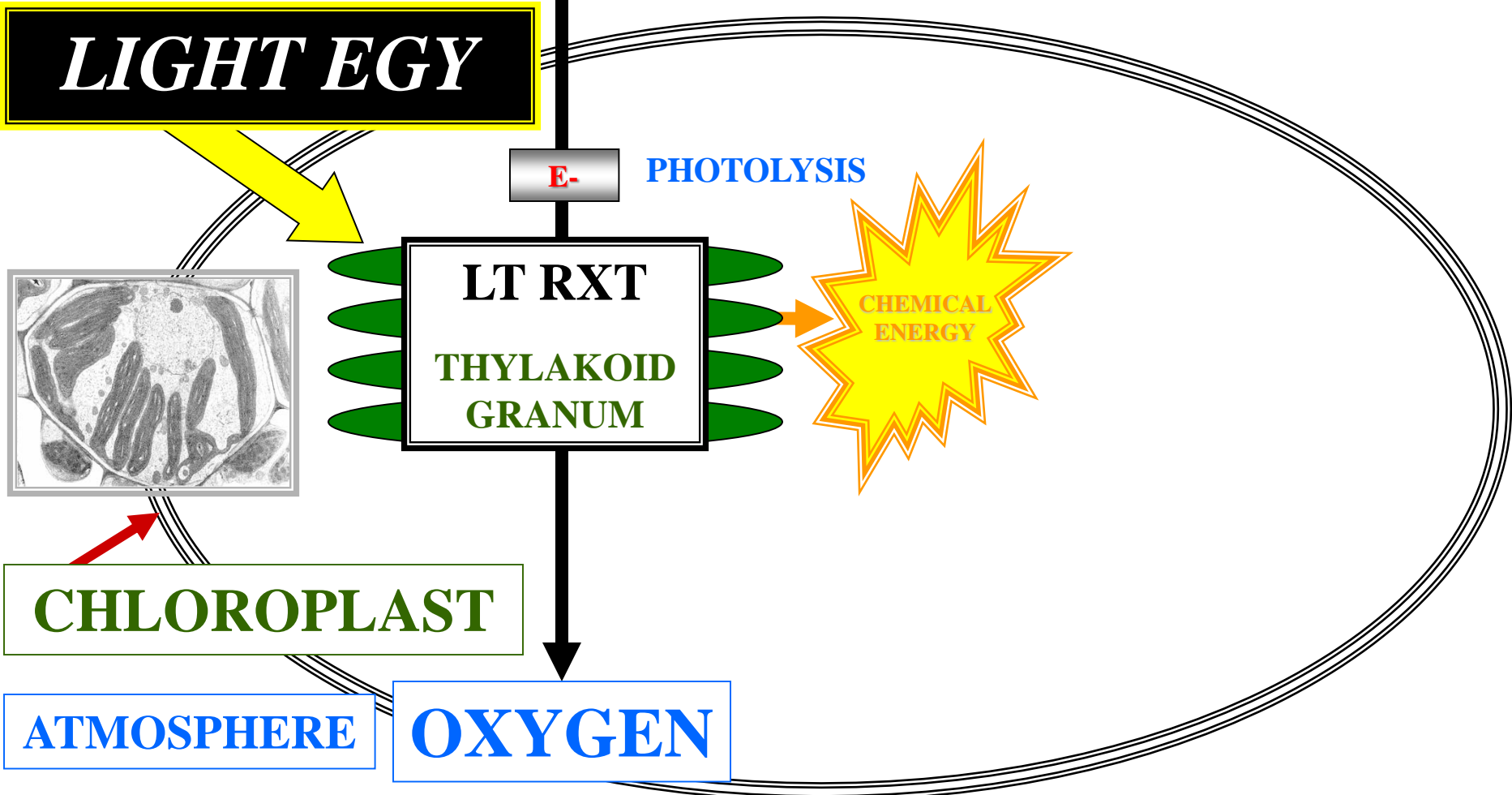
CHEMICAL
ENERGY



CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS

CI



WATER

LIGHT ENERGY

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

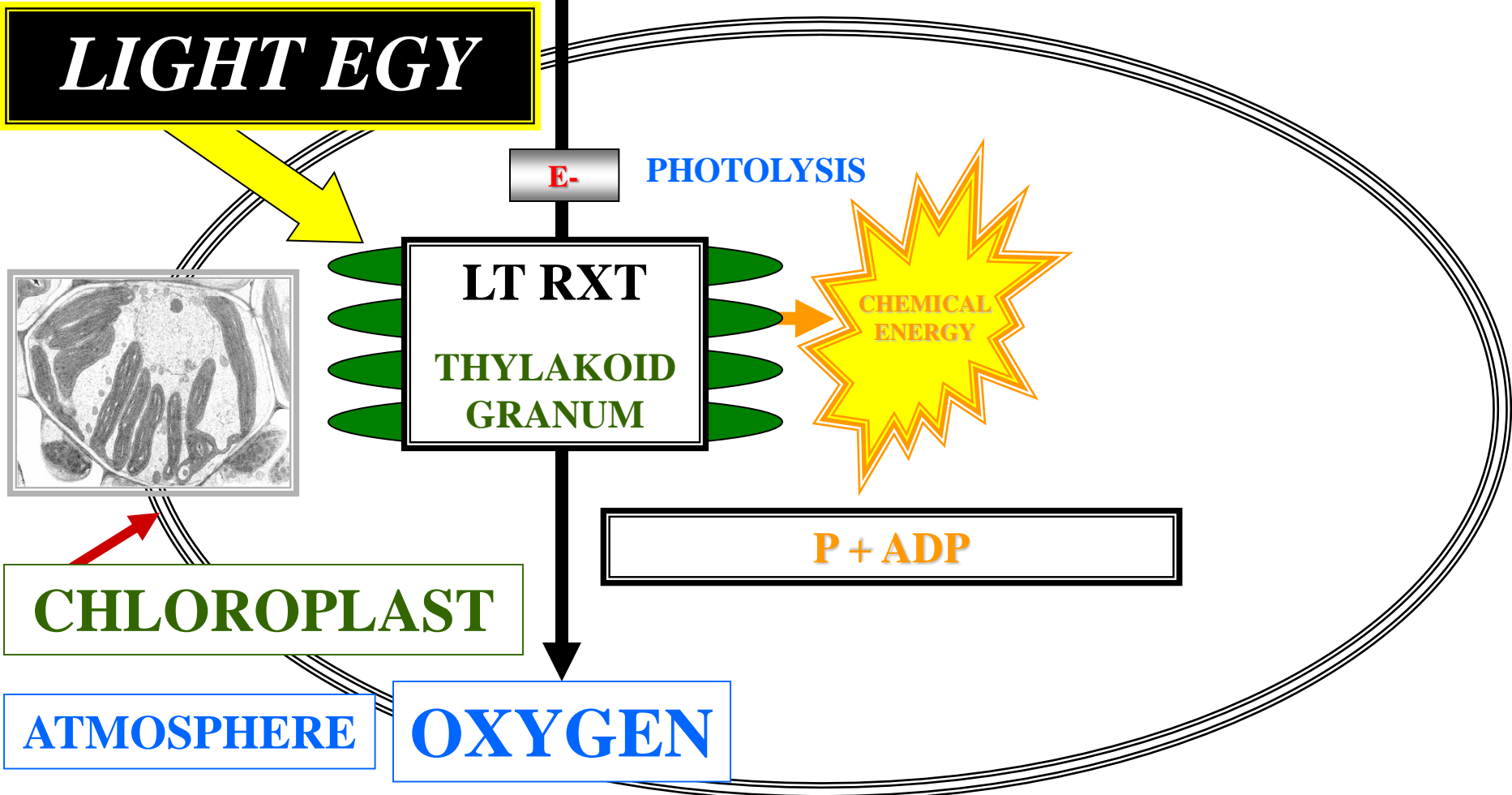
CHEMICAL
ENERGY

P + ADP

CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS

AT



WATER

LIGHT ENERGY

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

CHEMICAL
ENERGY

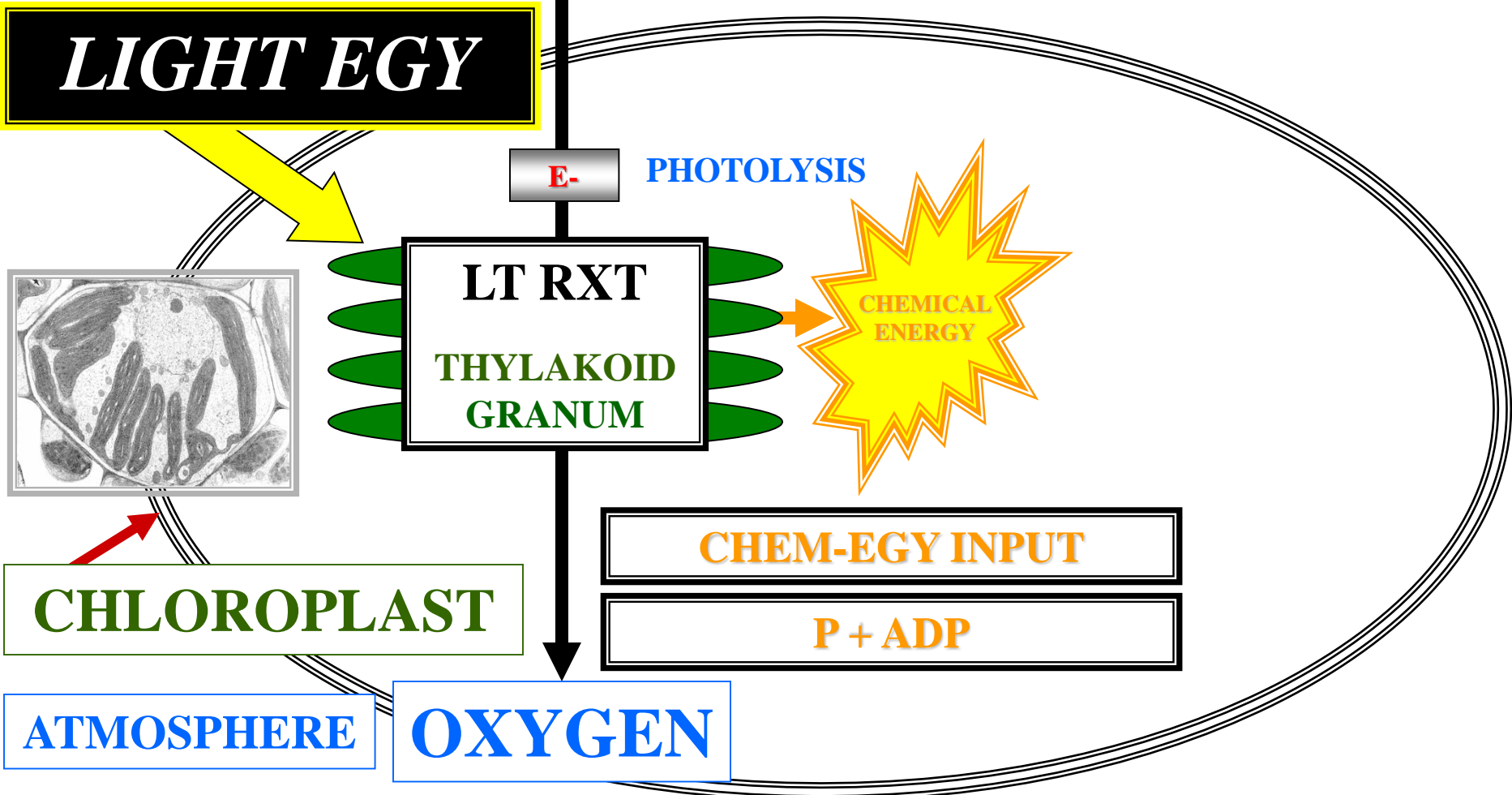
CHEM-ENERGY INPUT

P + ADP

CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS

P



WATER

LIGHT ENERGY

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

ATP

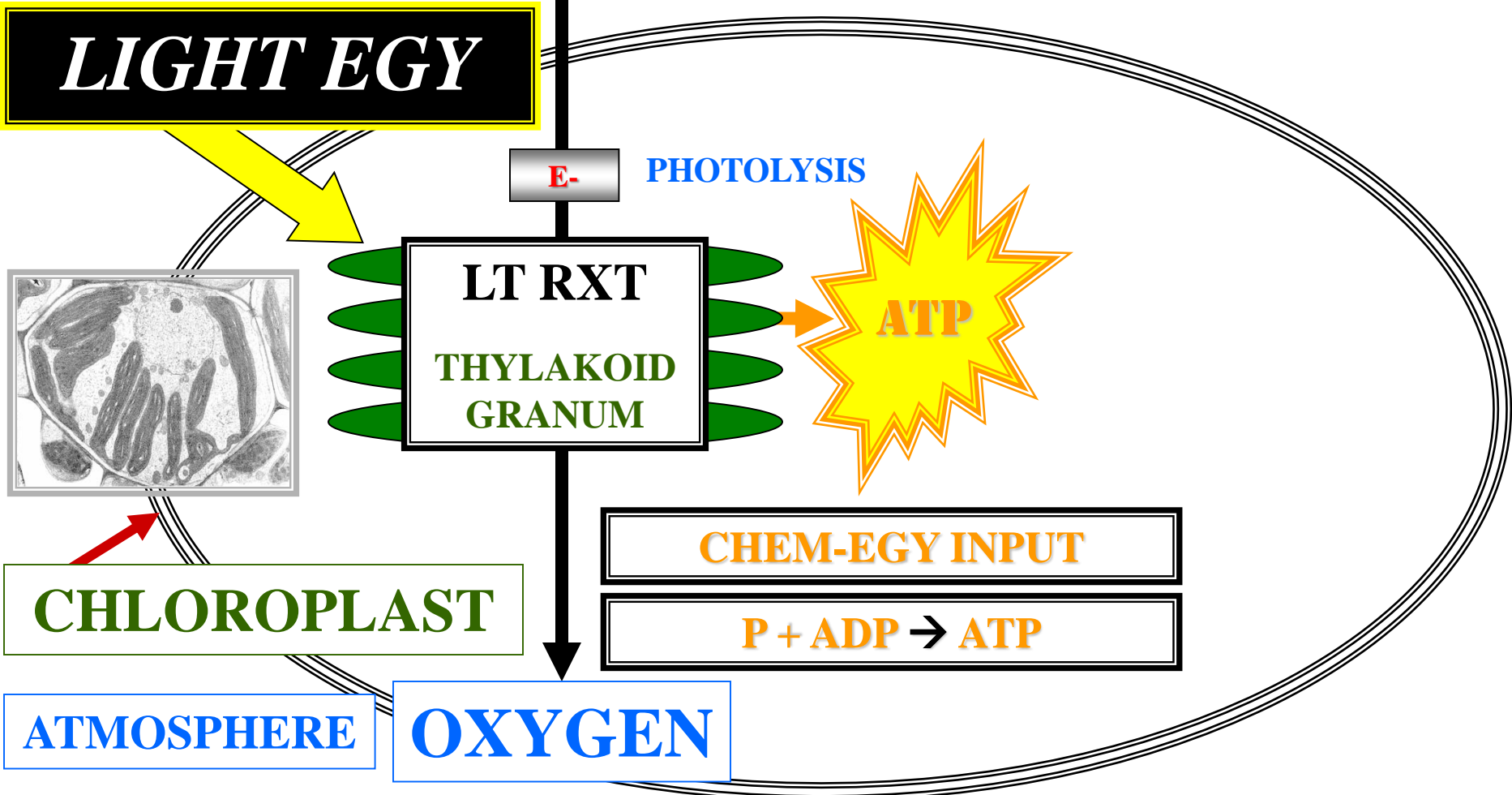
CHEM-ENERGY INPUT

$P + ADP \rightarrow ATP$

CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS

DR



WATER

LIGHT ENERGY

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

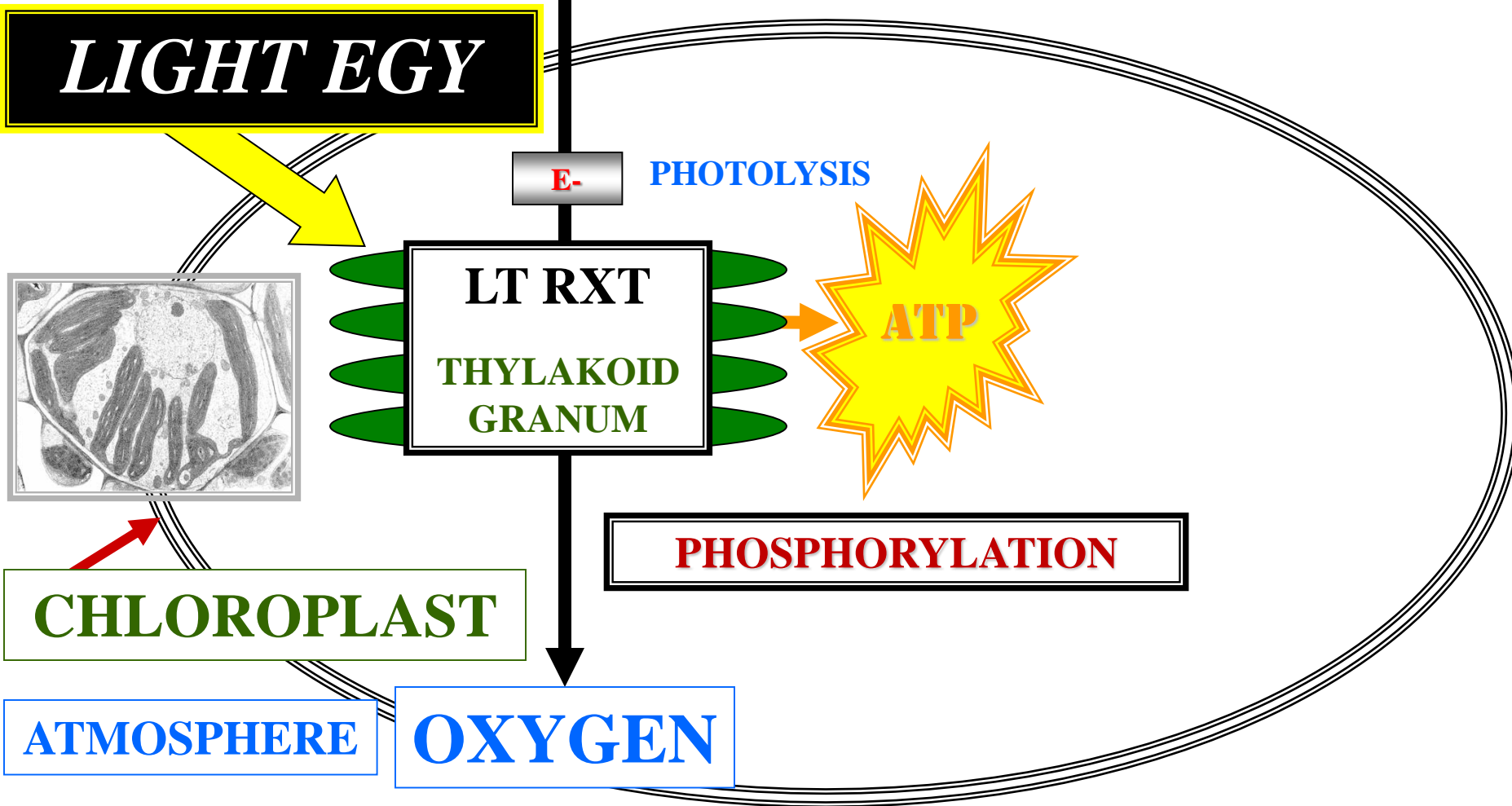
ATP

PHOSPHORYLATION

CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS

C



WATER

LIGHT ENERGY

E-

PHOTOLYSIS

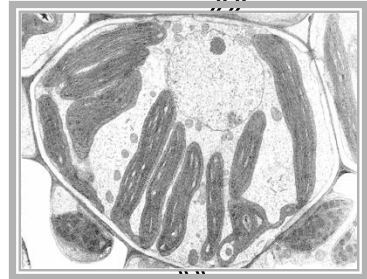
LT RXT

THYLAKOID
GRANUM

DK RXT

STROMA
ENZYMES

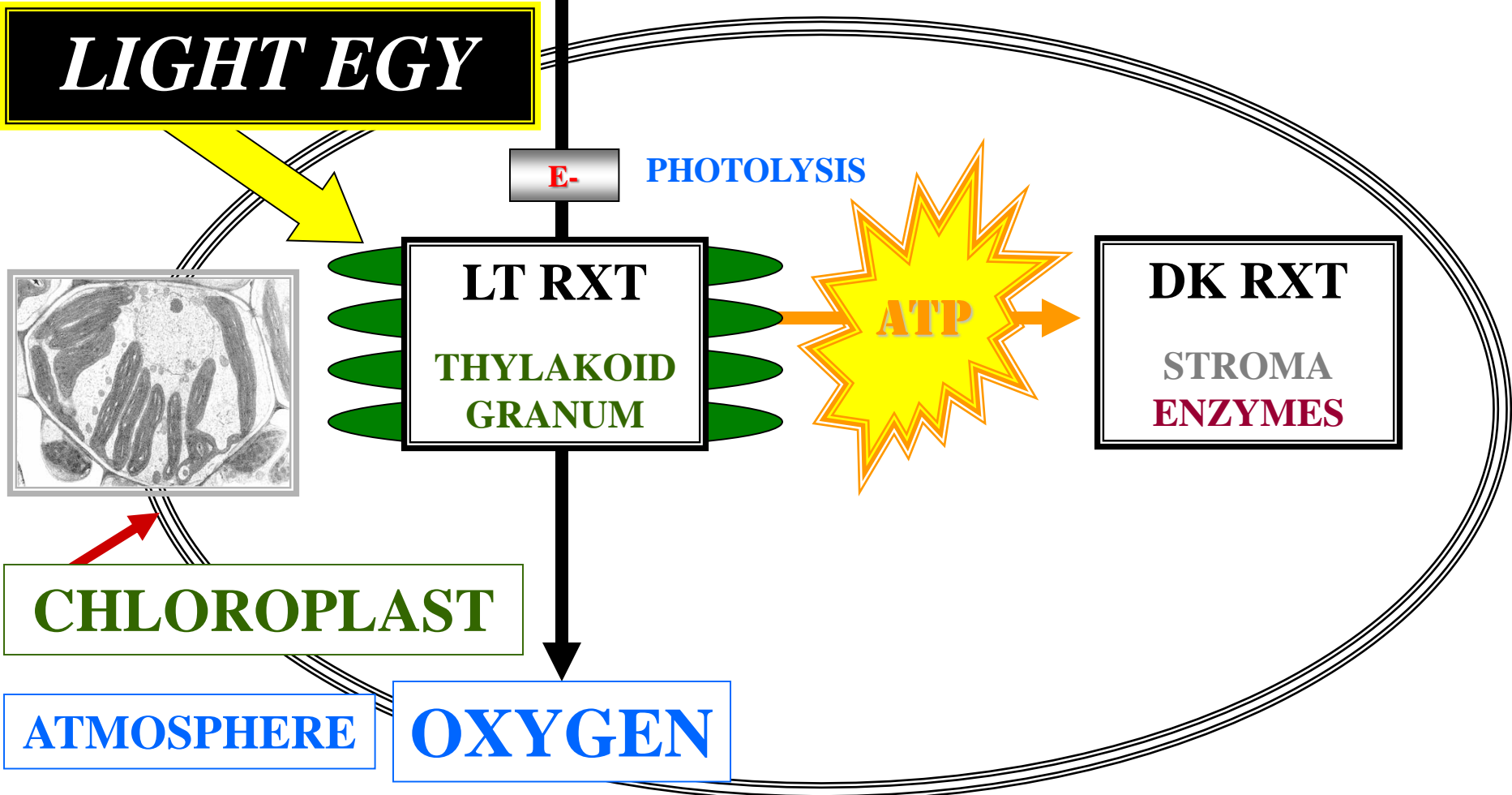
ATP



CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS

G



WATER

CO₂

LIGHT ENERGY

ATMOSPHERE

E-

PHOTOLYSIS

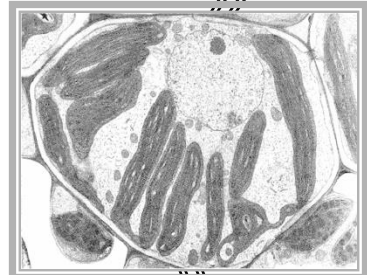
LT RXT

THYLAKOID
GRANUM

CHEMICAL
ENERGY

DK RXT

STROMA
ENZYMES

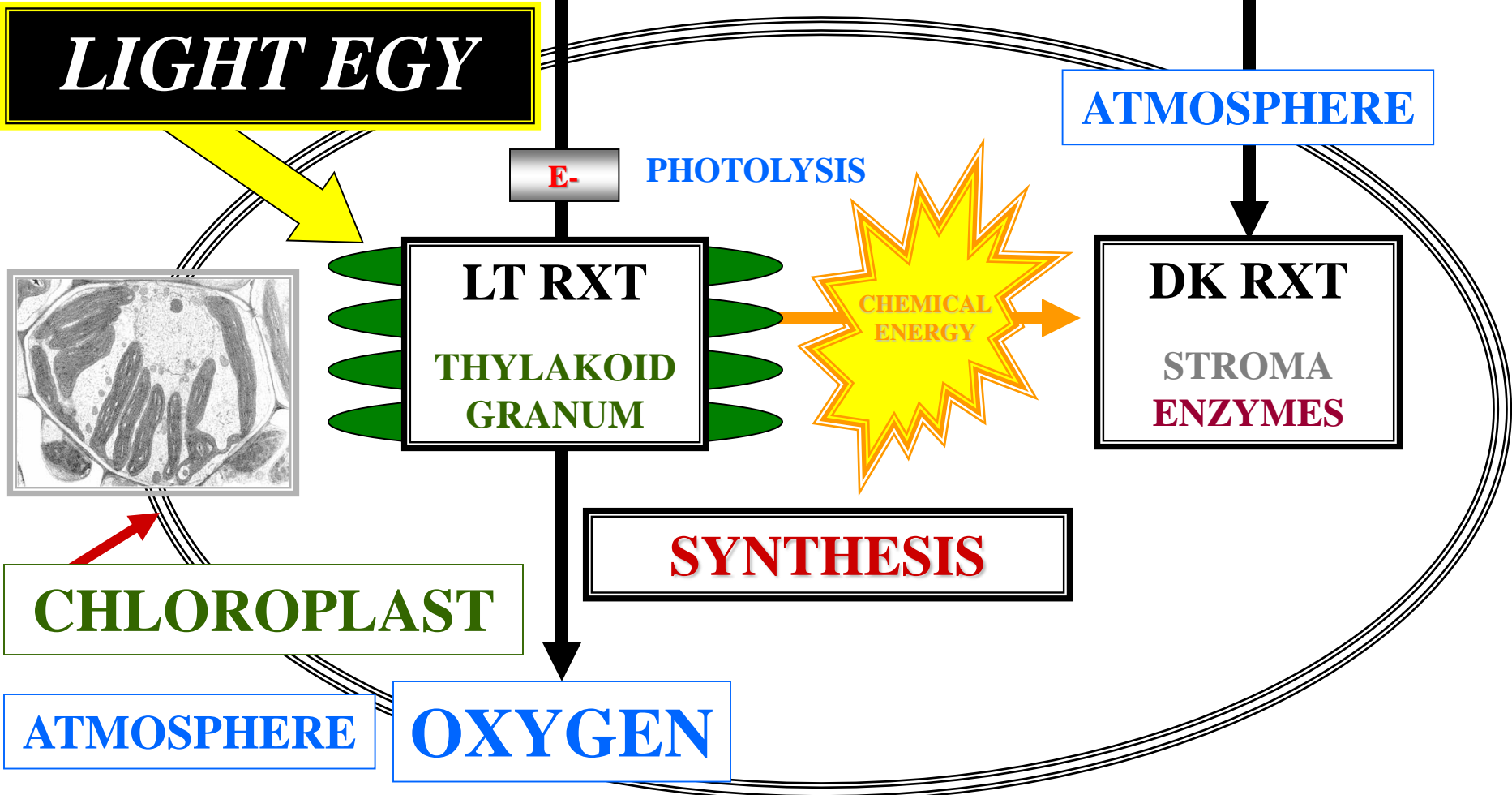


CHLOROPLAST

SYNTHESIS

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS



G



WATER

CO₂

LIGHT ENERGY

ATMOSPHERE

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

CHEMICAL
ENERGY

DK RXT

STROMA
ENZYMES

SYNTHESIS

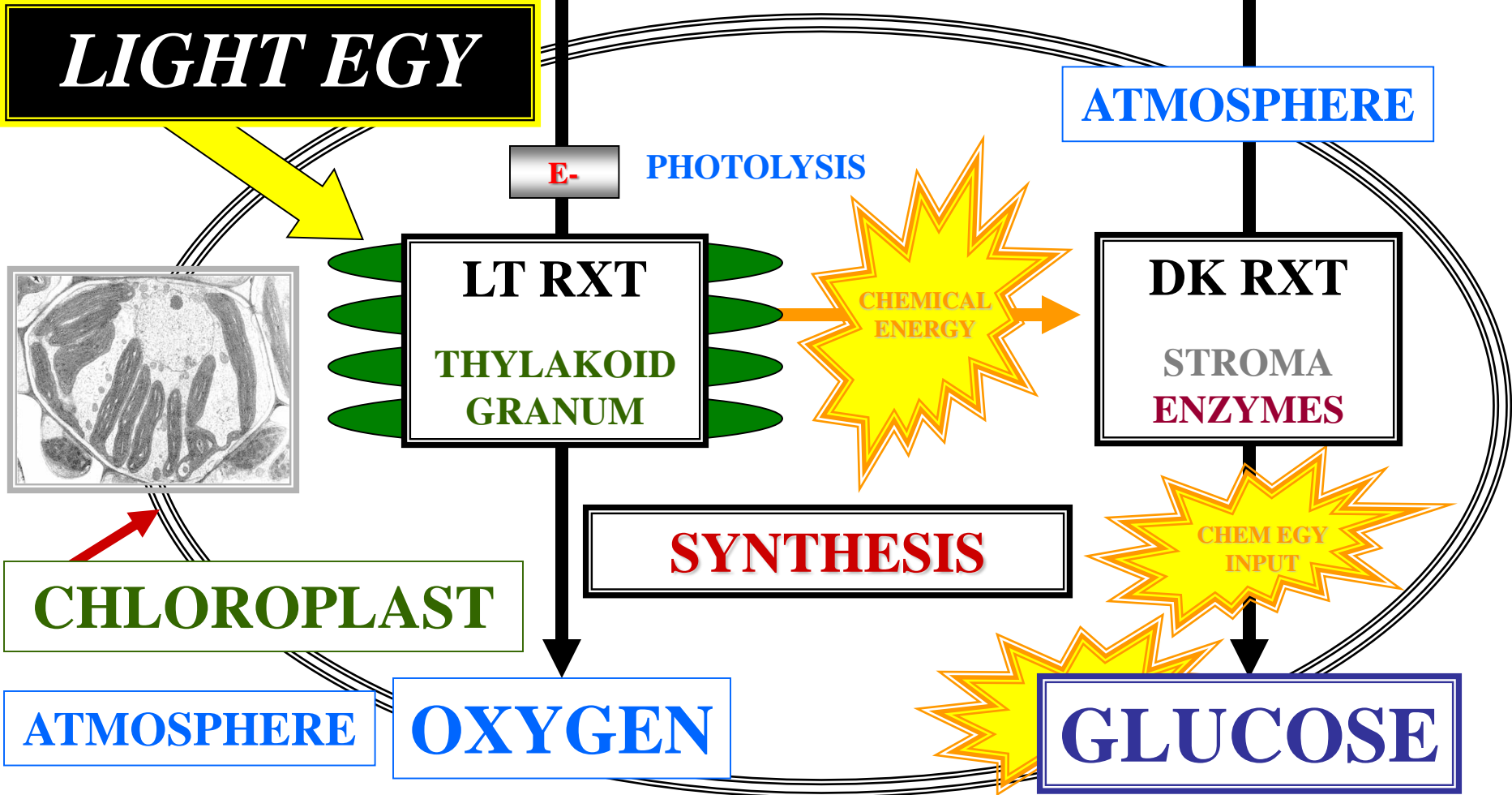
CHEMICAL
ENERGY
INPUT

CHLOROPLAST

ATMOSPHERE

OXYGEN

GLUCOSE

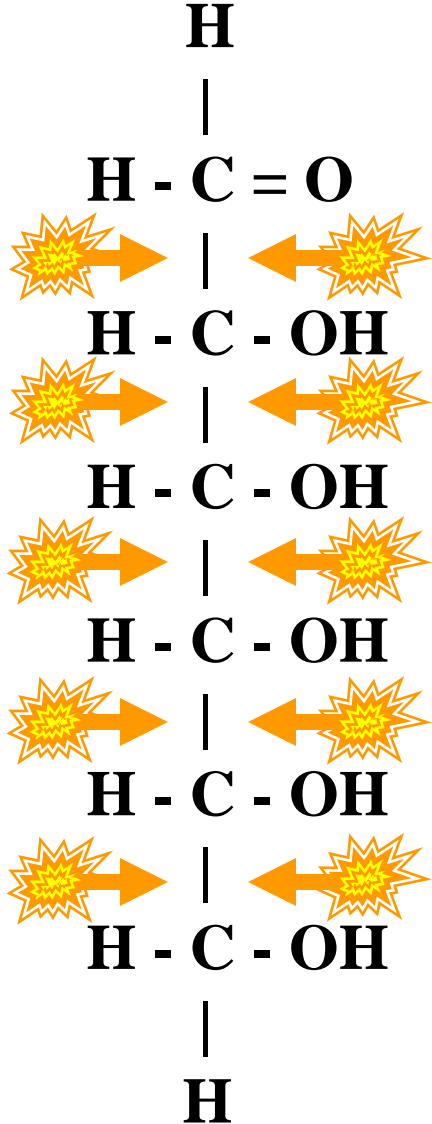


GLUCOSE

ENTERS
METABOLISM



ENTERS
METABOLISM



ENTERS
METABOLISM



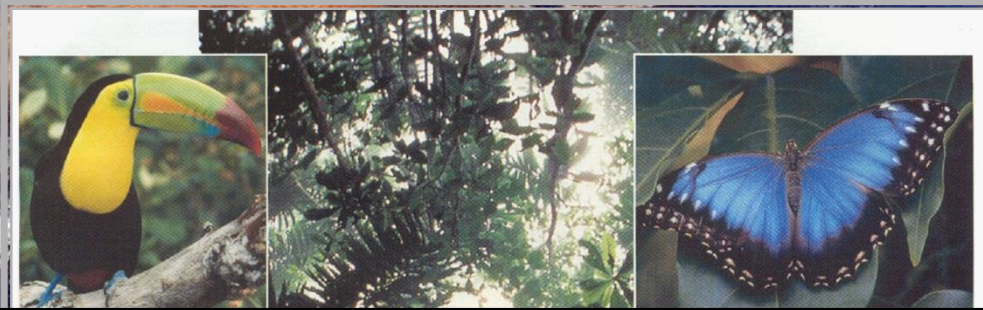
ENTERS
METABOLISM



PHOTOSYNTHESIS



HETEROTROPHS VS AUTOTROPHS



~10 MILLION SPECIES



EARTH



HETEROTROPHS

~10 MILLION SPECIES

AUTOTROPHS

EARTH

HETEROTROPHS



HETEROTROPHS

**INCAPABLE
CARBOHYDRATE
SYNTHESIS**

HETEROTROPHS

A

NORTH AMERICAN GRASSLAND

HETEROTROPHS



AUTOTROPHS



AUTOTROPHS

**CAPABLE
CARBOHYDRATE
SYNTHESIS**

AUTOTROPHS



TROPICAL RAINFOREST

AUTOTROPHS

AUTOTROPH TYPES

AUTOTROPH TYPES

CHEMOSYNTHESIS

AUTOTROPH TYPES

AUTOTROPH TYPES



CHEMOSYNTHESIS
PHOTOSYNTHESIS

AUTOTROPH TYPES

A lush tropical rainforest scene with dense green foliage, including various ferns and plants. A prominent orange flower is visible on the right side. The background is slightly blurred, emphasizing the foreground plants.

