

TYPICAL PLANT ORGANS

ROOT
STEM

TYPICAL PLANT ORGANS

TYPICAL PLANT ORGANS

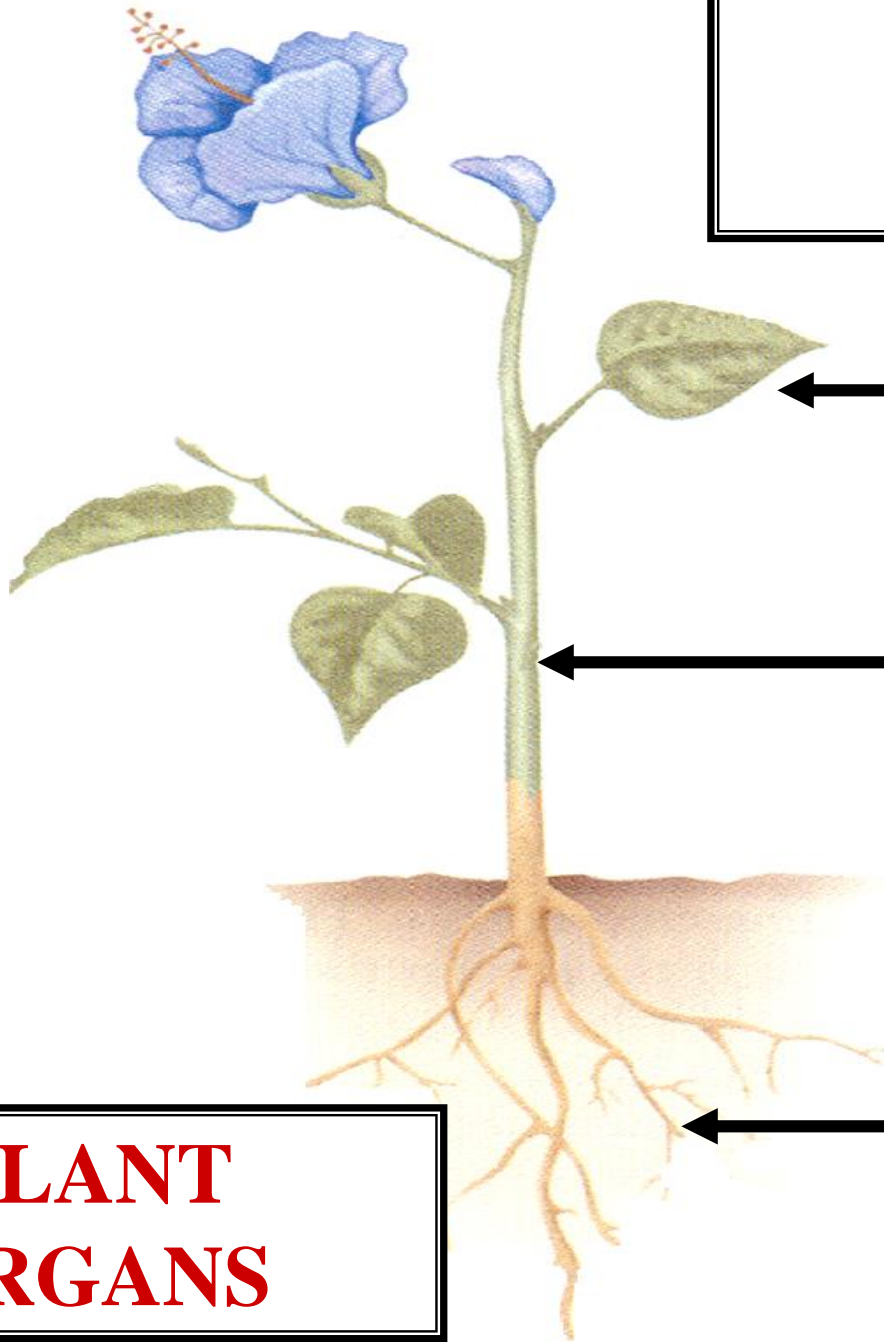


ROOT
STEM
LEAF

TYPICAL PLANT ORGANS

TYPICAL PLANT