**TROPICAL
RAINFOREST**

PHOTOSYNTHESIS

PHOTOSYNTHESIS DEFINED



PHOTOSYNTHESIS



Photosynthesis

**CONVERSION
LIGHT ENERGY
TO
CHEMICAL ENERGY**

Photosynthesis

**LIGHT
ENERGY**

Photosynthesis

**CHEMICAL
ENERGY**

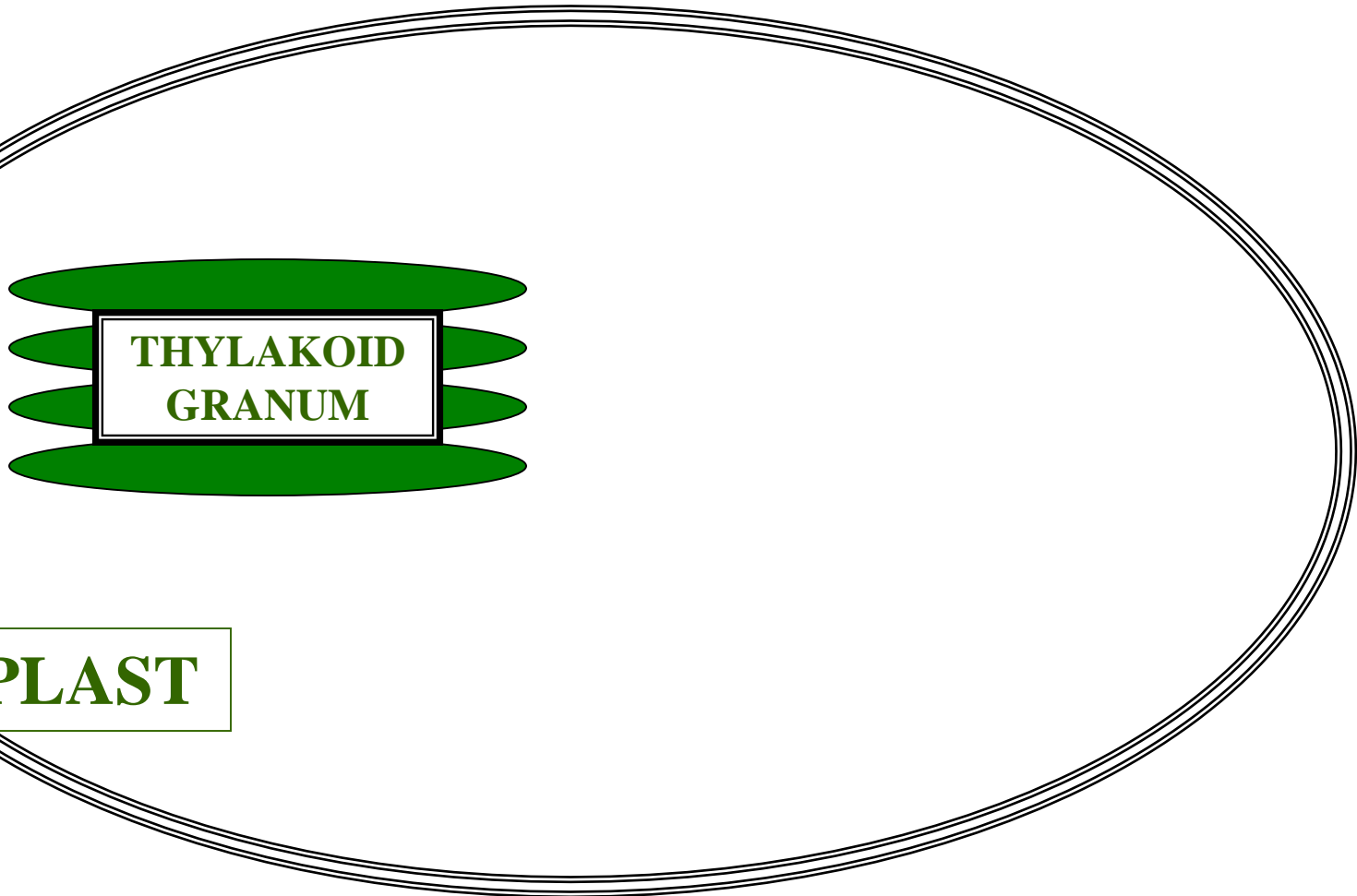
Photosynthesis



GLUCOSE

PHOTOSYNTHESIS

LT



**THYLAKOID
GRANUM**

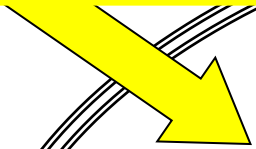
CHLOROPLAST

PHOTOSYNTHESIS

LR



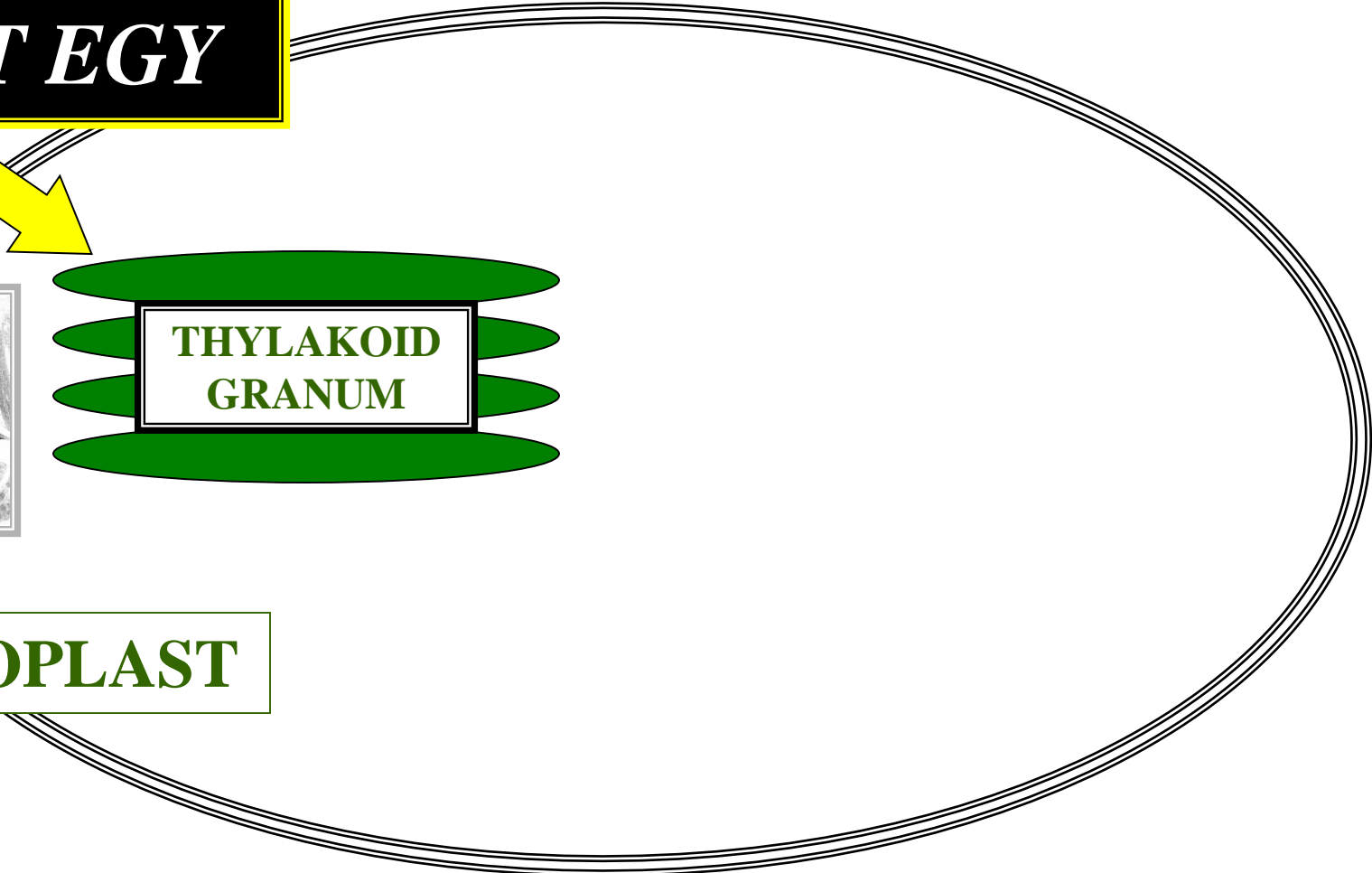
LIGHT ENERGY



**THYLAKOID
GRANUM**



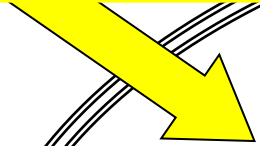
CHLOROPLAST



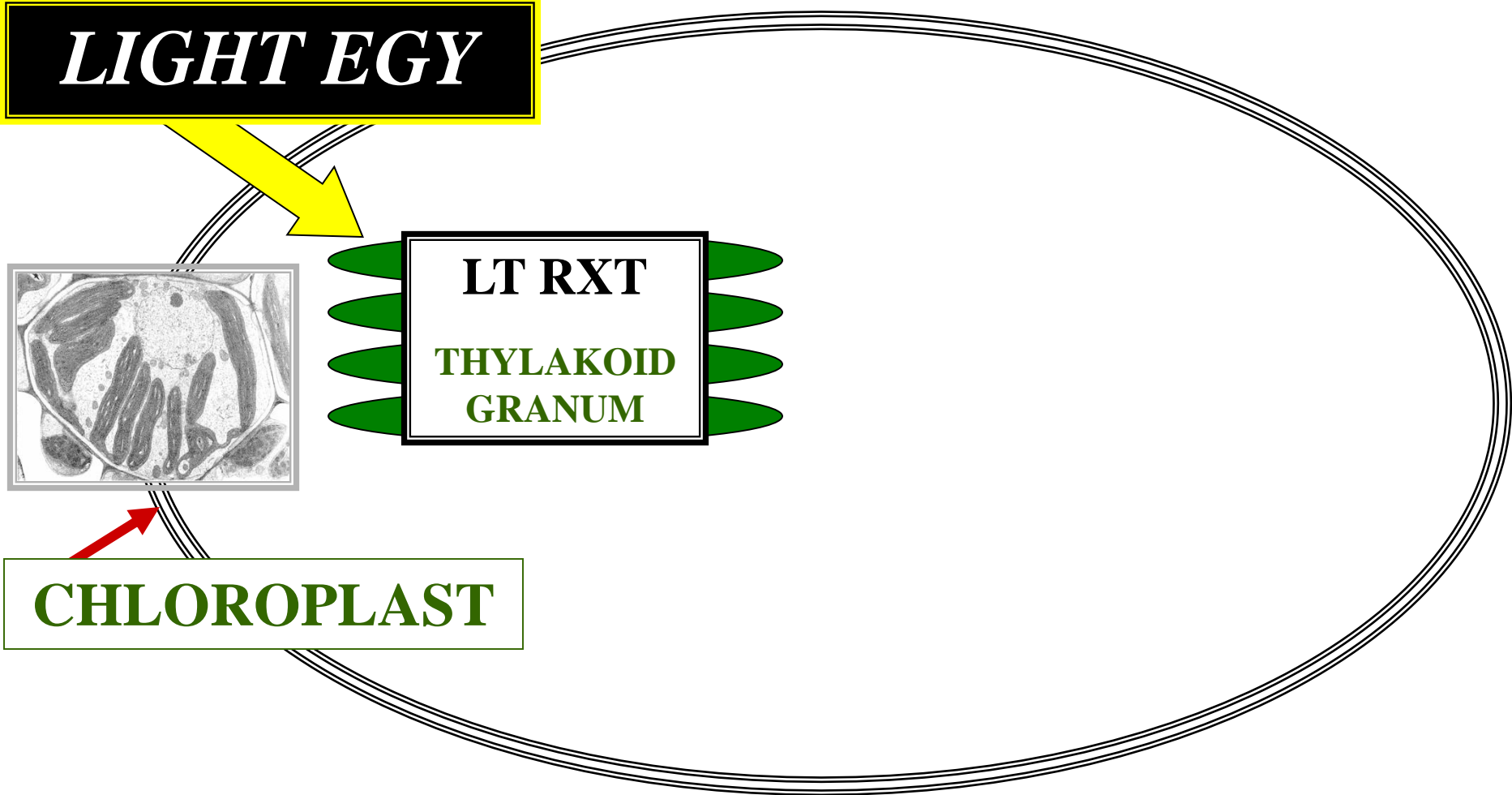
PHOTOSYNTHESIS



LIGHT ENERGY



CHLOROPLAST



PHOTOSYNTHESIS

C



WATER

LIGHT ENERGY

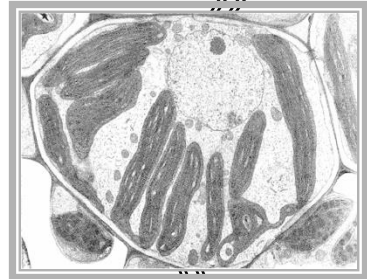
E-

PHOTOLYSIS

LIGHT REACTION

THYLAKOID
GRANUM

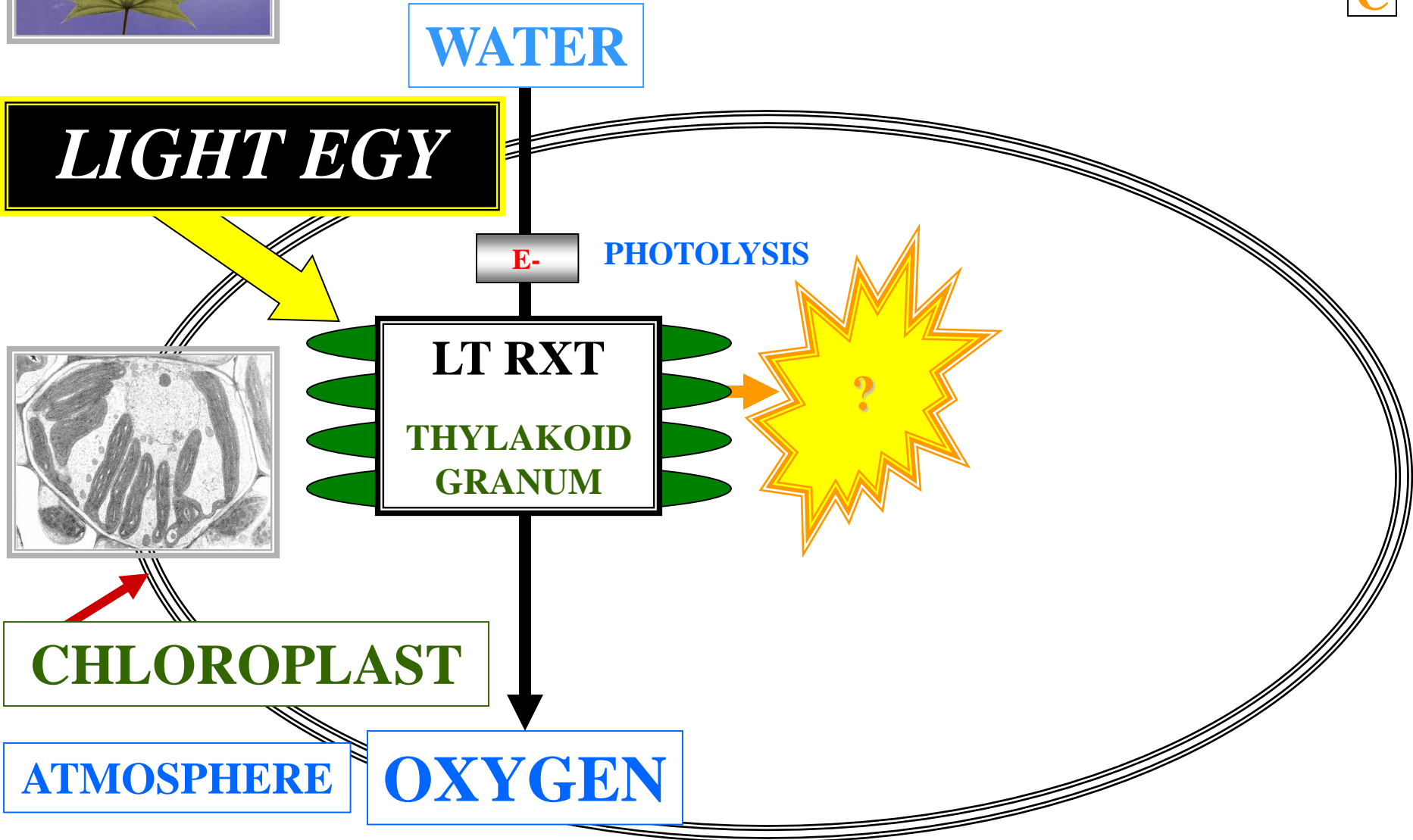
?



CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS

A



WATER

LIGHT ENERGY

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

CHEMICAL
ENERGY

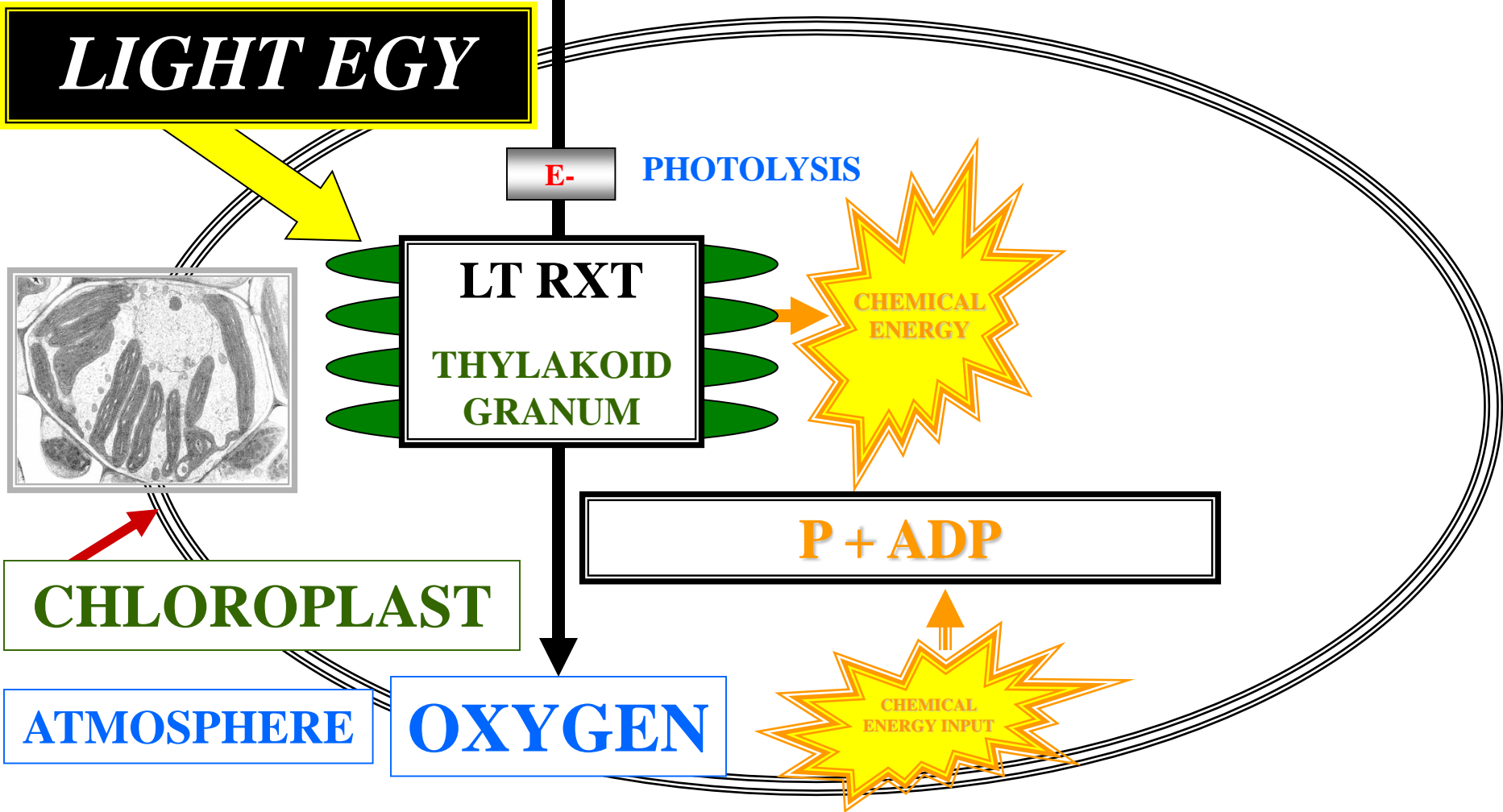
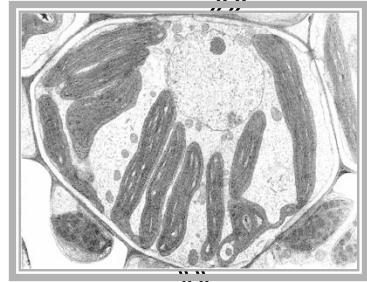
P + ADP

CHEMICAL
ENERGY INPUT

OXYGEN

CHLOROPLAST

ATMOSPHERE



PHOTOSYNTHESIS

P



WATER

LIGHT ENERGY

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

ATP

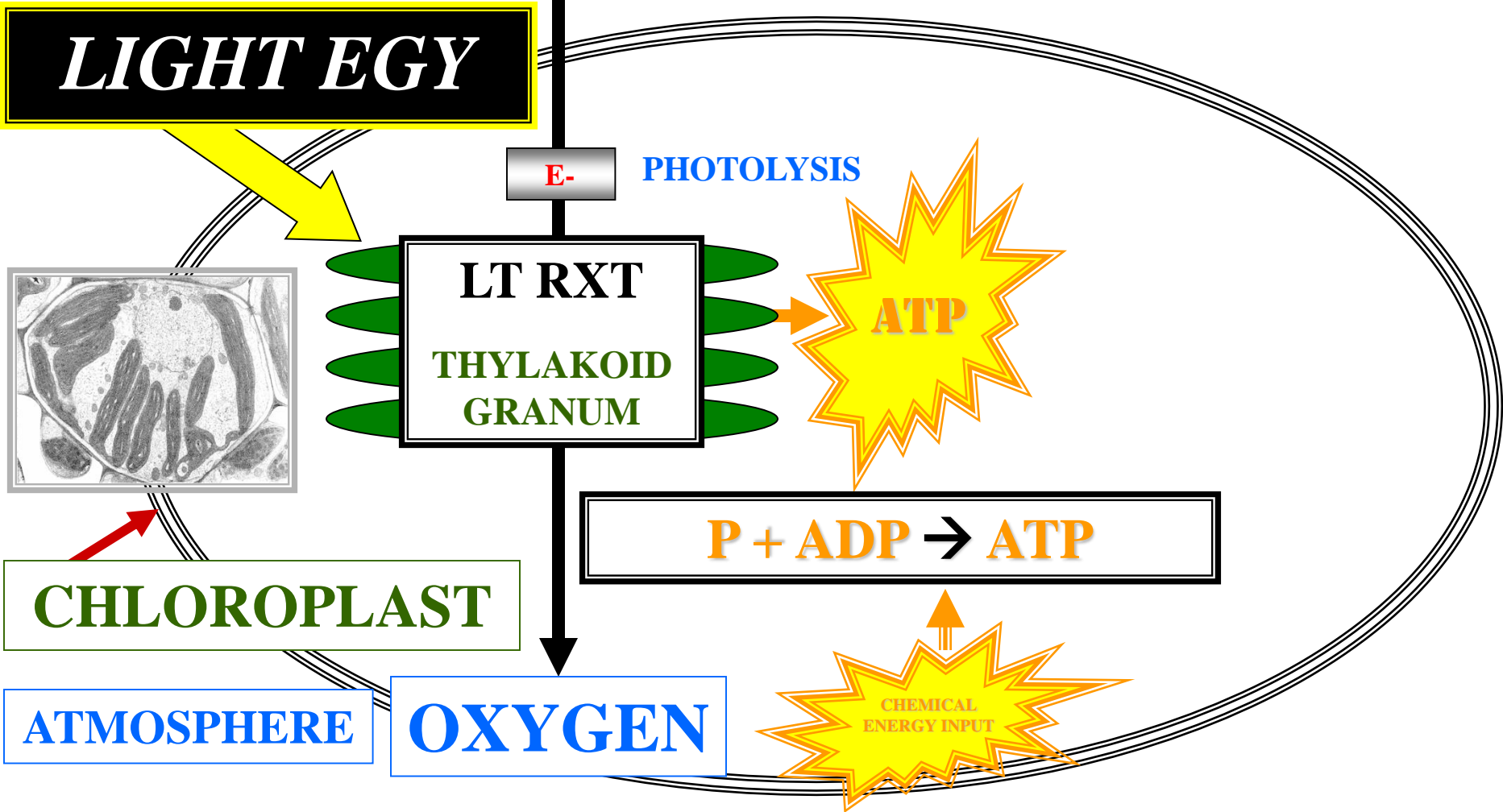
$P + ADP \rightarrow ATP$

CHEMICAL
ENERGY INPUT

CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS



S



WATER

LIGHT ENERGY

E-

PHOTOLYSIS

LIGHT REACTION

THYLAKOID GRANUM

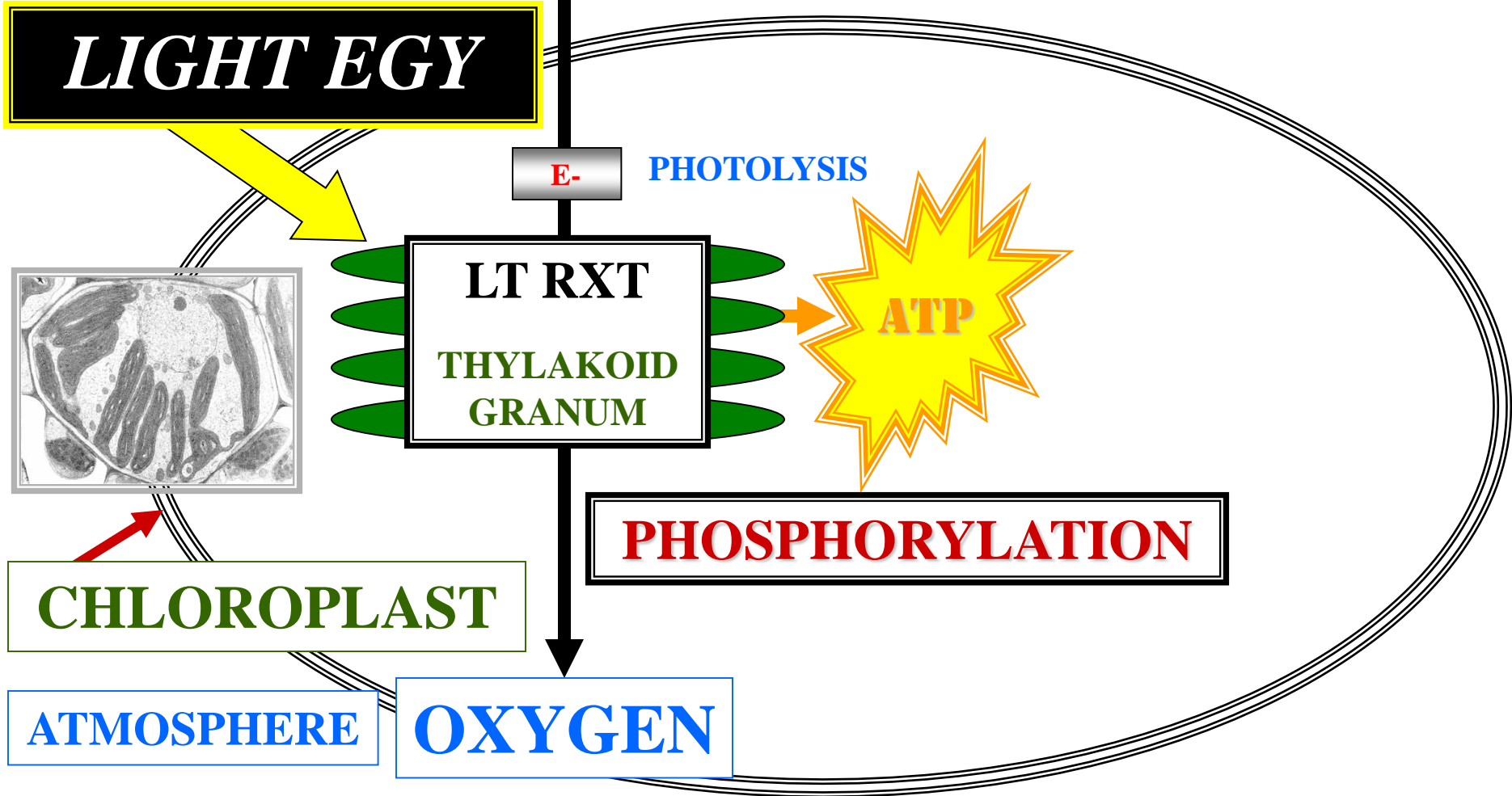
ATP

PHOSPHORYLATION

CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS

DK



WATER

LIGHT ENERGY

E-

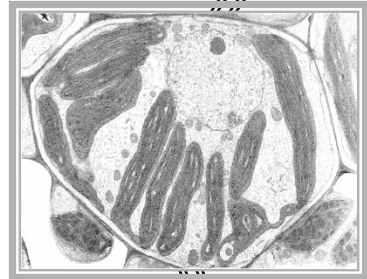
PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

ATP

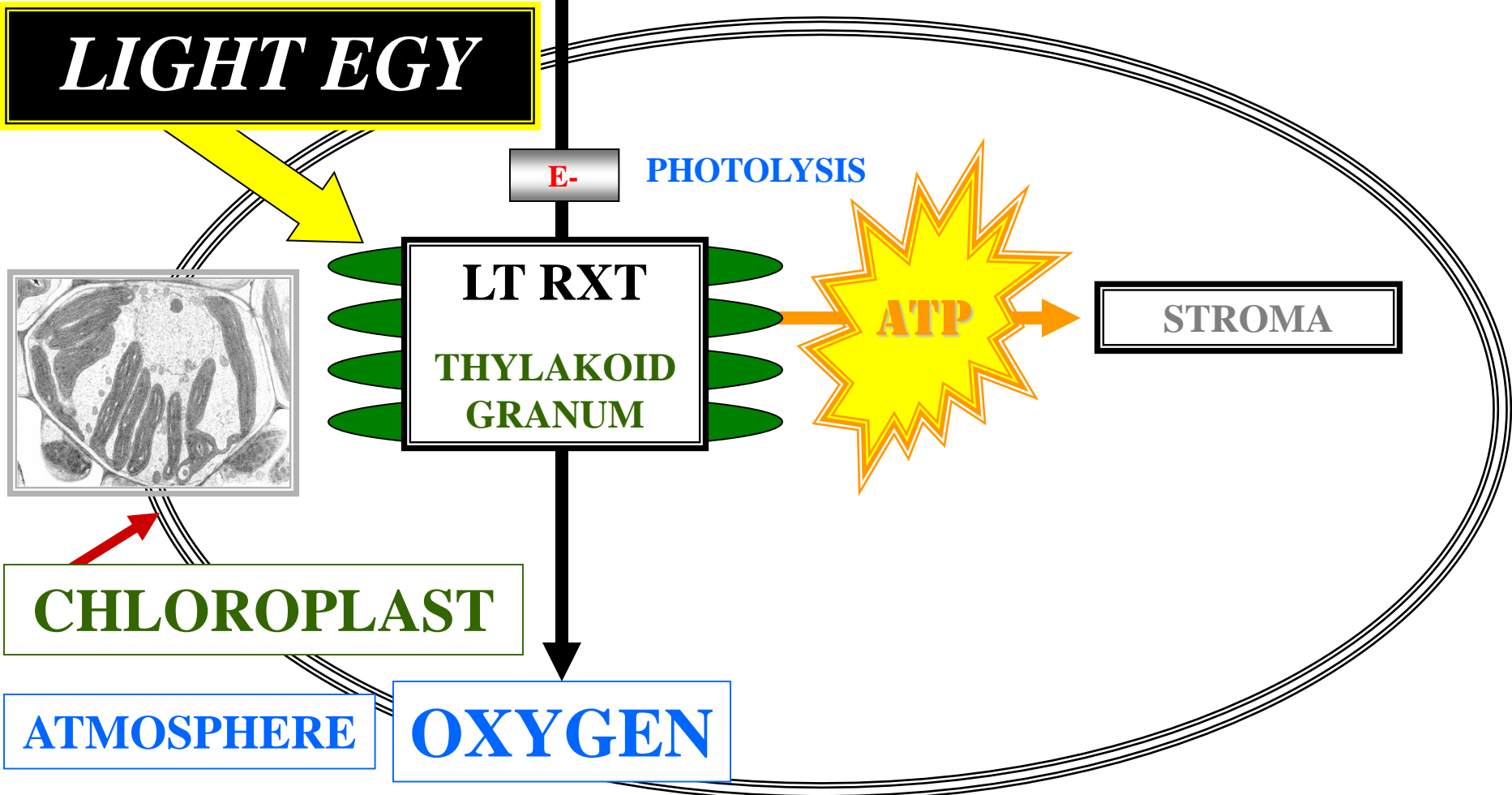
STROMA



CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS



?

C

WATER

LIGHT ENERGY

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

DK RXT

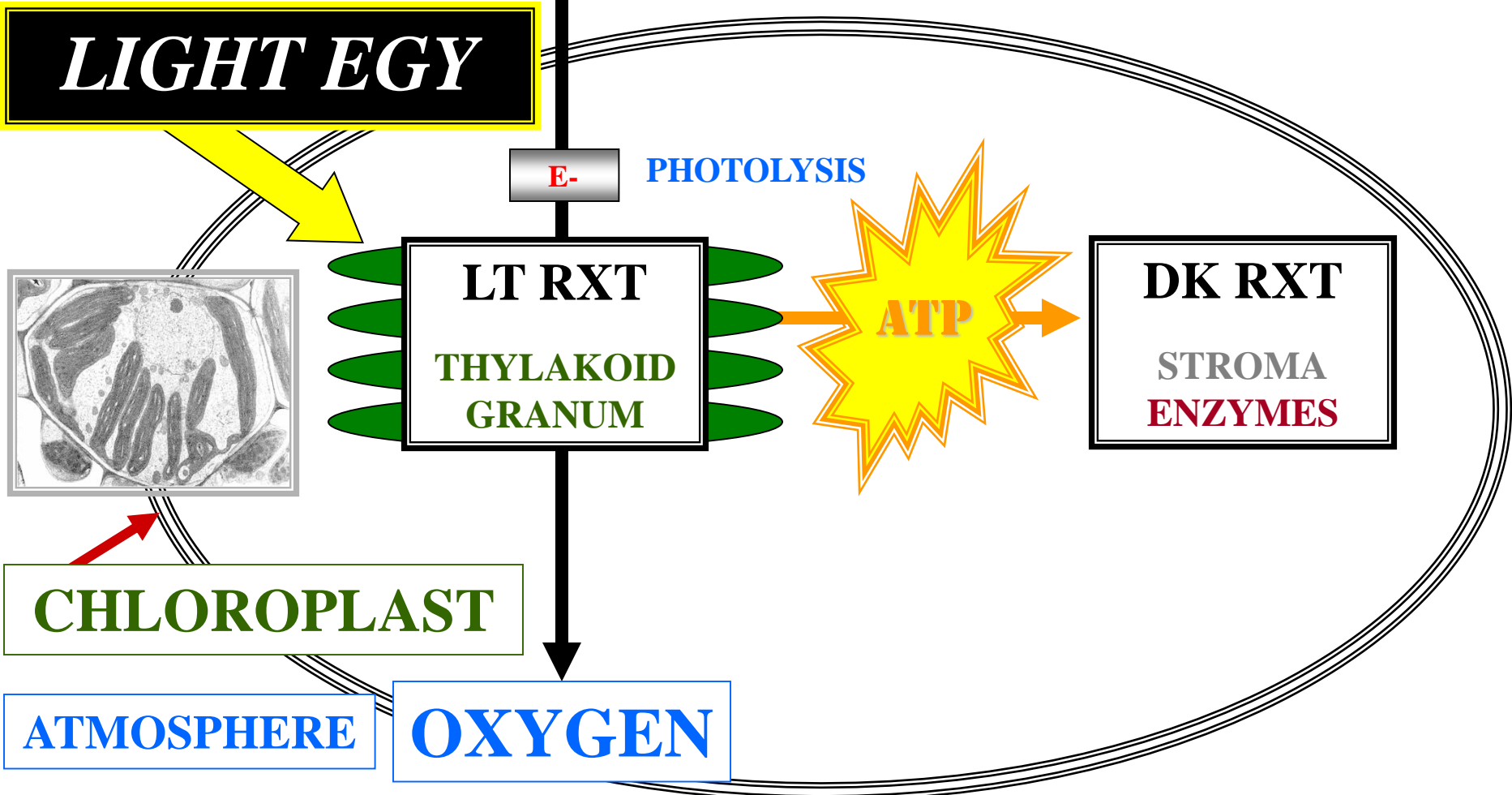
STROMA
ENZYMES

ATP

CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS

C



WATER

?

LIGHT ENERGY

ATMOSPHERE

E- PHOTOLYSIS



LT RXT
THYLAKOID
GRANUM

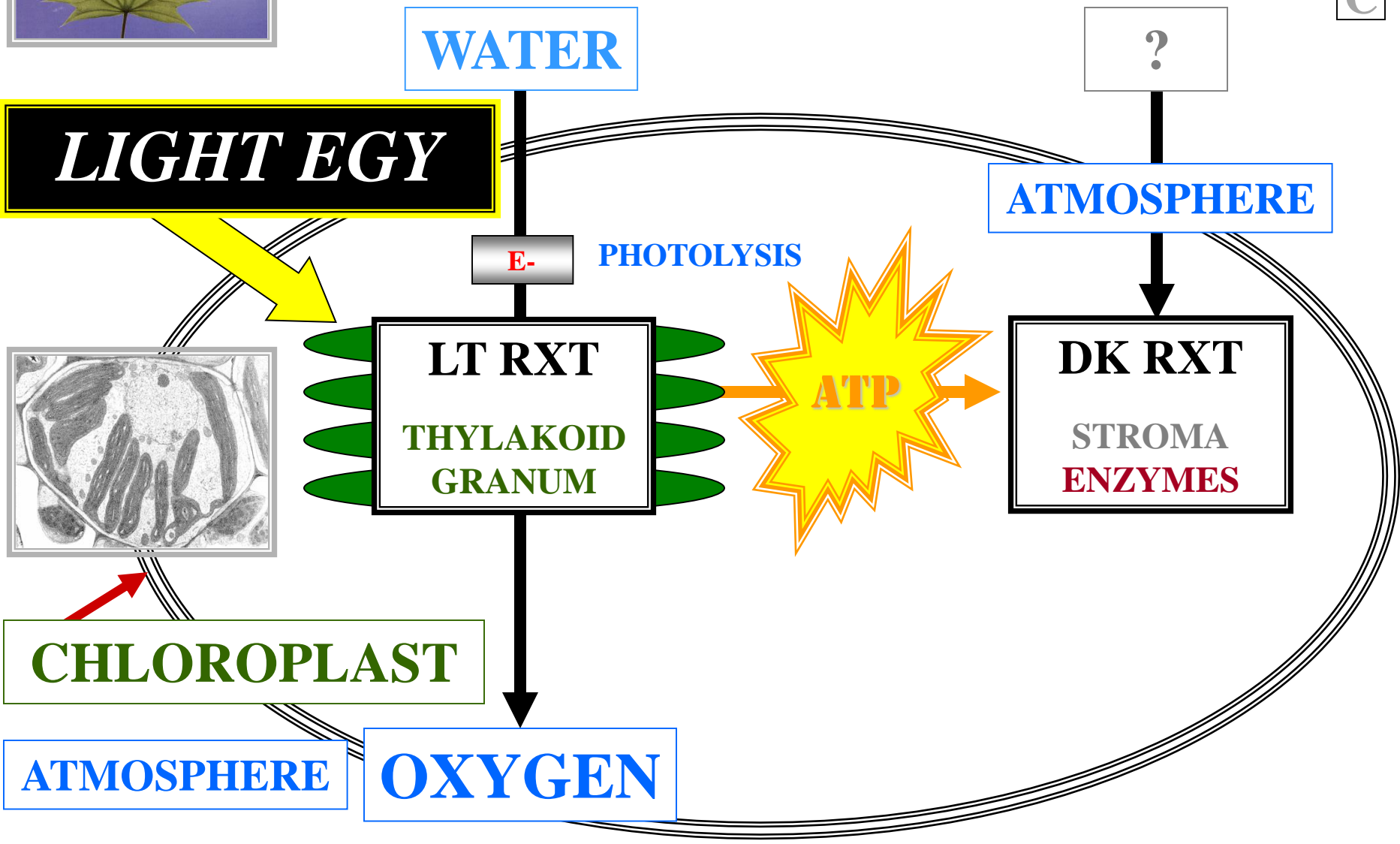


DK RXT
STROMA
ENZYMES

CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS



S

?

WATER

CO₂

LIGHT ENERGY

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

ATP

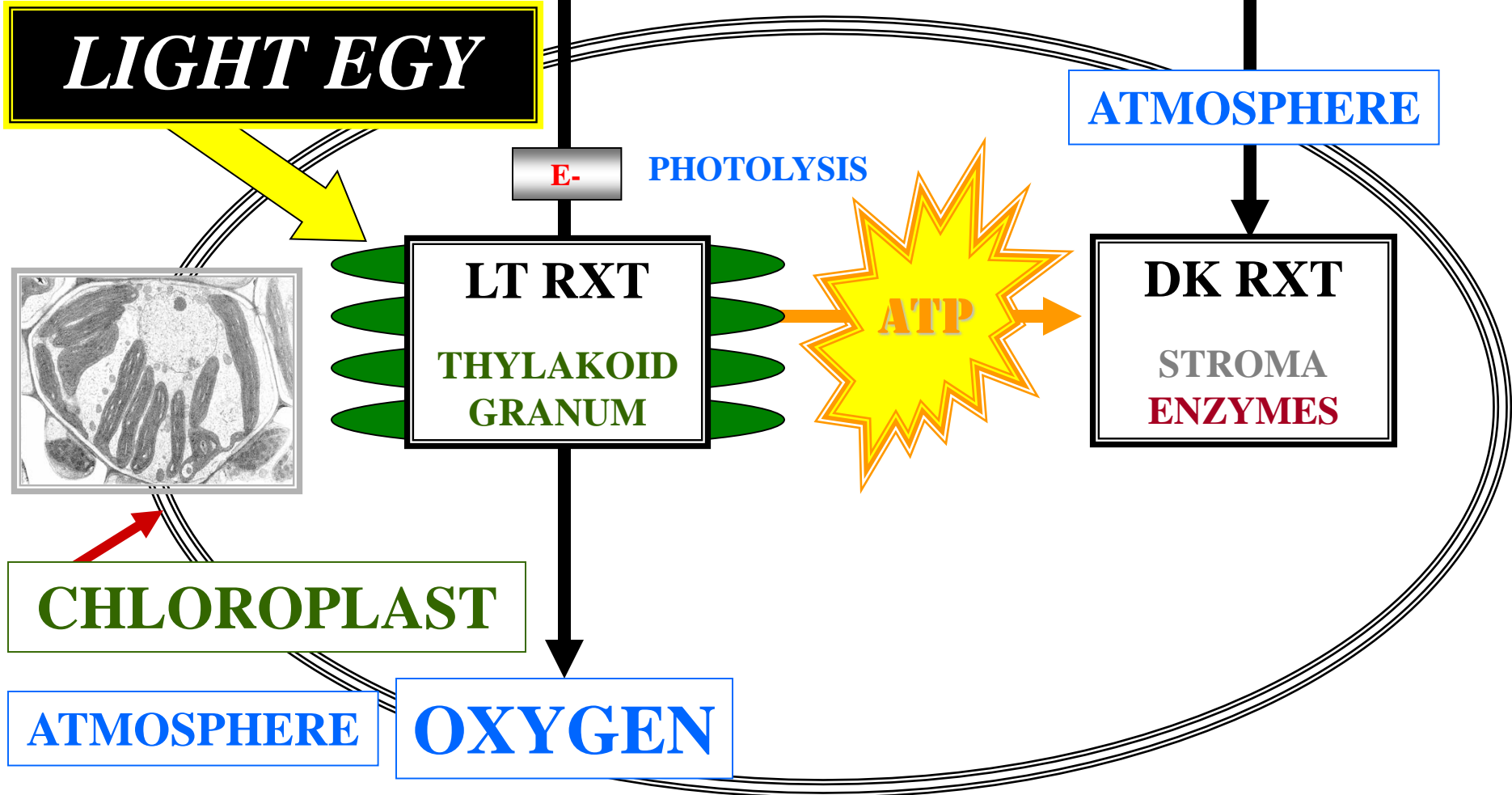
DK RXT

STROMA
ENZYMES

CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS

G



WATER

CO₂

LIGHT ENERGY

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

CHEMICAL
ENERGY

DK RXT

STROMA
ENZYMES

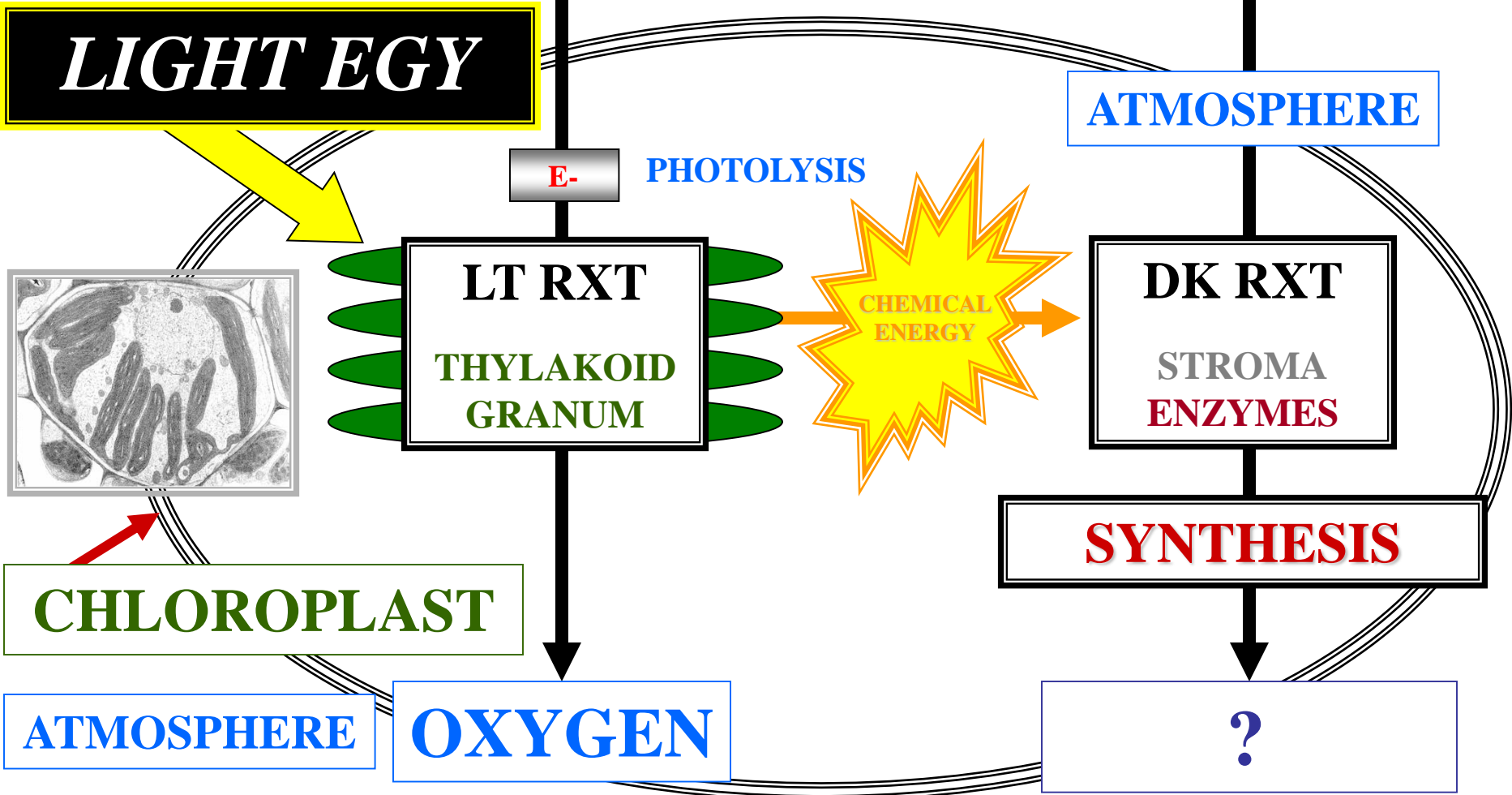
CHLOROPLAST

SYNTHESIS

ATMOSPHERE

OXYGEN

?



PHOTOSYNTHESIS



G

WATER

CO₂

LIGHT ENERGY

PHOTO

ATMOSPHERE

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

CHEMICAL
ENERGY

DK RXT

STROMA
ENZYMES

CHEMICAL
ENERGY INPUT

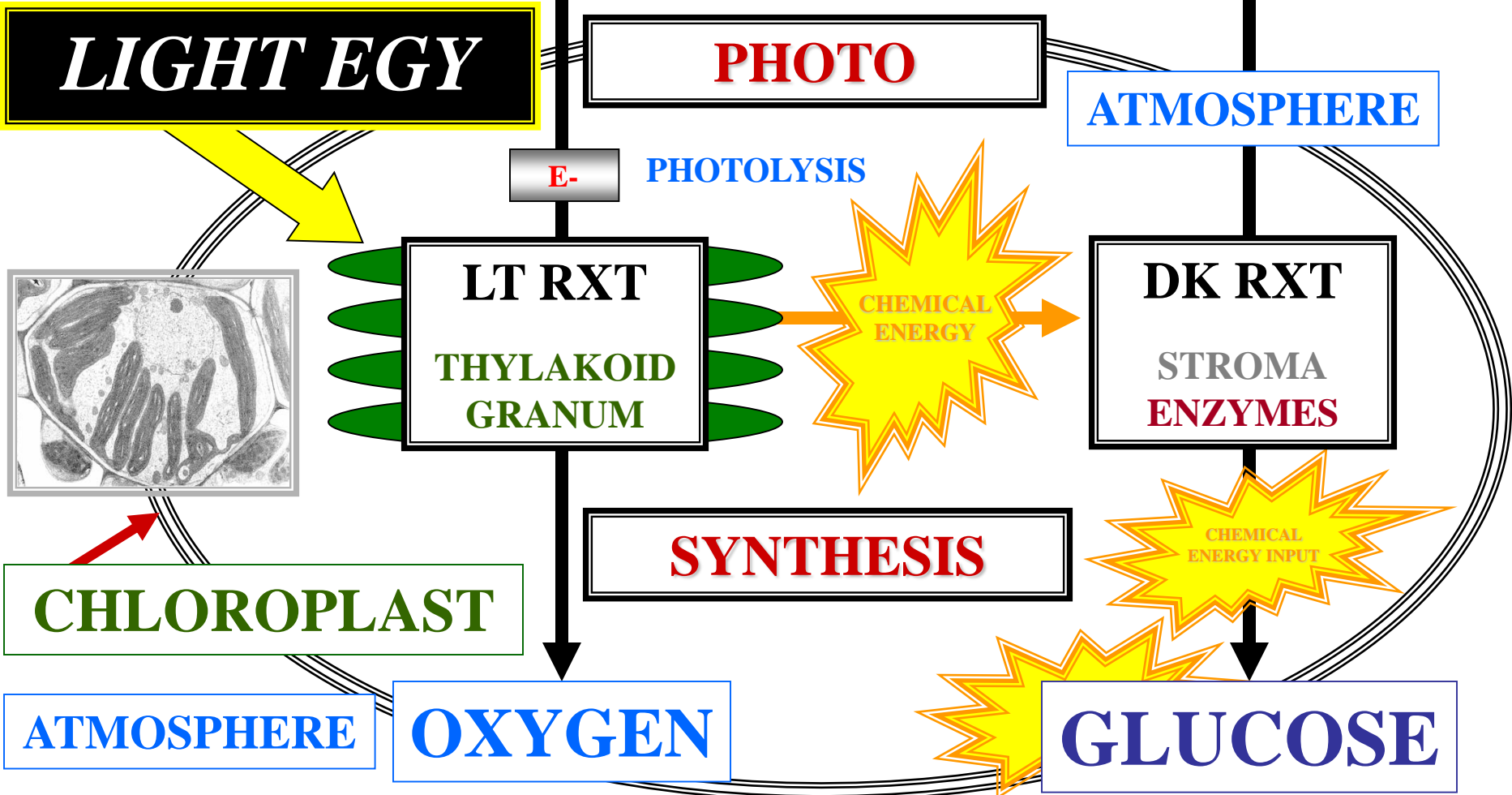
CHLOROPLAST

SYNTHESIS

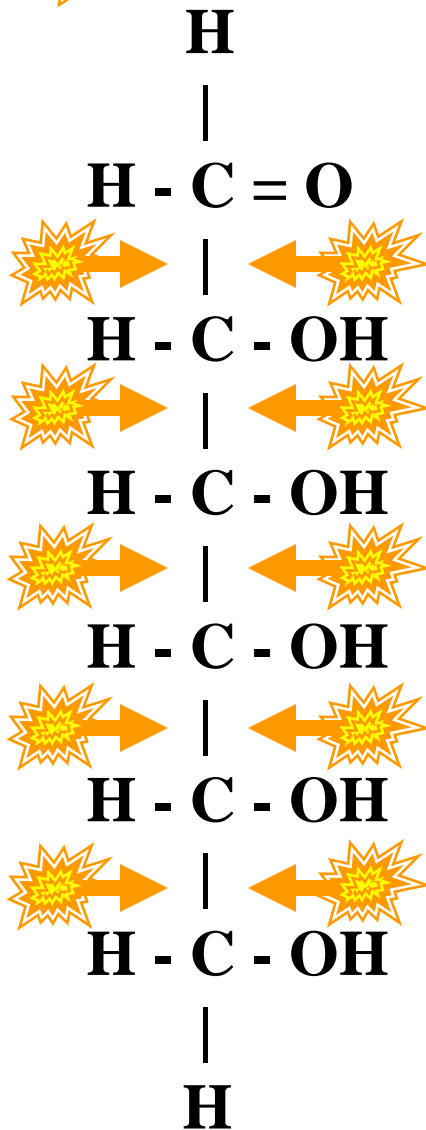
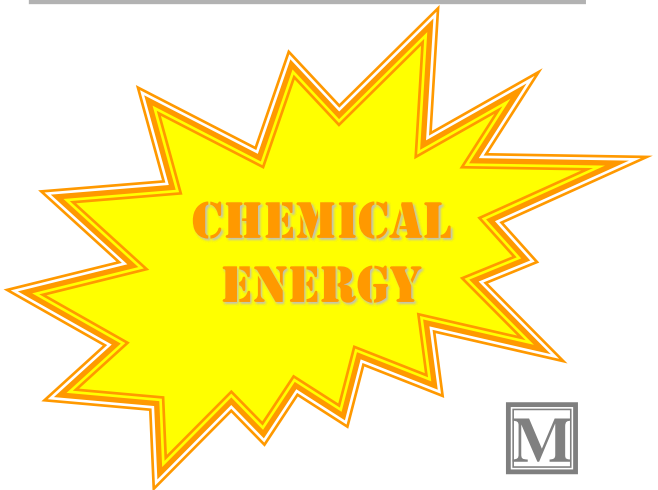
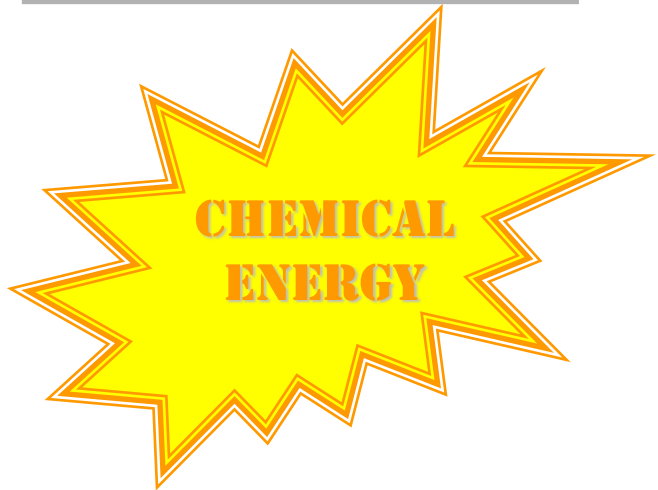
ATMOSPHERE