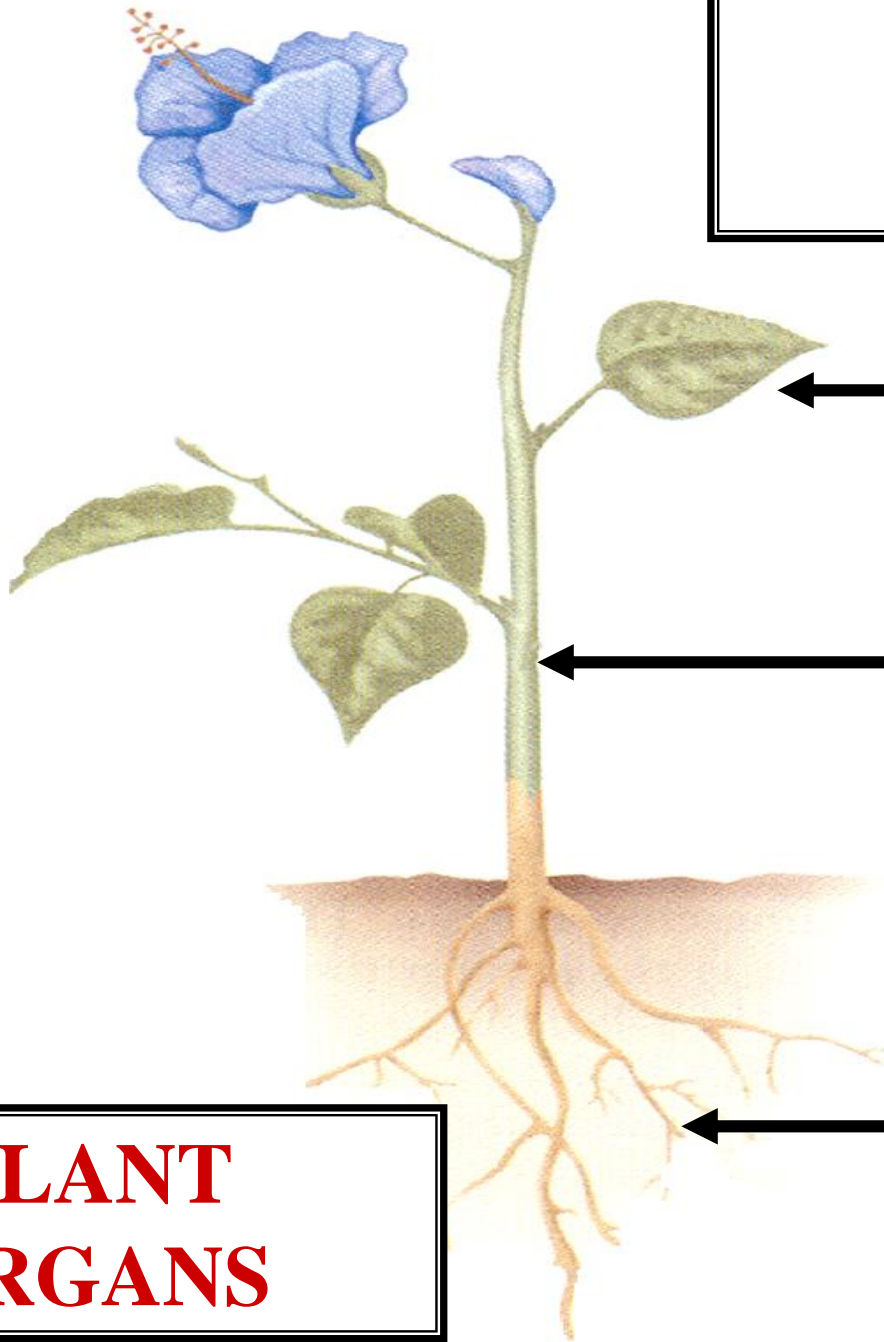
R



**PLANT
ORGANS**

TYPICAL PLANT

S

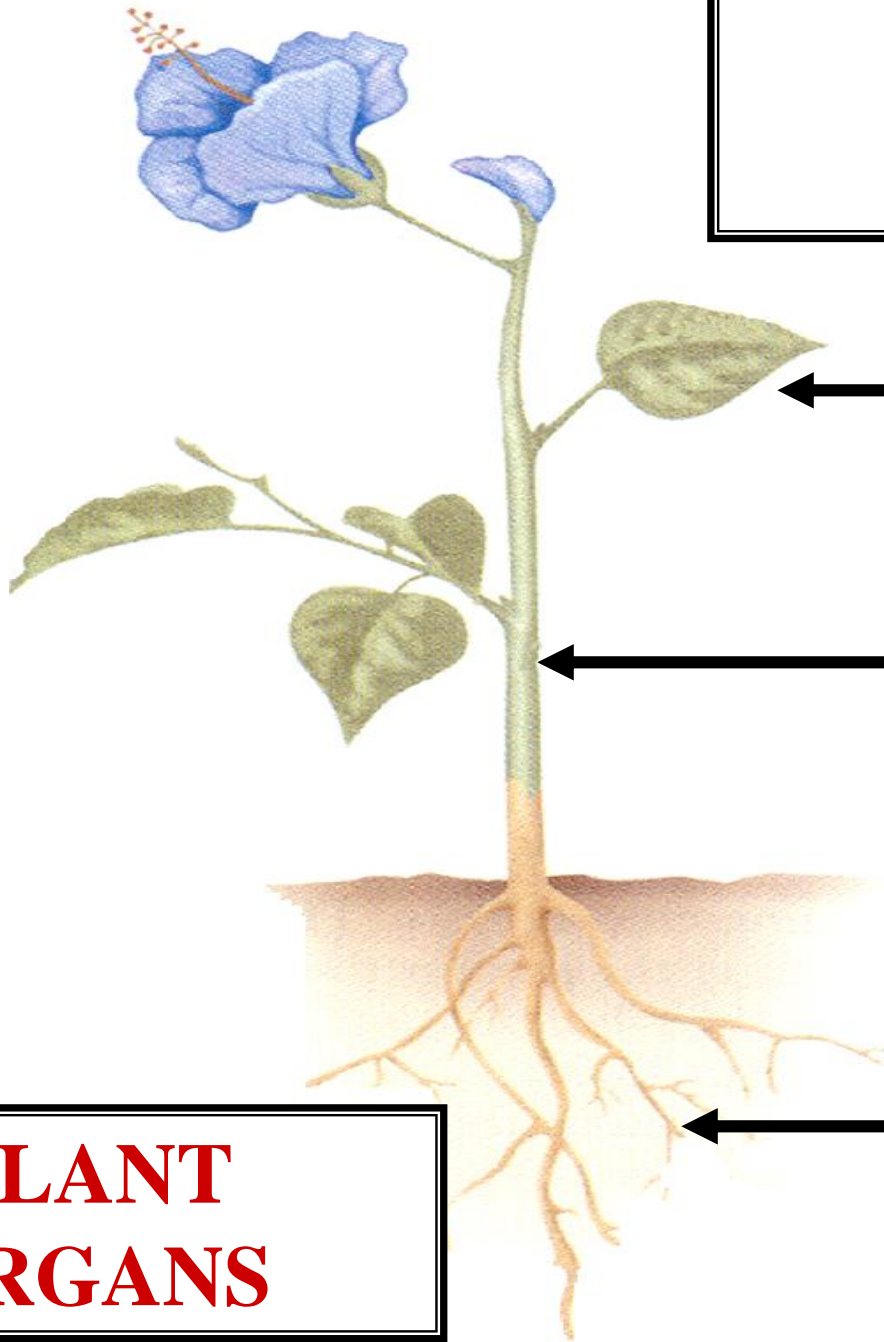


ROOT

**PLANT
ORGANS**

TYPICAL PLANT

L



STEM

ROOT