OXYGEN

GLUCOSE



GLUCOSE

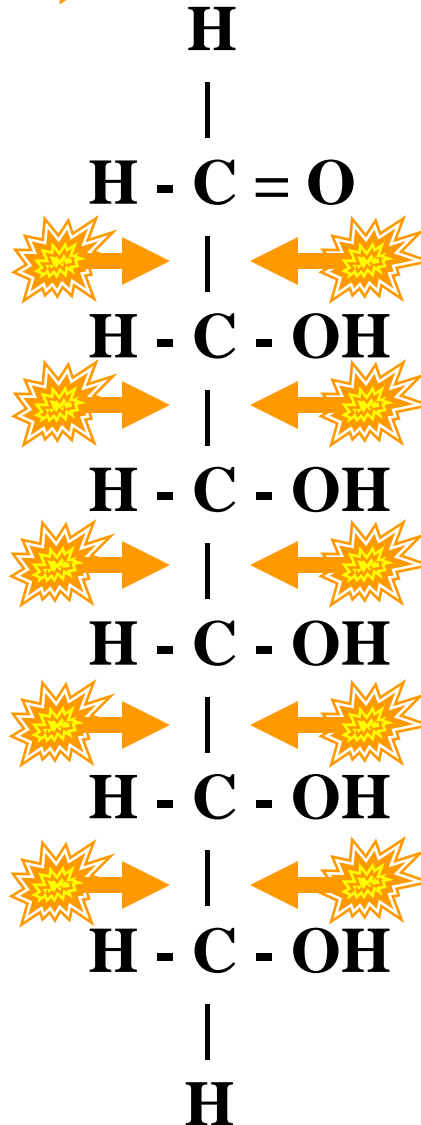


GLUCOSE



ENTERS
CELL
METABOLISM

ENTERS
CELL
METABOLISM



GLUCOSE

H

H - C = O



H - C - OH



H - C - OH



H - C - OH



H - C - OH



H - C - OH

H

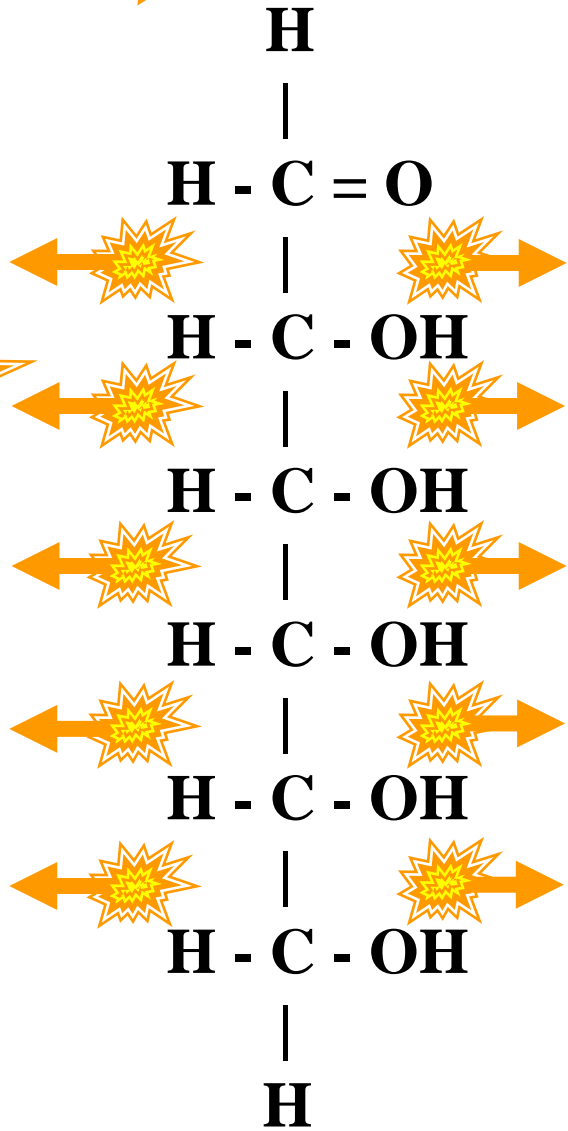
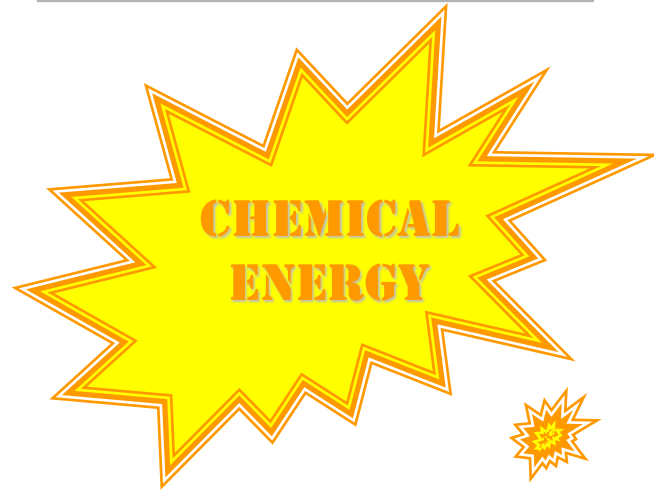


ENTERS
CELL
RESPIRATION

ENTERS
CELL
RESPIRATION

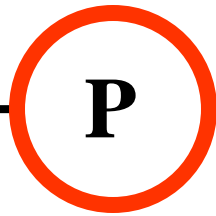
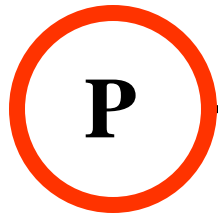


GLUCOSE





ADP

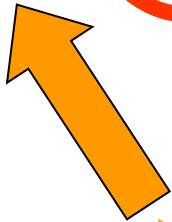
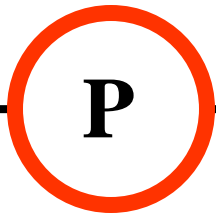