**PLANT
ORGANS**

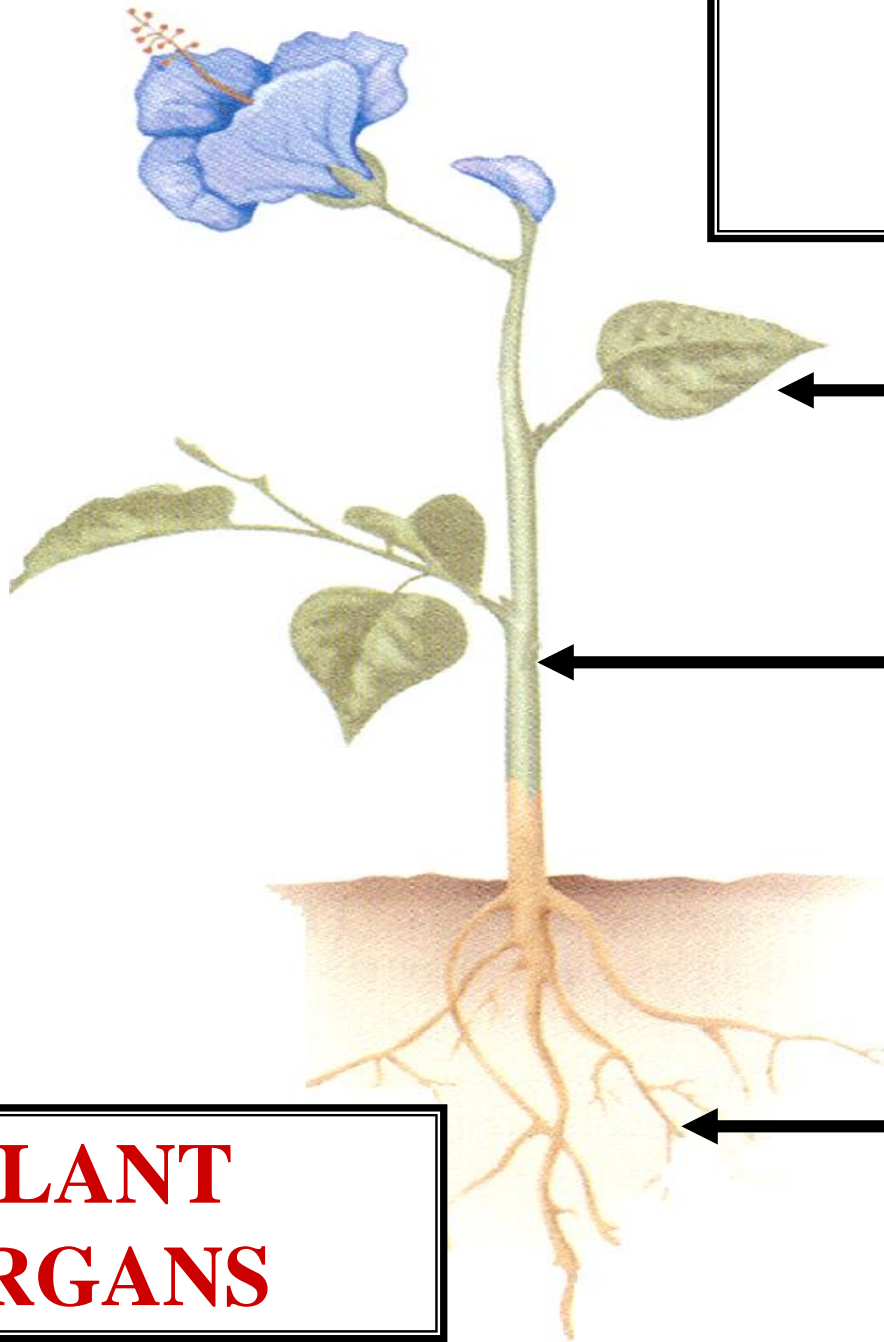
TYPICAL PLANT

LEAF

STEM

ROOT

**PLANT
ORGANS**



LEAF

LEAF



LEAF

PRINCIPLE PHOTOSYNTHETIC ORGAN

LEAF

PHOTOSYNTHESIS

EX



LEAF
PRINCIPLE
PHOTOSYNTHETIC
ORGAN

MAPLE

PHOTOSYNTHESIS

EG



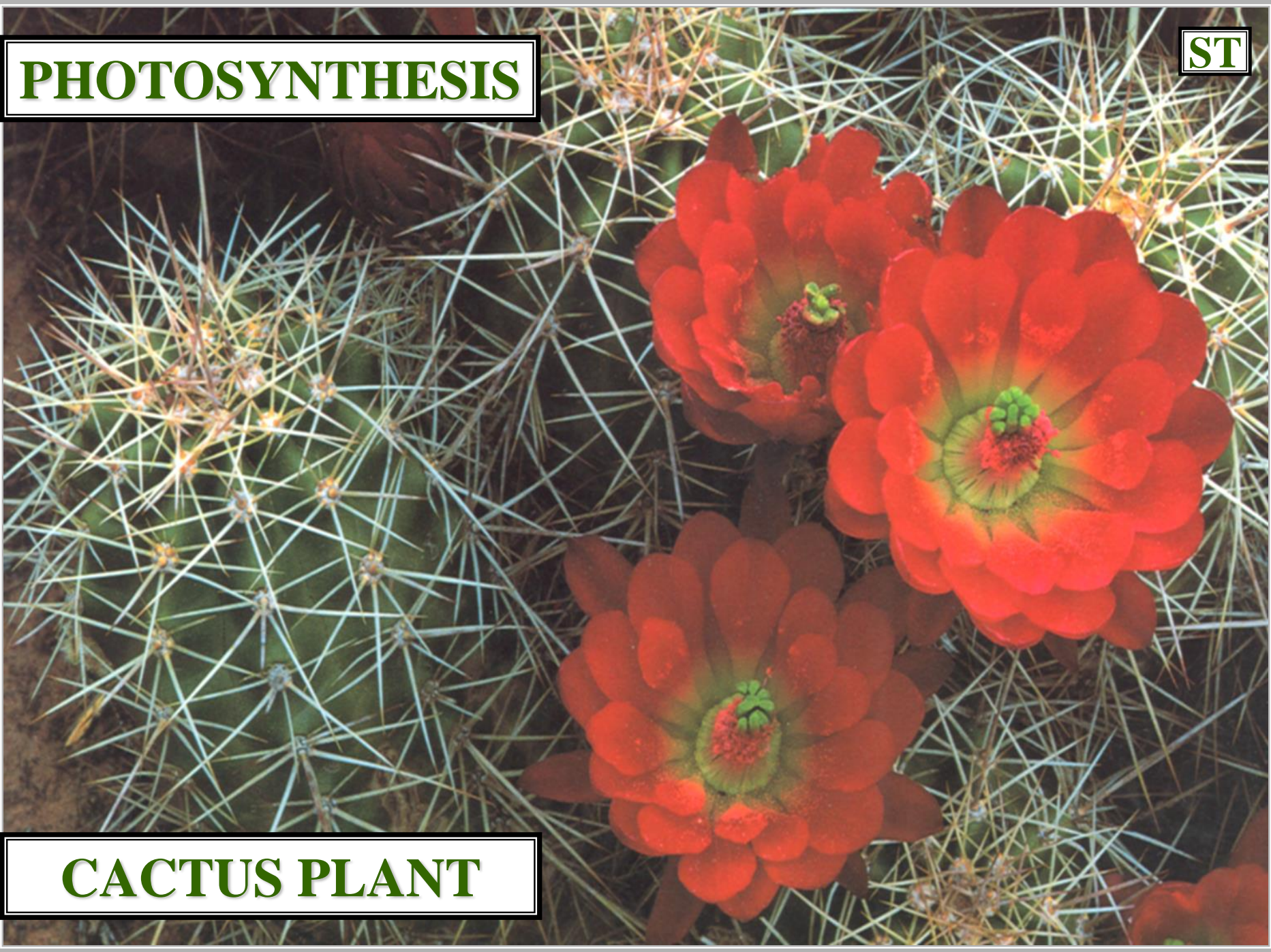
LEAF
PRINCIPLE
PHOTOSYNTHETIC
ORGAN
NUMEROUS EXCEPTIONS