**CHEMICAL
ENERGY**





ADP

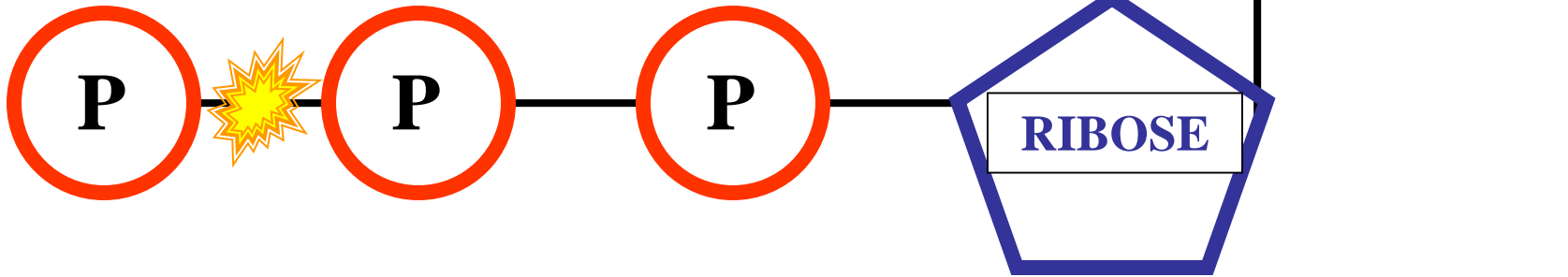


**CHEMICAL
ENERGY
INPUT**





ADP

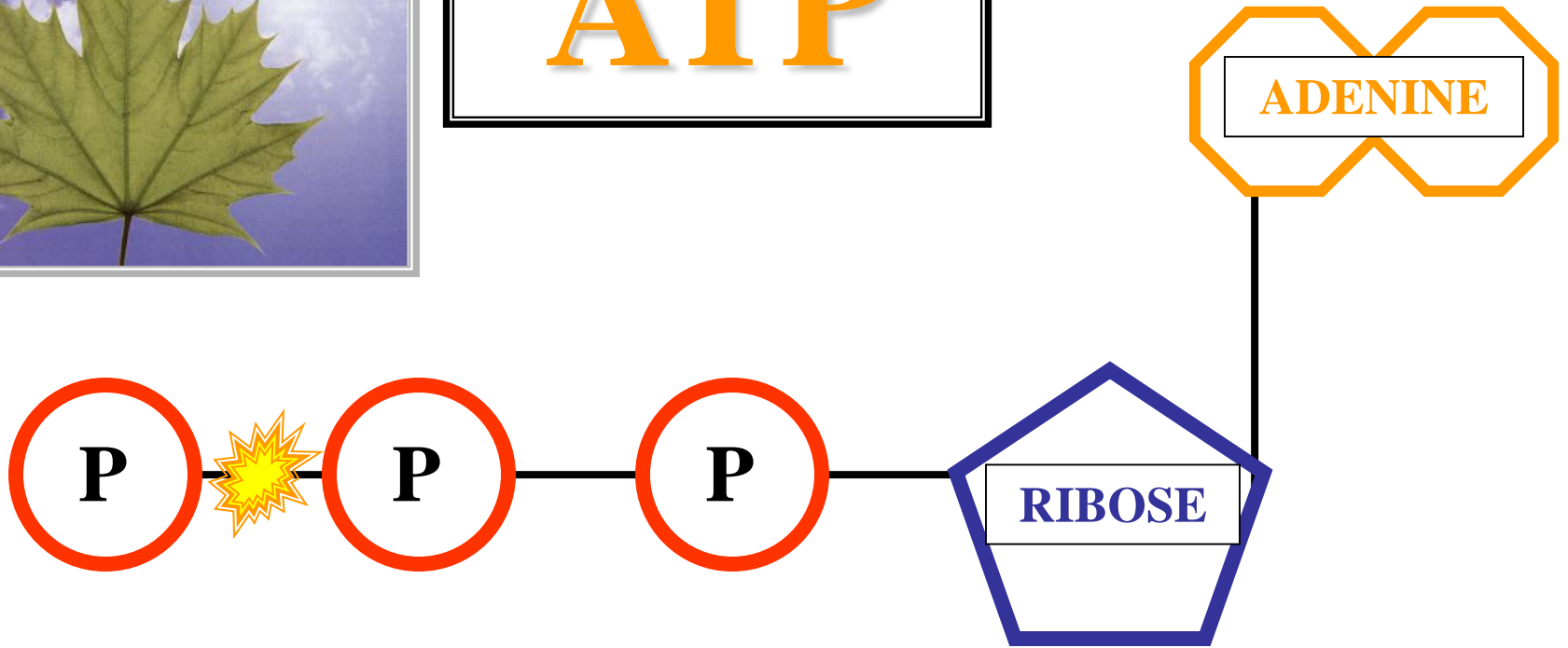


ADENOSINE DIPHOSPHATE

 = HOLDS BIO-CHEM ENERGY



ATP



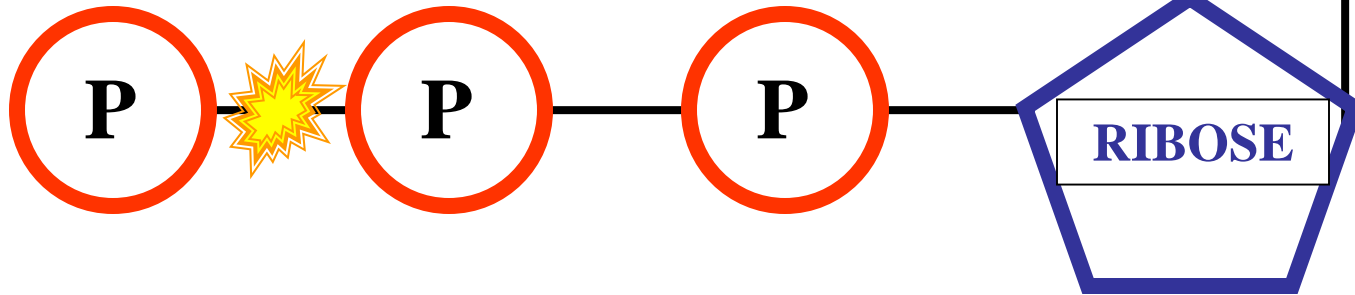
ADENOSINE TRIPHOSPHATE

 = HOLDS BIO-CHEM ENERGY



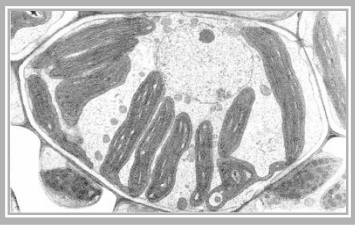
ATP

AT



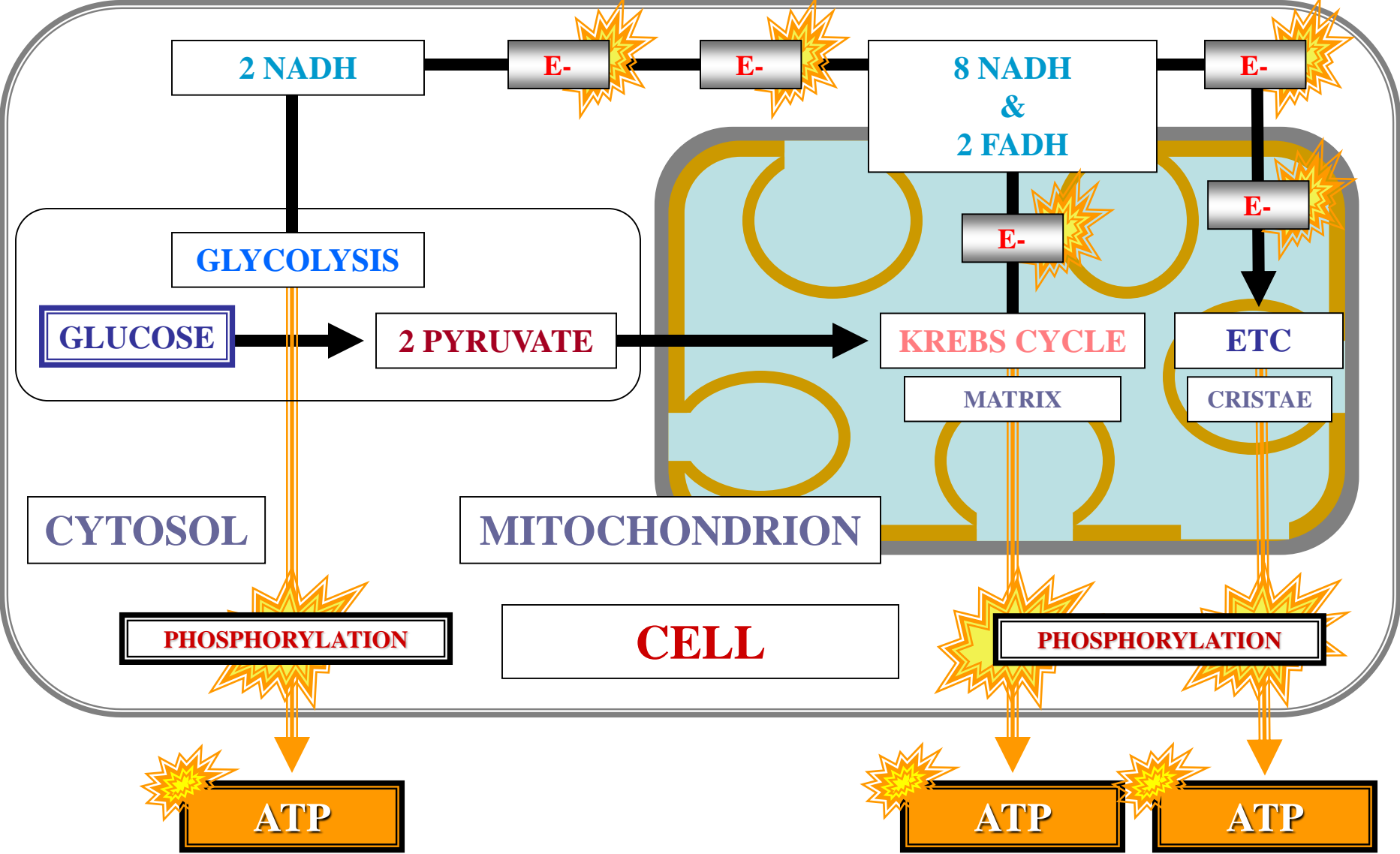
PHOSPHORYLATION

 = HOLDS BIO-CHEM ENERGY

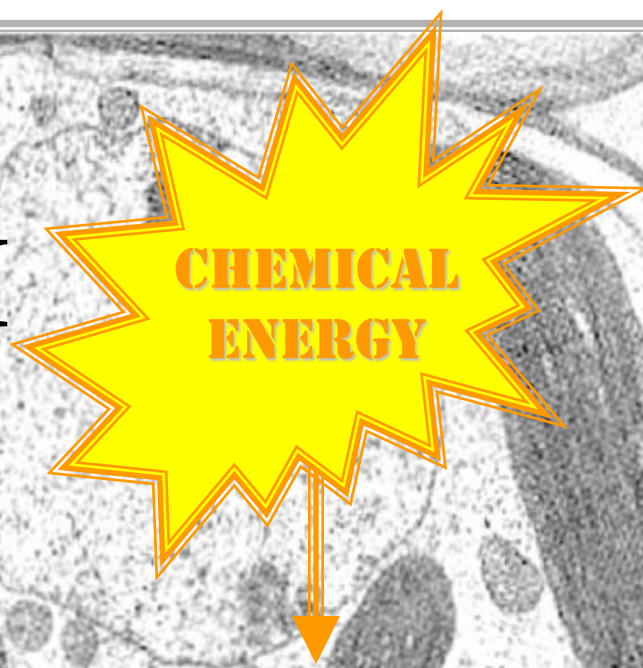


AT

RESPIRATION



CELL METABOLISM



CELL METABOLISM



**CHEMICAL
ENERGY**

CMP-A + CMP-B → CMP-C

**ATP DELIVERS CHEM-EGY
TO
ENDERGONIC
BIOCHEMICAL REACTIONS**

CELL METABOLISM



**CHEMICAL
ENERGY**



**CHEMICAL ENERGY
DRIVES
ENDERGONIC REACTIONS
TO A PRODUCT**

O



***EFFICIENT
CELL
METABOLISM***



E



ORGANIZATION INCREASES



***ENTROPY
DECREASES***





HOMEOSTASIS



TYPICAL PLANT ORGANS

TYPICAL PLANT ORGANS

ROOT

TYPICAL PLANT ORGANS

TYPICAL PLANT ORGANS

ROOT
STEM

TYPICAL PLANT ORGANS

TYPICAL PLANT ORGANS

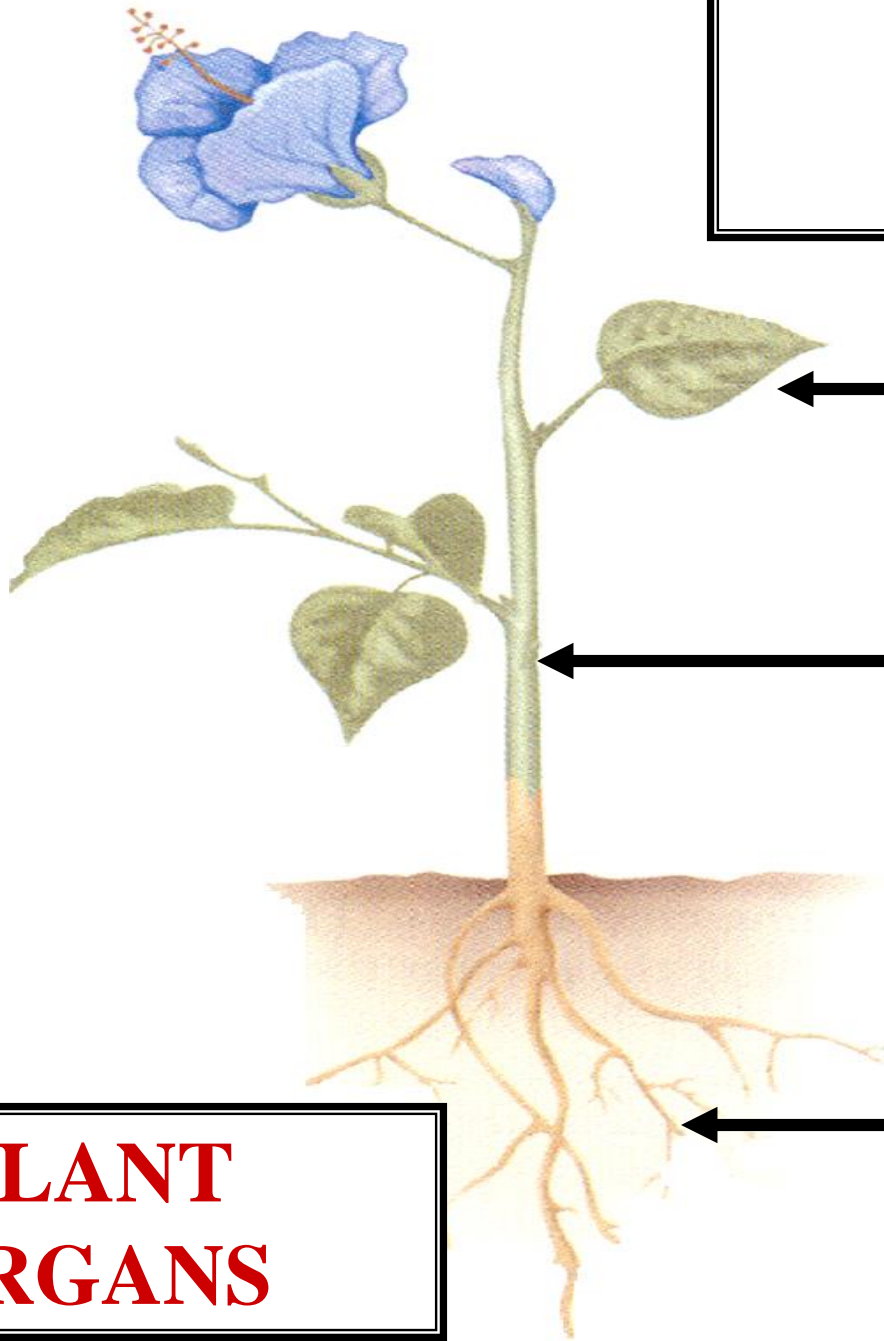


ROOT
STEM
LEAF

TYPICAL PLANT ORGANS

TYPICAL PLANT

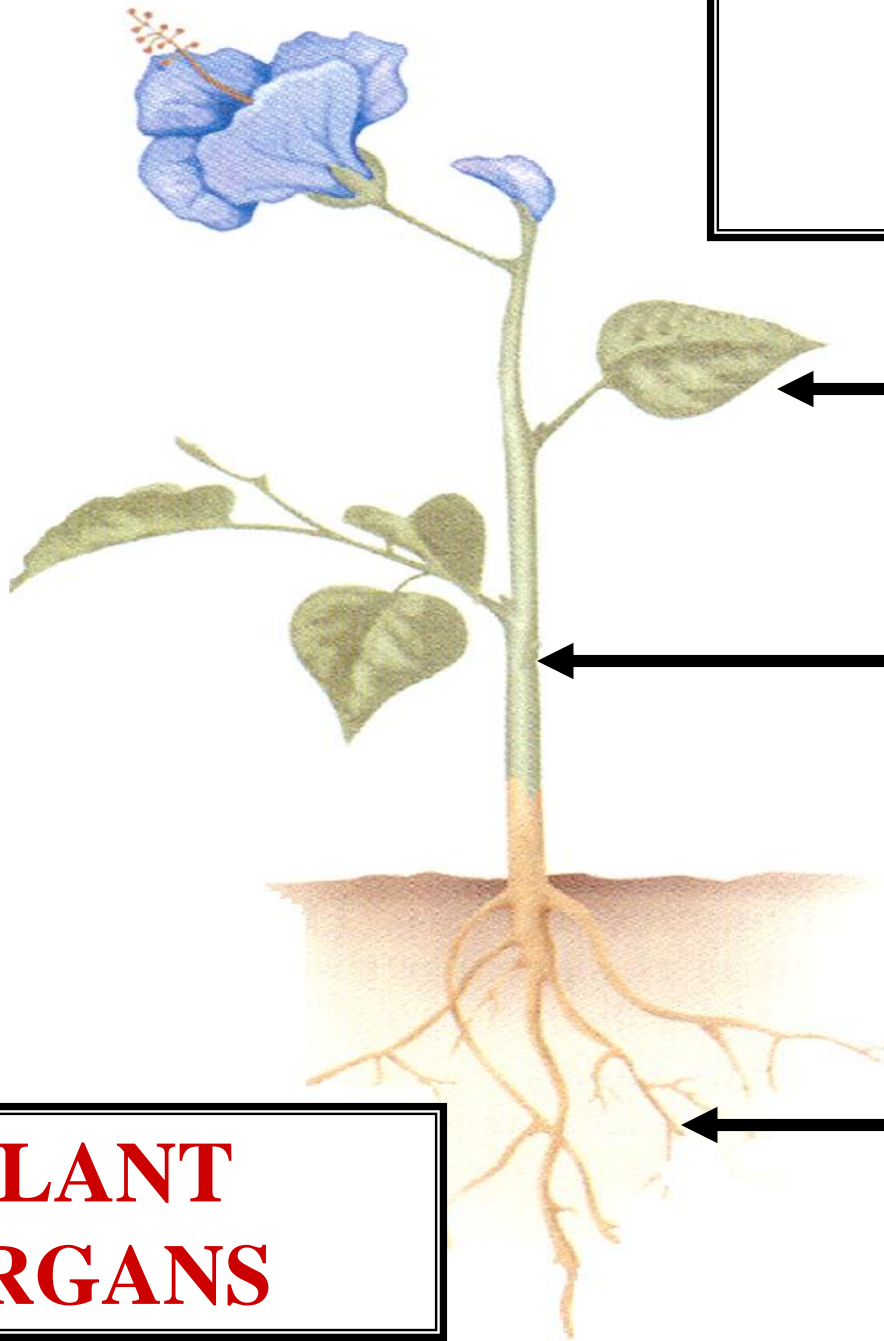
R



**PLANT
ORGANS**

TYPICAL PLANT

S

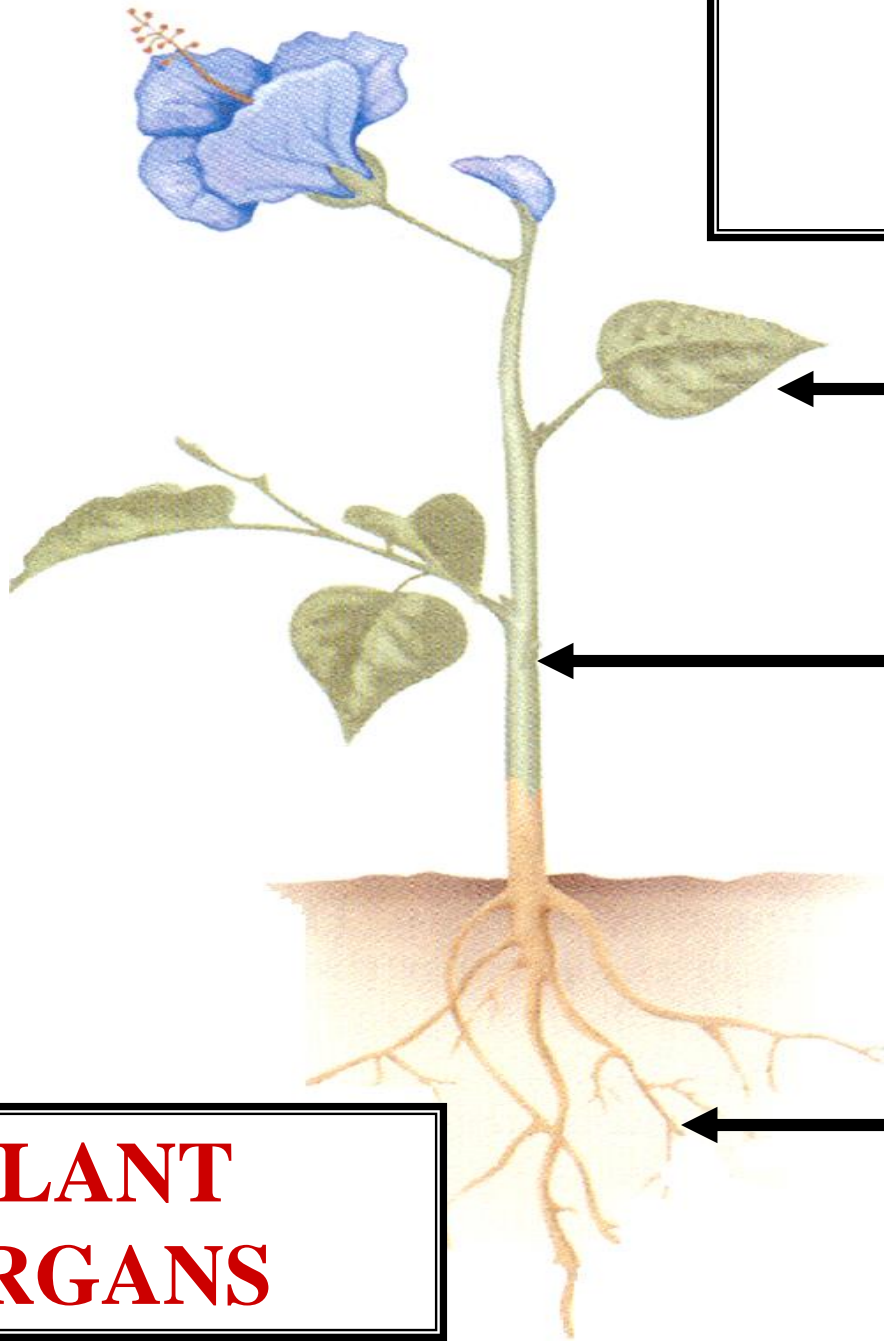


ROOT

**PLANT
ORGANS**

TYPICAL PLANT

L



STEM

ROOT

**PLANT
ORGANS**

TYPICAL PLANT



LEAF

The diagram shows a typical plant with a central stem, several green leaves, and a blue flower. The roots are shown extending into the soil. Arrows point from the labels 'LEAF', 'STEM', and 'ROOT' to their respective parts of the plant.

STEM

ROOT

PLANT
ORGANS

LEAF

LEAF



LEAF

PRINCIPLE PHOTOSYNTHETIC ORGAN

LEAF

PHOTOSYNTHESIS

EX



LEAF
PRINCIPLE
PHOTOSYNTHETIC
ORGAN

MAPLE

PHOTOSYNTHESIS

EG



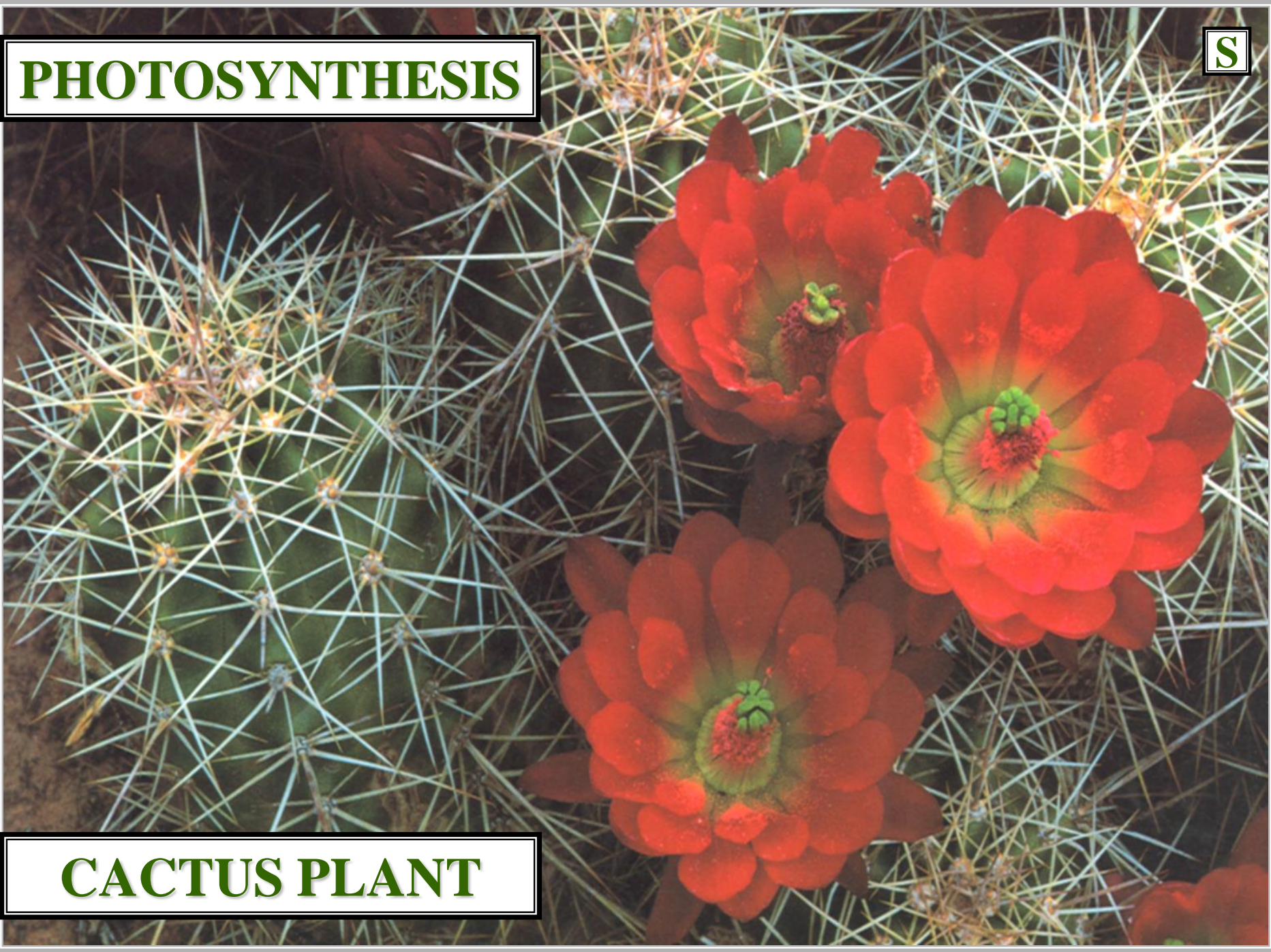
LEAF
PRINCIPLE
PHOTOSYNTHETIC
ORGAN
NUMEROUS EXCEPTIONS

MAPLE

PHOTOSYNTHESIS

S

CACTUS PLANT



PHOTOSYNTHESIS STEM



CACTUS PLANT

PHOTOSYNTHESIS

A

LEAF
PRINCIPLE
PHOTOSYNTHETIC
ORGAN

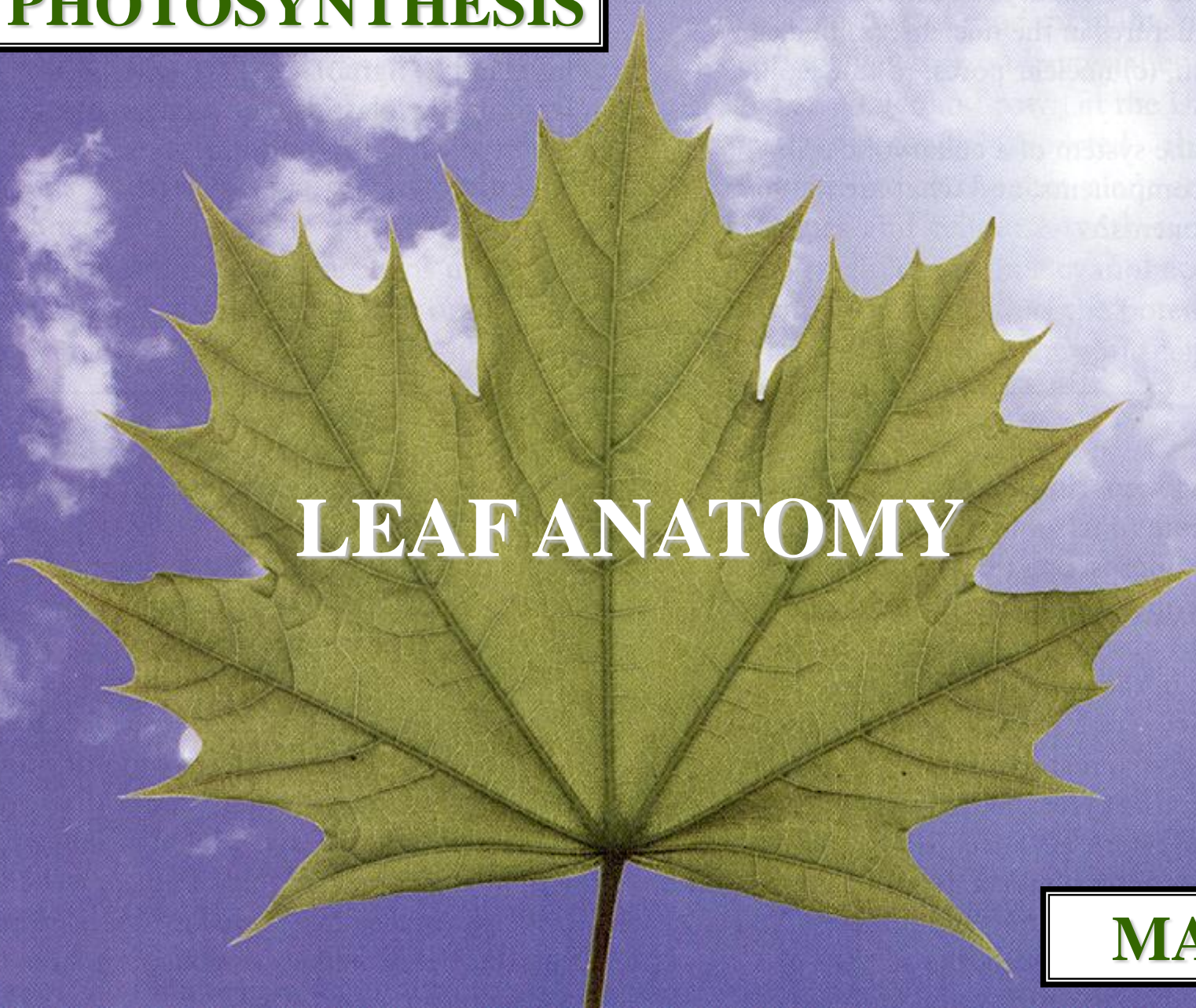
MAPLE

PHOTOSYNTHESIS



LEAF ANATOMY

MAPLE





LEAF ANATOMY

PHOTOSYNTHESIS



LEAF ANATOMY SPECIFICS CONSULT LEAF ANATOMY NOTES

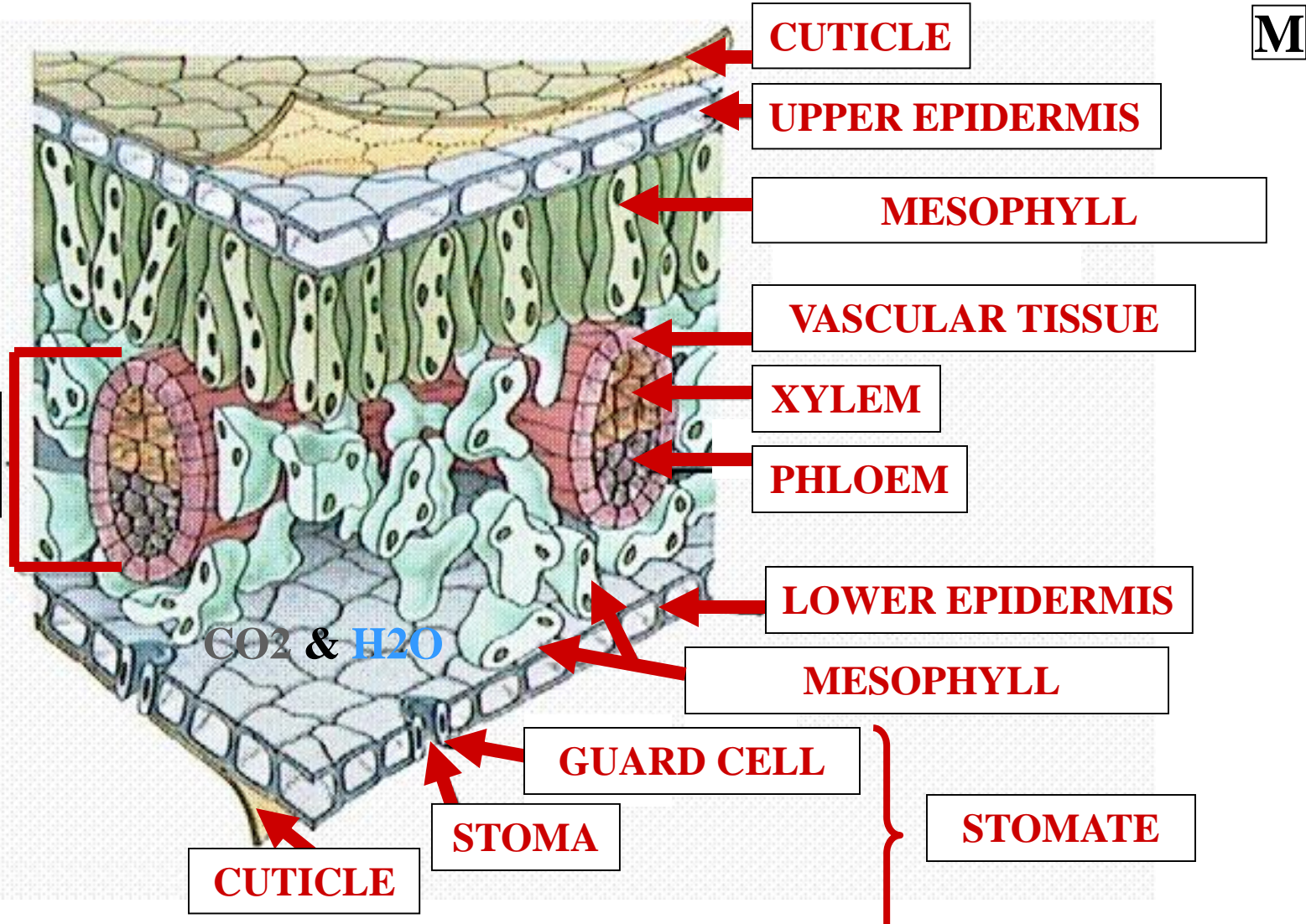
MAPLE

TYPICAL LEAF ANATOMY



M

VASCULAR TISSUE

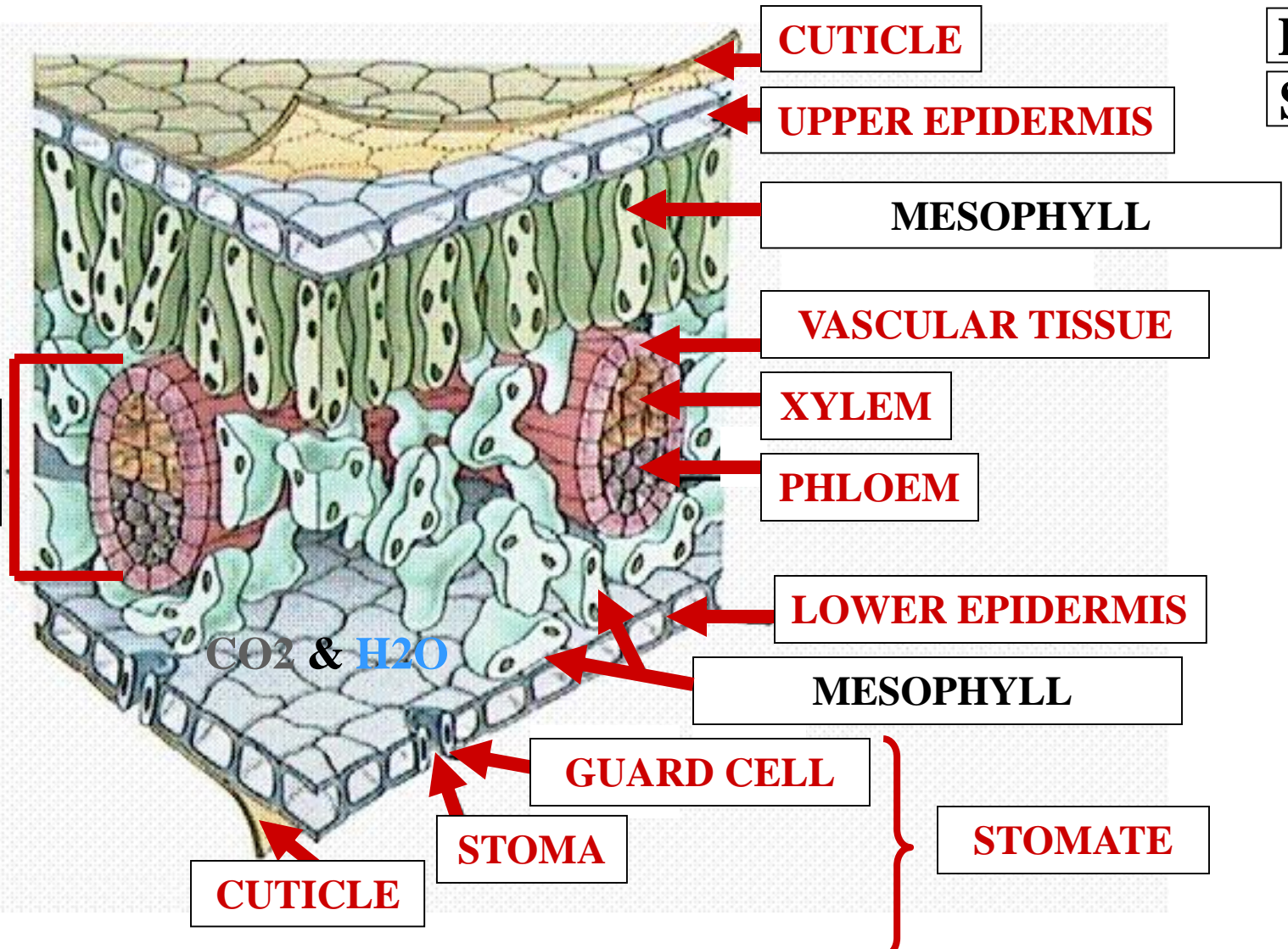


C.S.