MAPLE

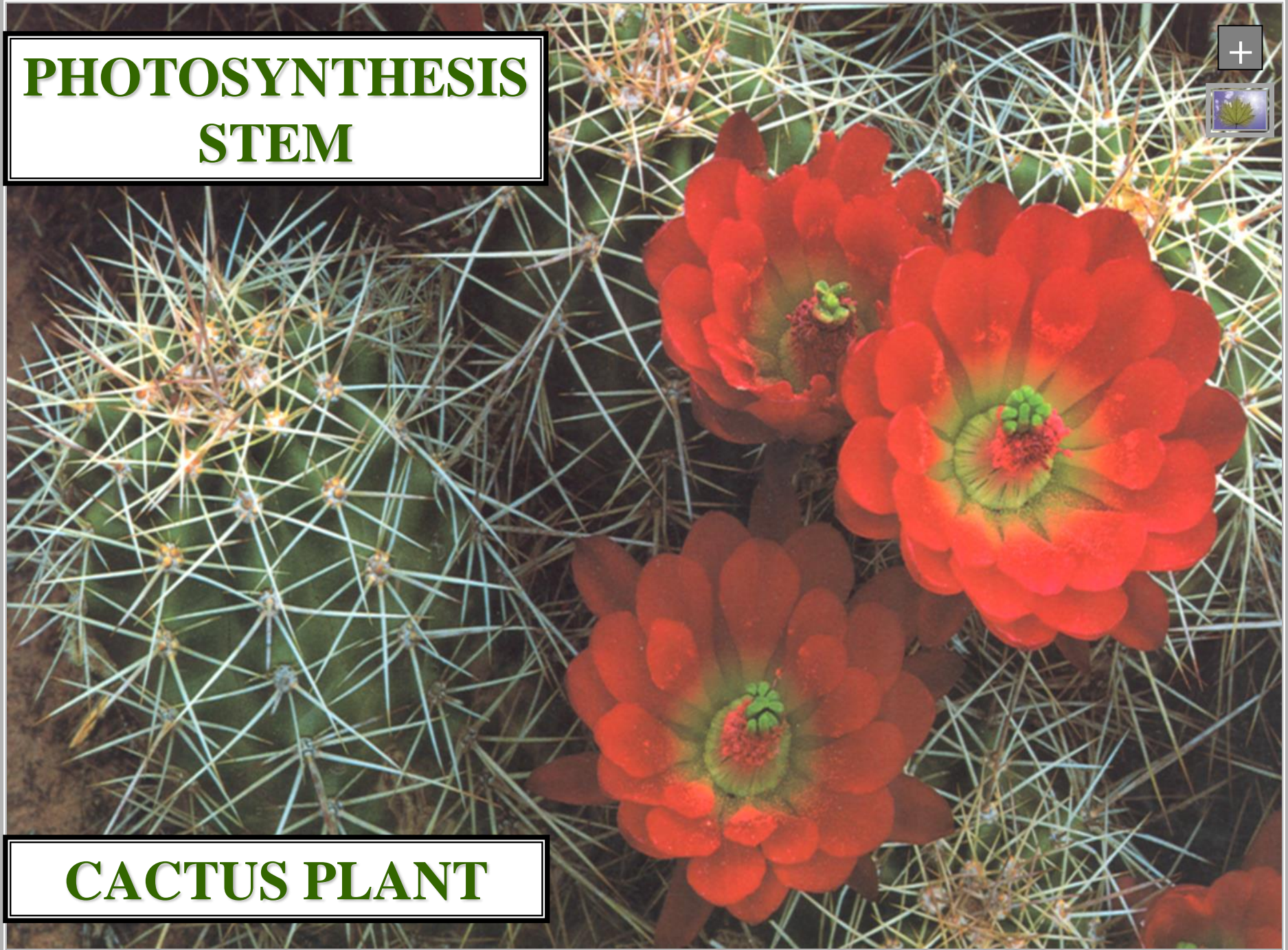
PHOTOSYNTHESIS

ST

CACTUS PLANT



PHOTOSYNTHESIS STEM



CACTUS PLANT

PHOTOSYNTHESIS



LEAF
PRINCIPLE
PHOTOSYNTHETIC
ORGAN