TYPICAL LEAF ANATOMY



P
S

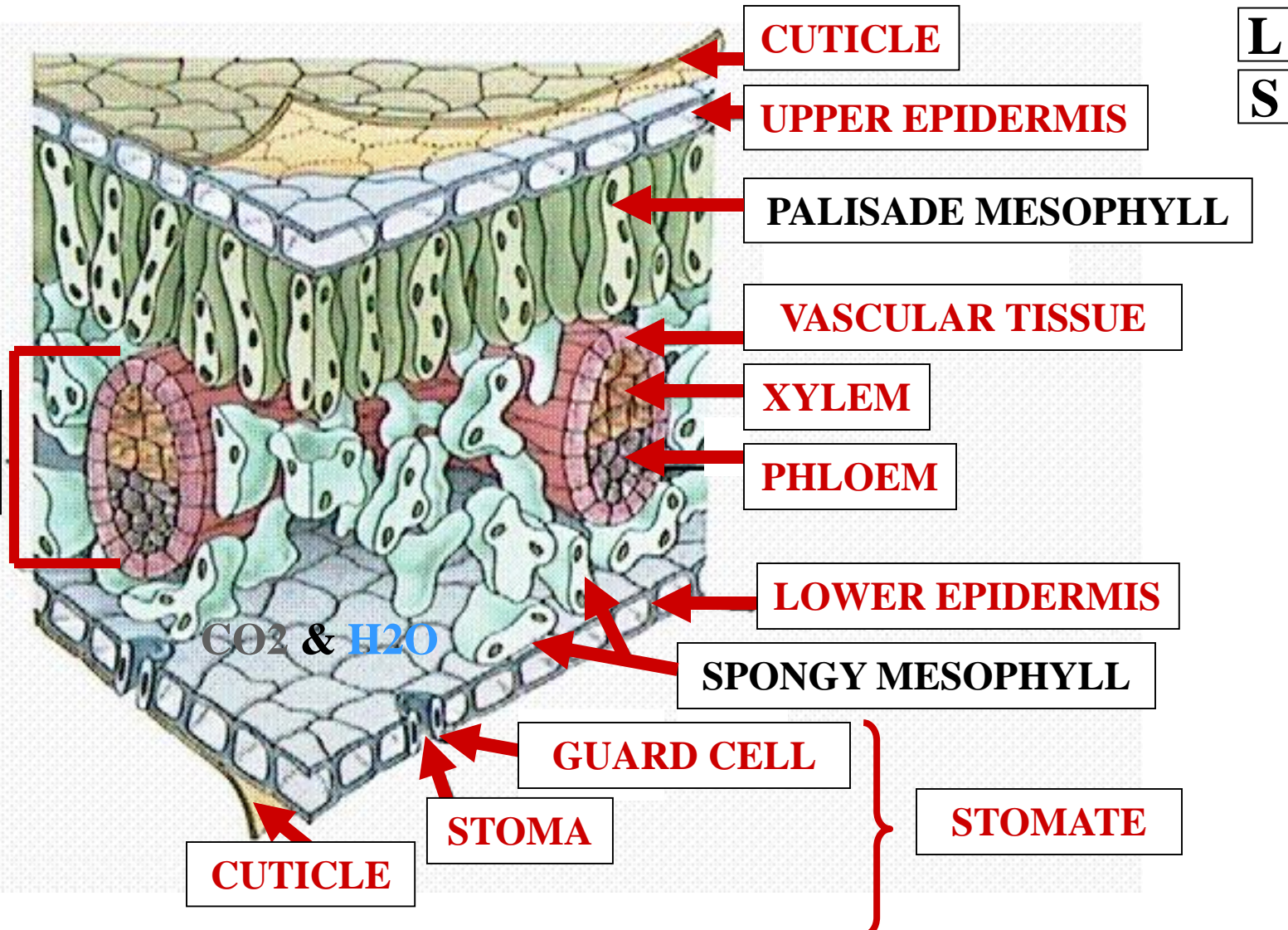


VASCULAR TISSUE

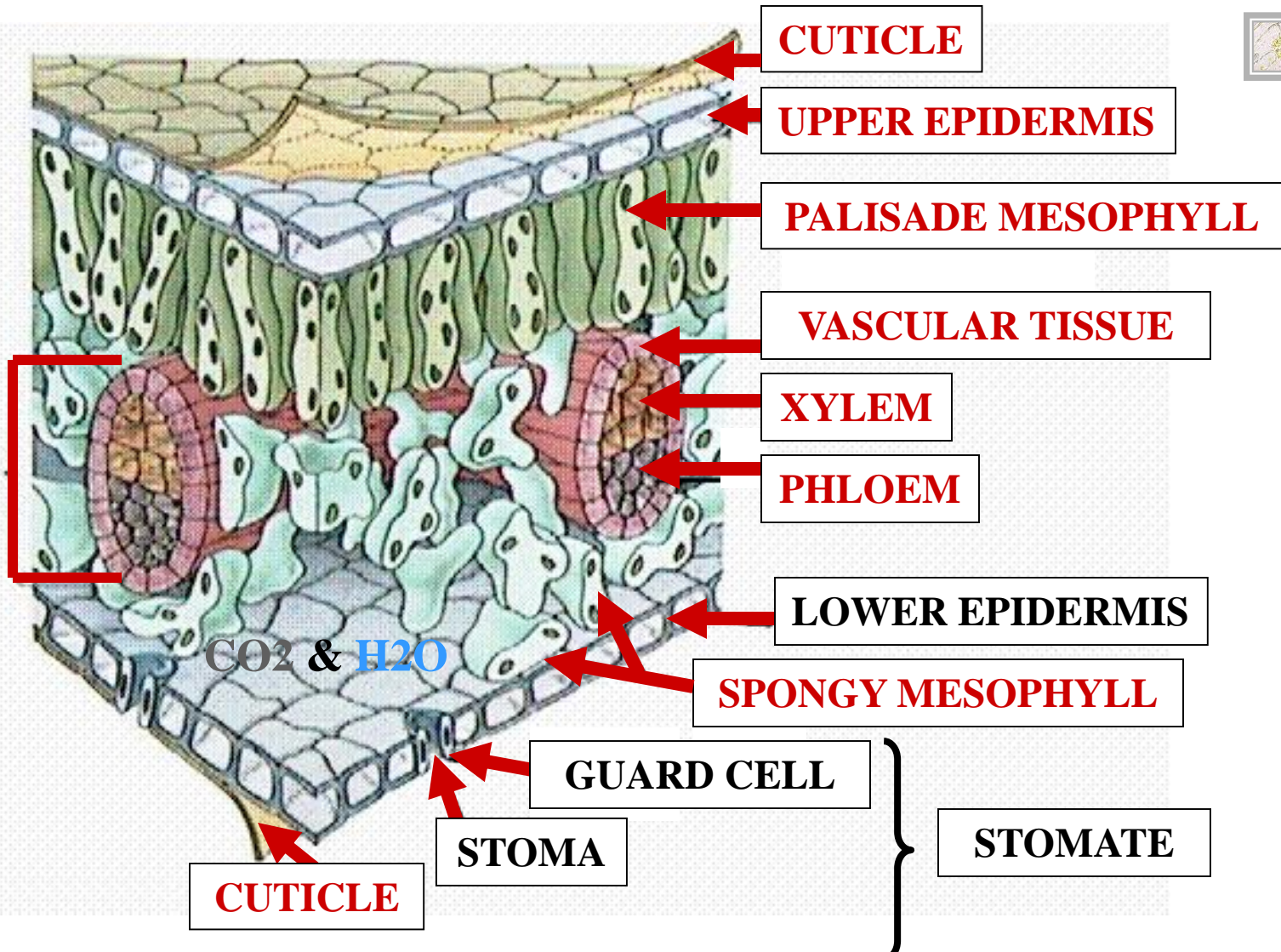
C.S.

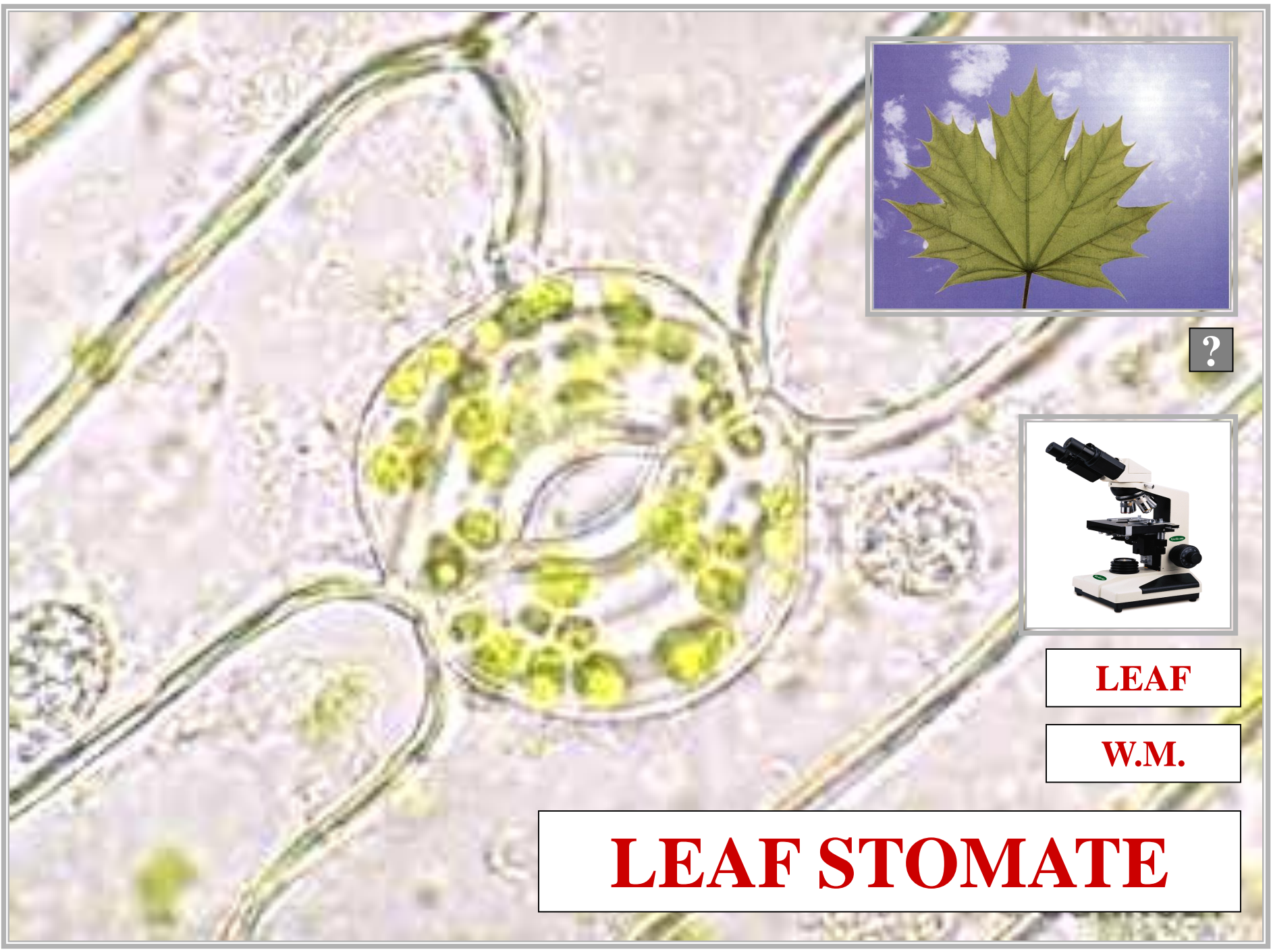
CO₂ & H₂O

TYPICAL LEAF ANATOMY



TYPICAL LEAF ANATOMY

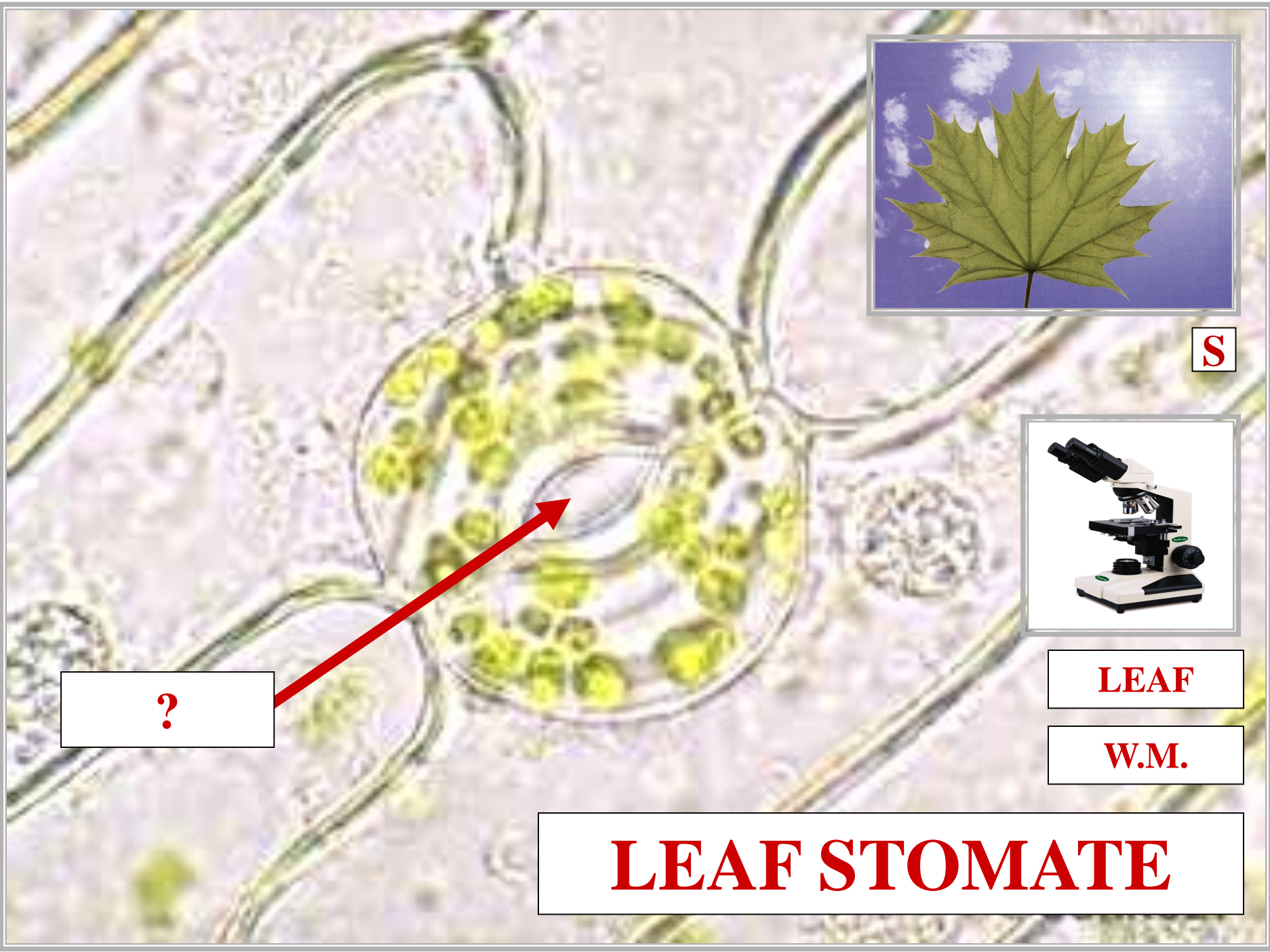




LEAF

W.M.

LEAF STOMATE



S

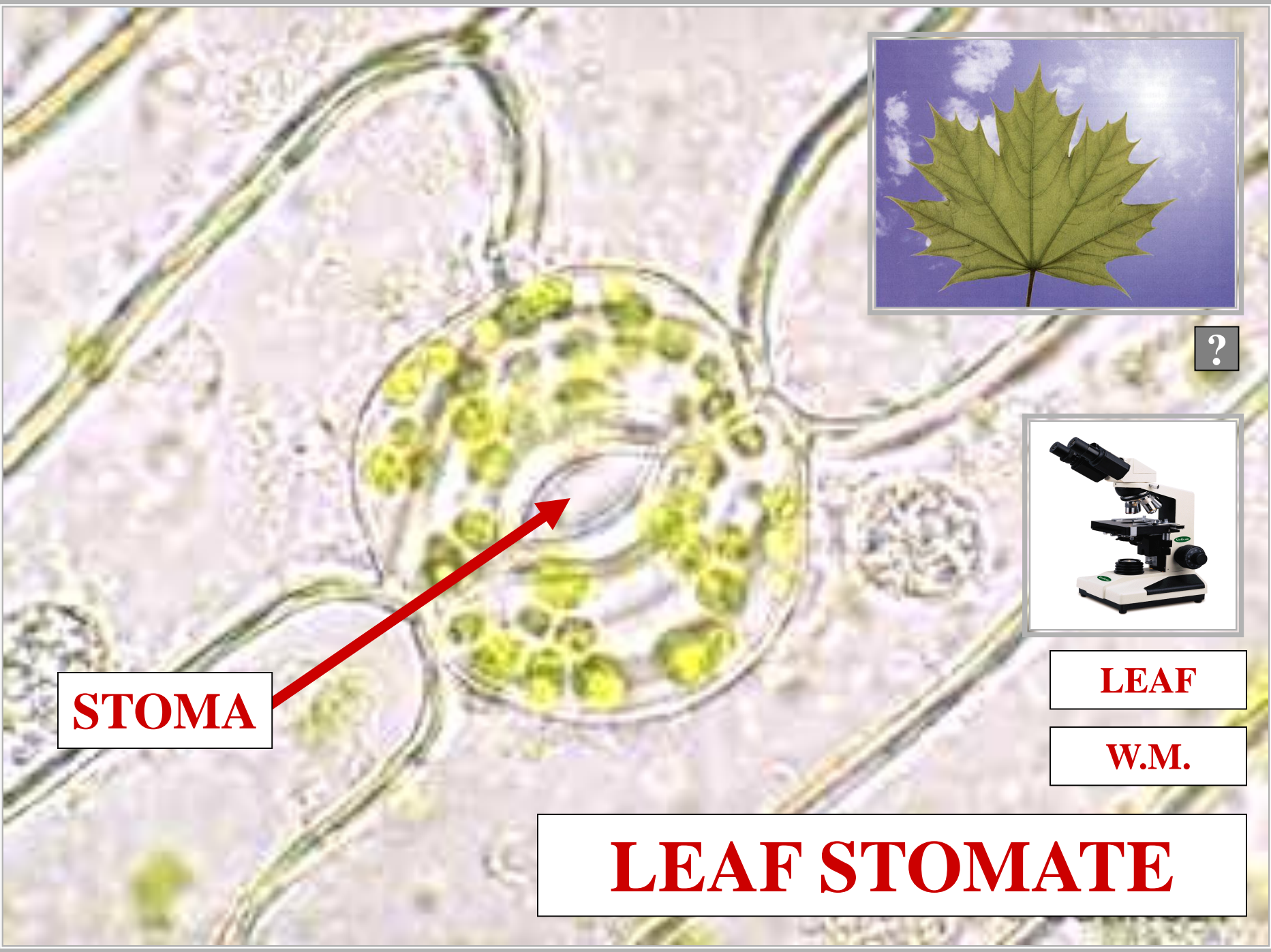


LEAF

W.M.

?

LEAF STOMATE

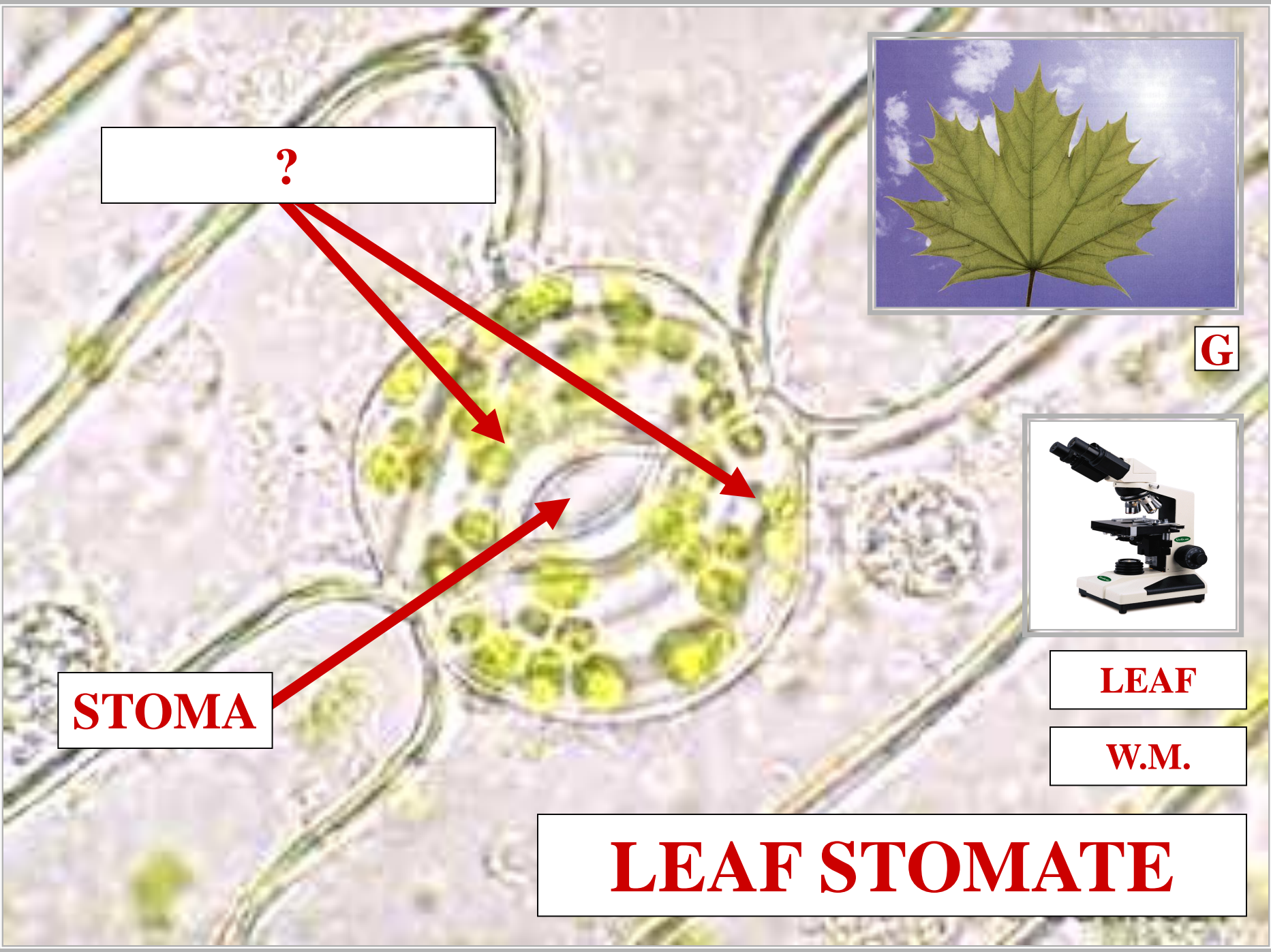


STOMA

LEAF

W.M.