MAPLE

PHOTOSYNTHESIS



LEAF ANATOMY

MAPLE



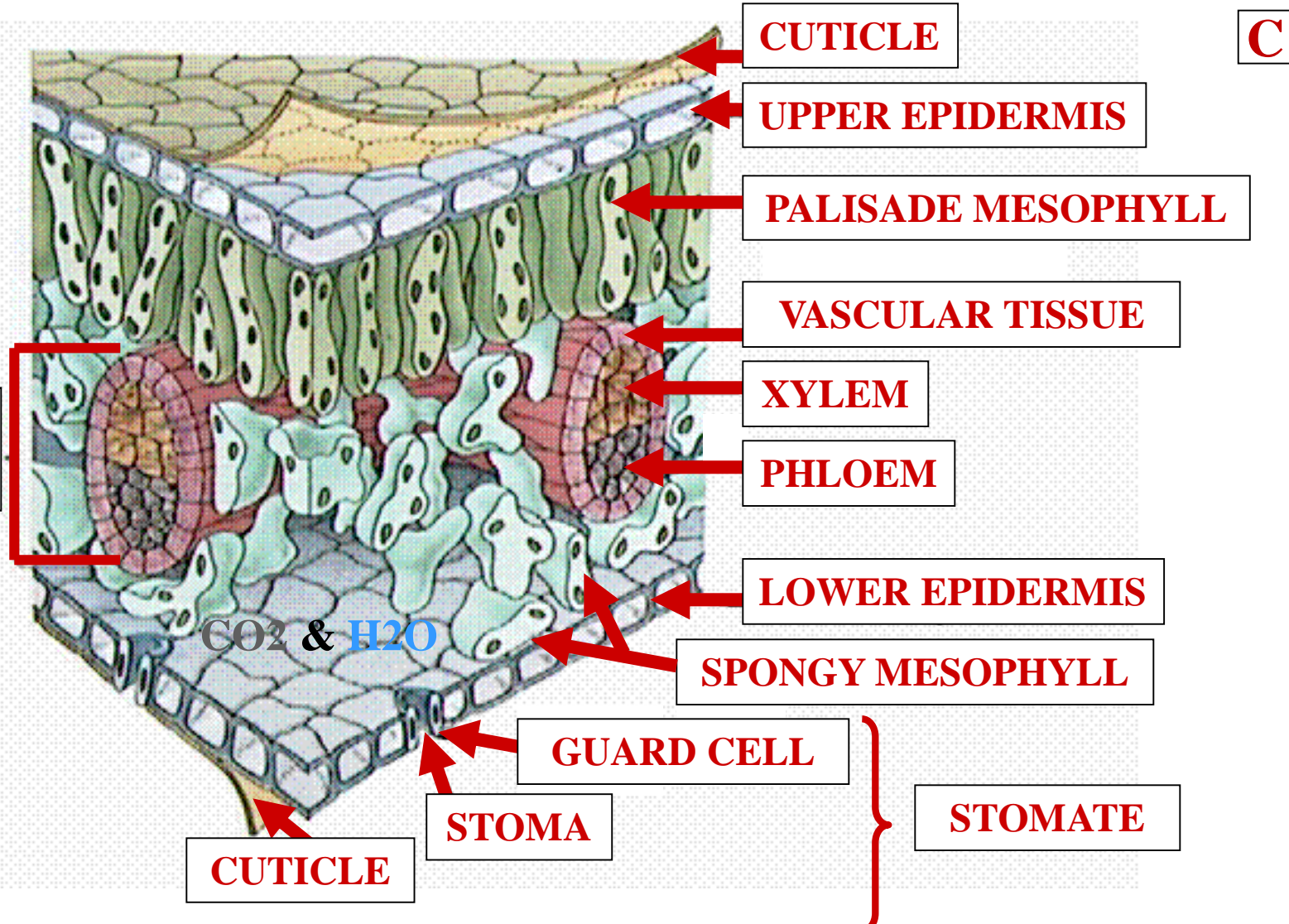
LEAF ANATOMY



LEAF ANATOMY

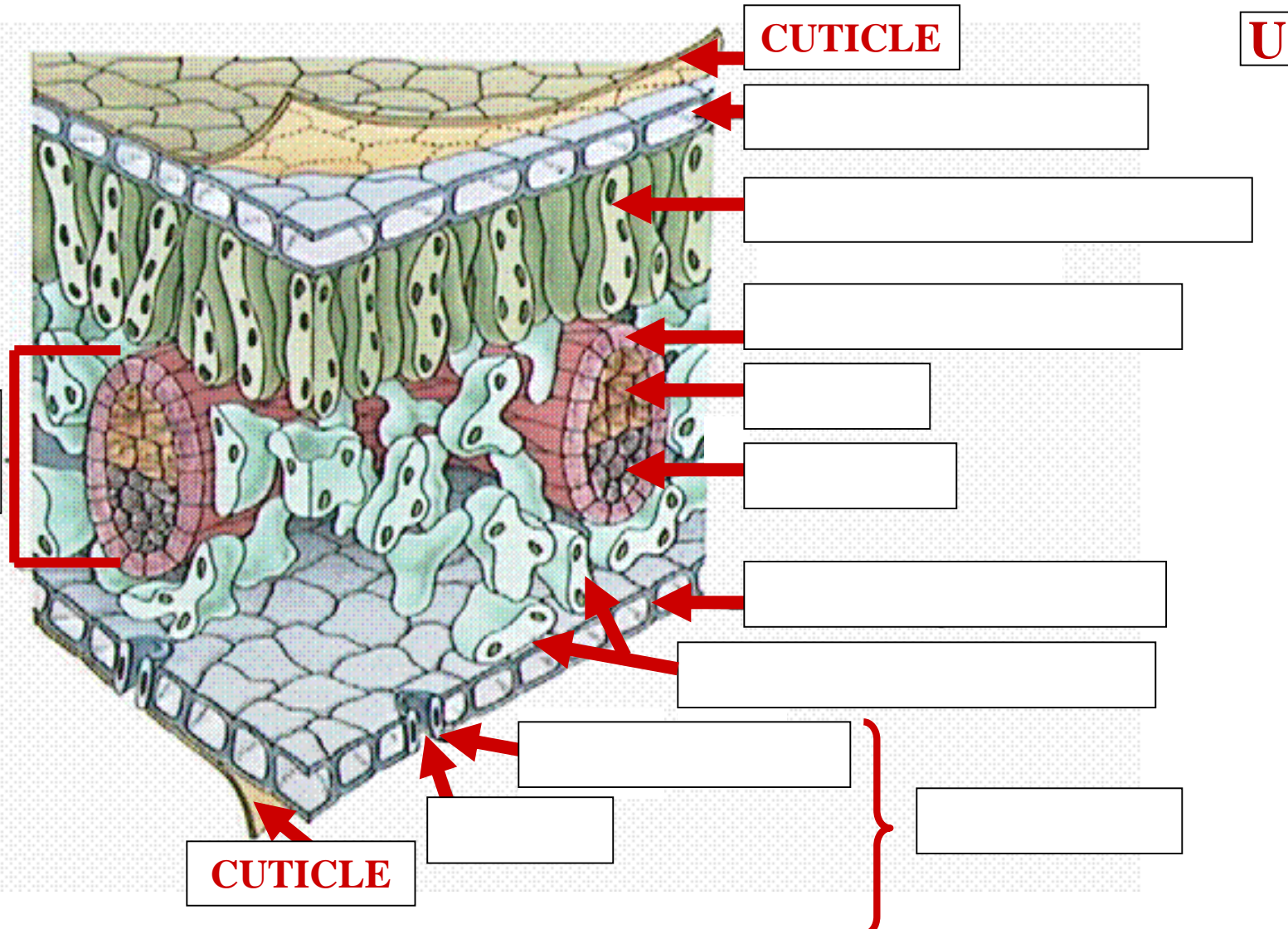


VASCULAR TISSUE



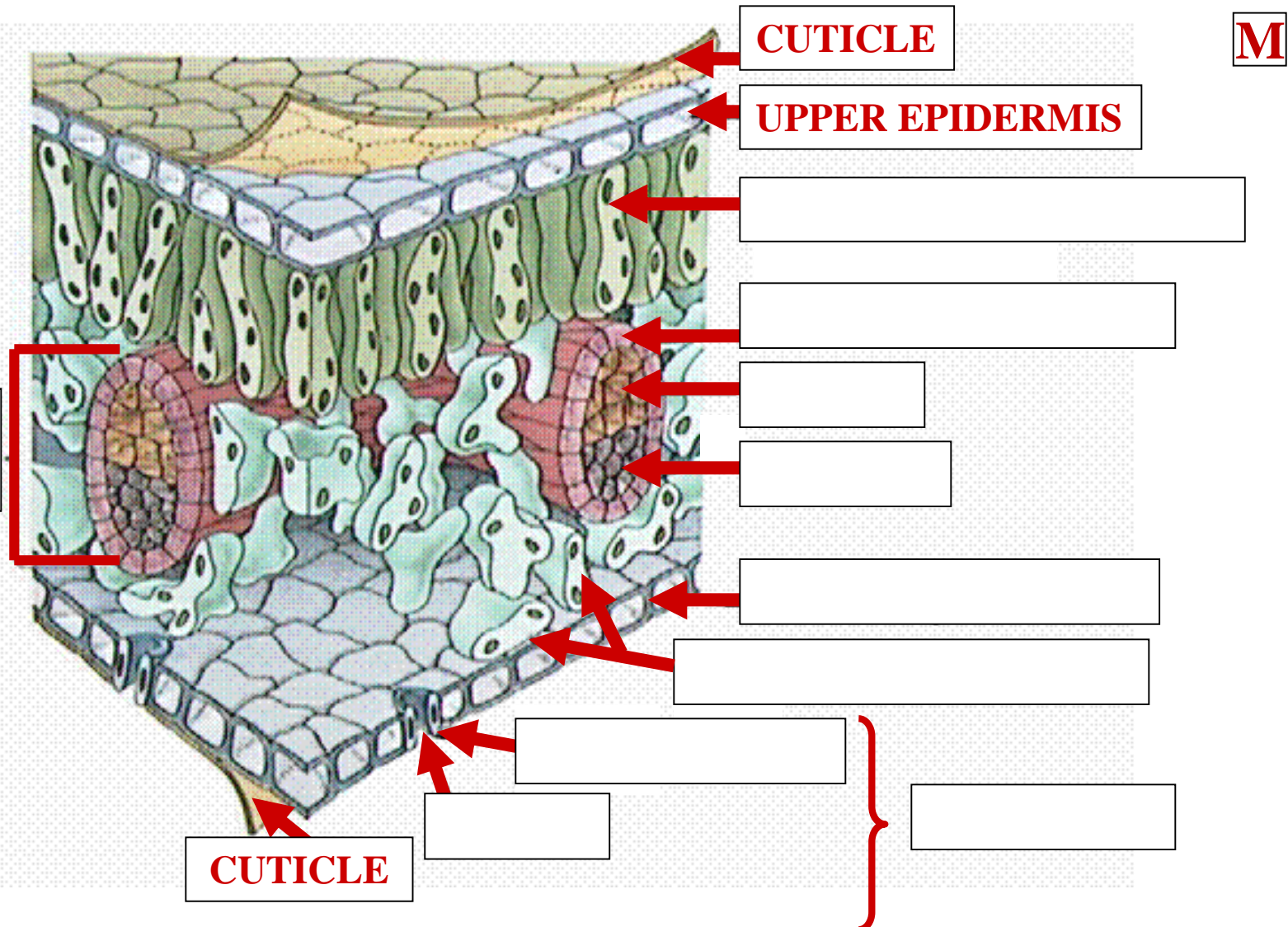


LEAF ANATOMY



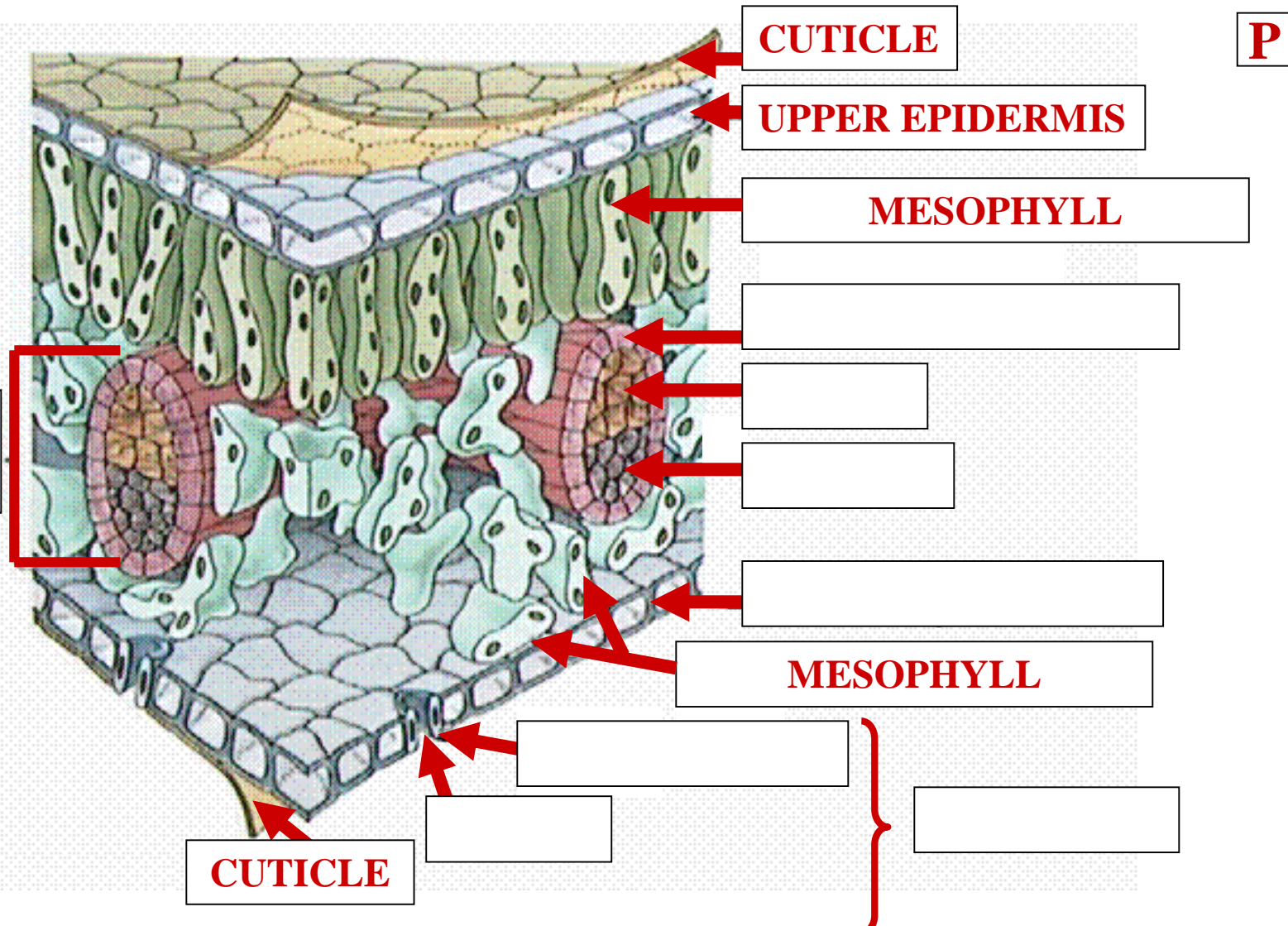


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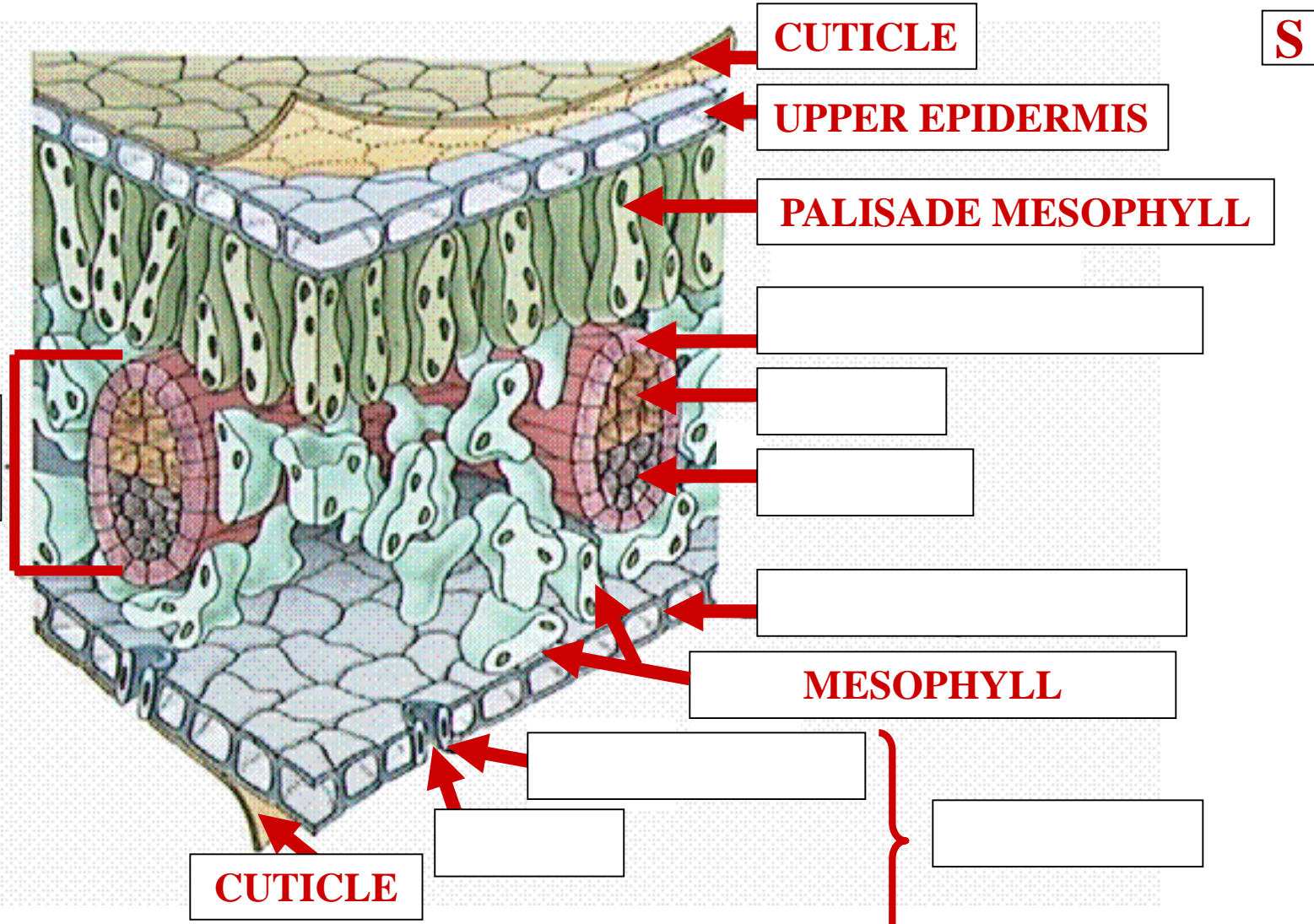