LEAF STOMATE



?



G



STOMA

LEAF

W.M.

LEAF STOMATE

GUARD CELLS



STOMA

LEAF

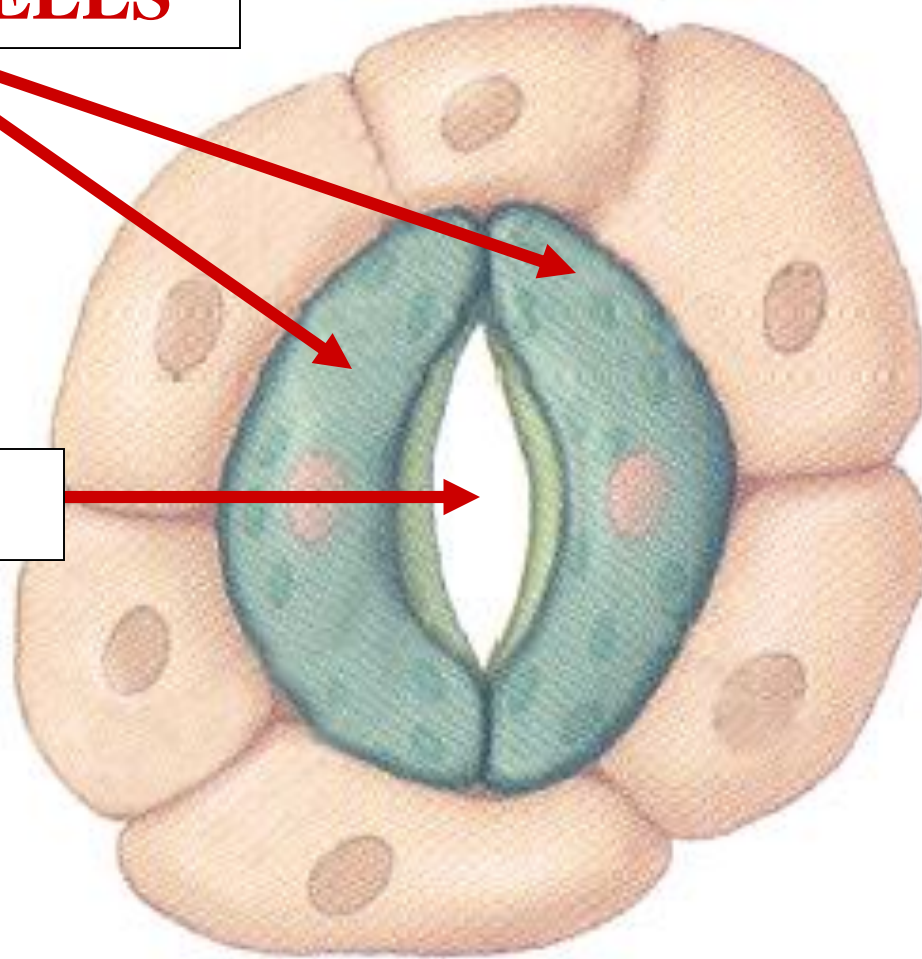
W.M.

LEAF STOMATE

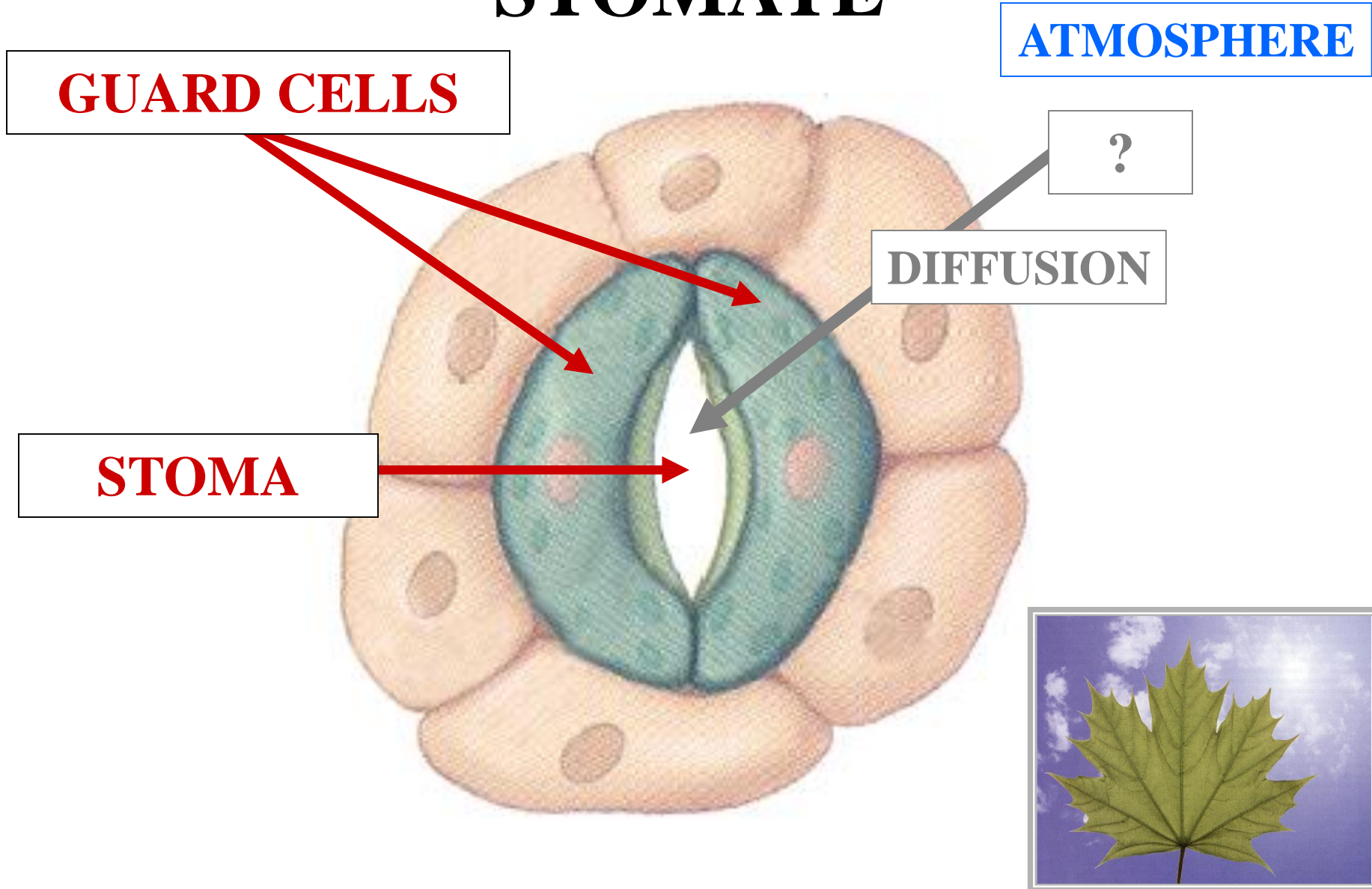
LEAF STOMATE

GUARD CELLS

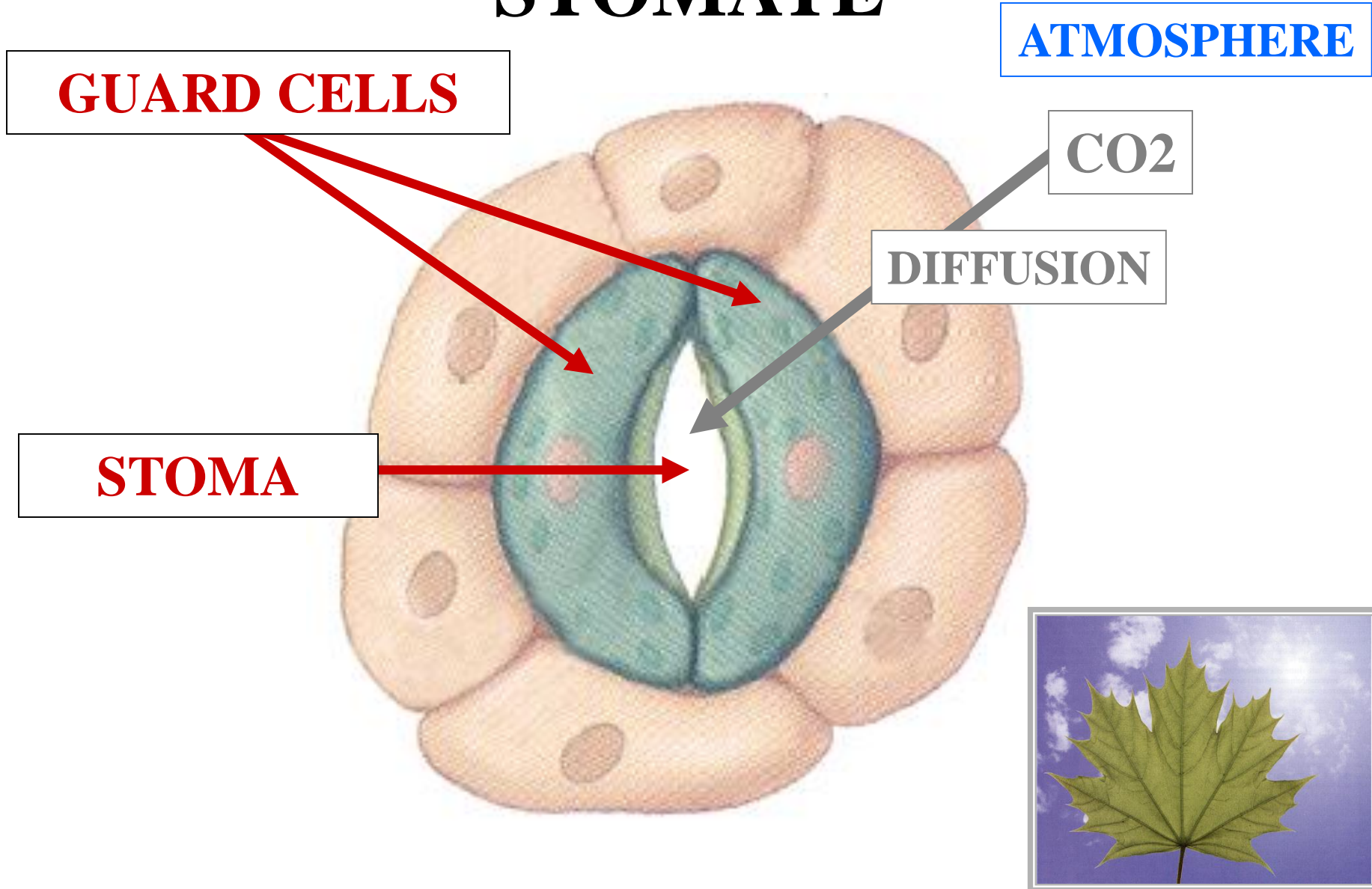
STOMA



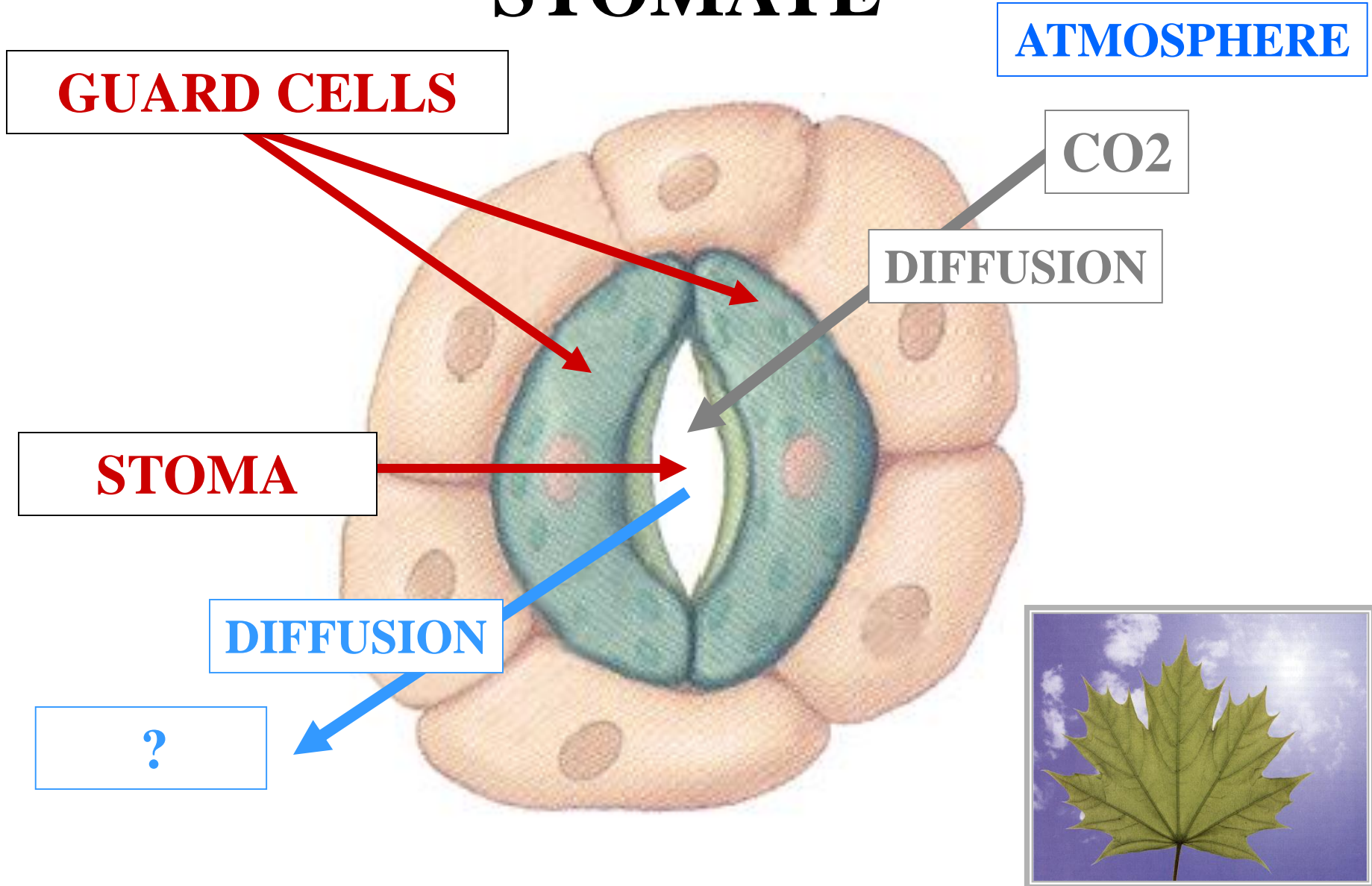
LEAF STOMATE



LEAF STOMATE



LEAF STOMATE



GUARD CELLS

ATMOSPHERE

CO2

DIFFUSION

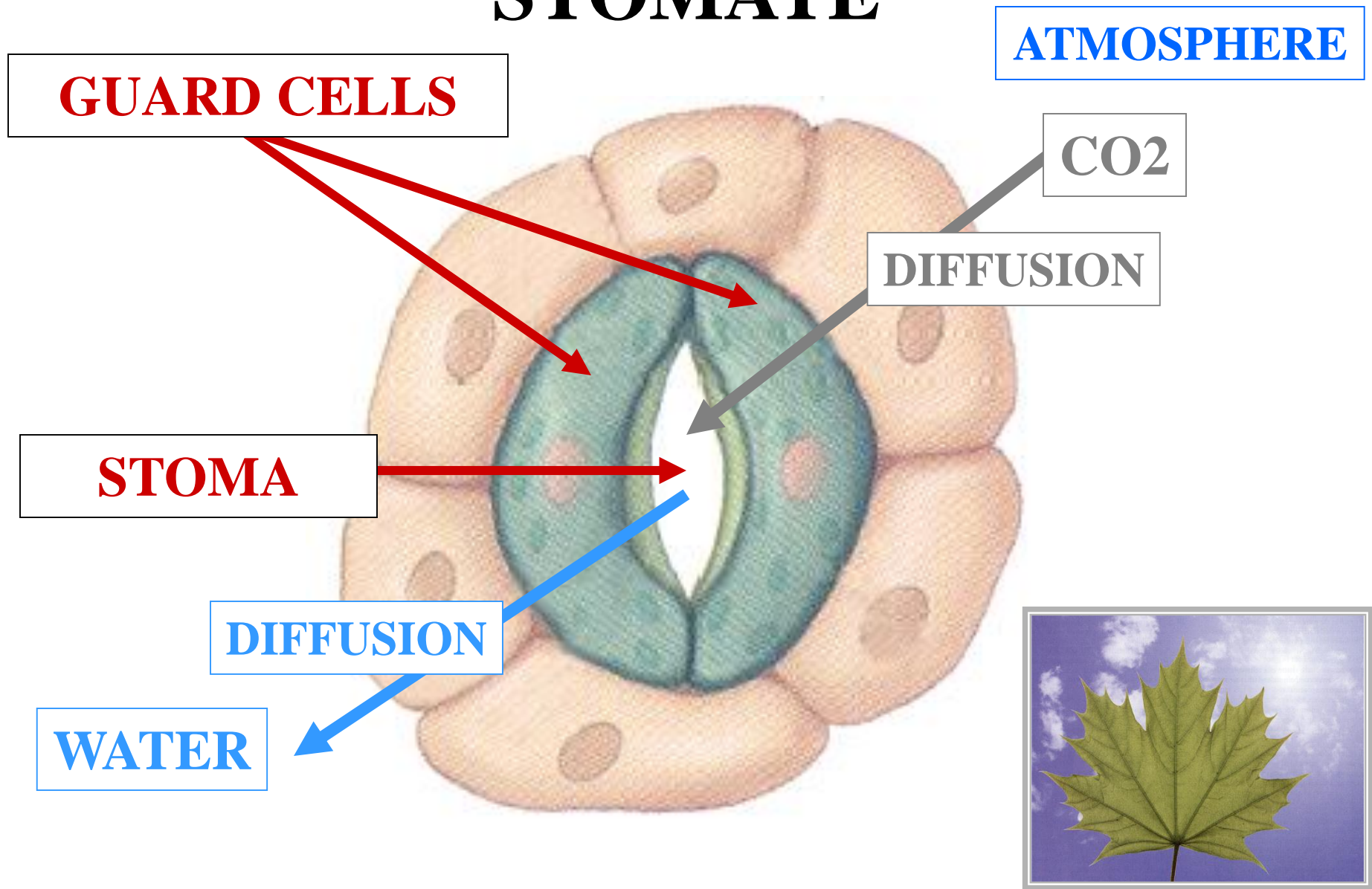
STOMA

DIFFUSION

?



LEAF STOMATE





*WATER
RETENTION
VITAL*



*EFFICIENT
METABOLISM*

A large, vibrant green maple leaf is the central focus, set against a bright blue sky with scattered white clouds. The leaf's veins are clearly visible, and its edges are serrated. The overall composition is clean and natural.

ORGANIZATION INCREASES



*ENTROPY
DECREASES*



HOMEOSTASIS

PHOTOSYNTHESIS

WATER

WATER

WATER

LEAF
DESICICATION
OCCURS DURING
PHOTOSYNTHETIC

MAPLE



LEAF STOMATE



C

ATMOSPHERE

GUARD CELLS

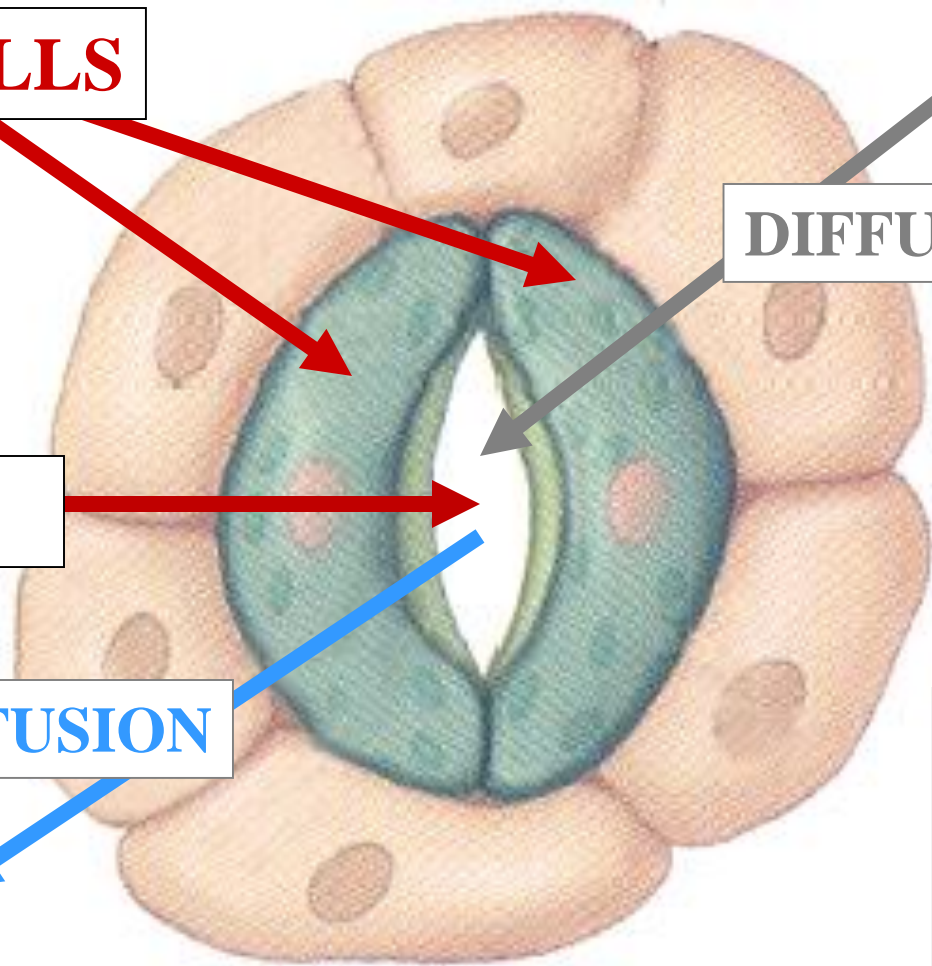
CO₂

DIFFUSION

STOMA

DIFFUSION

WATER



LEAF STOMATE