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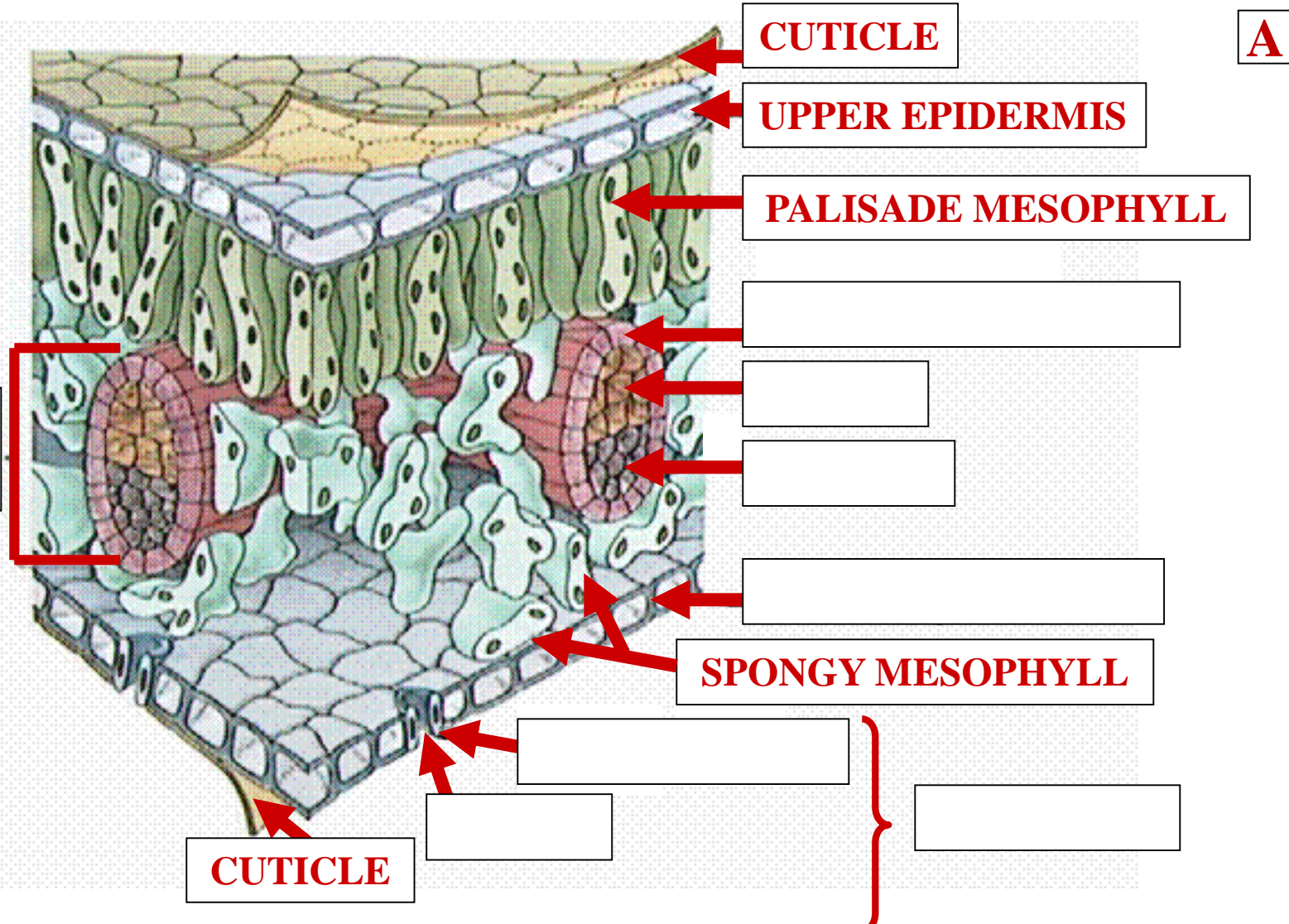




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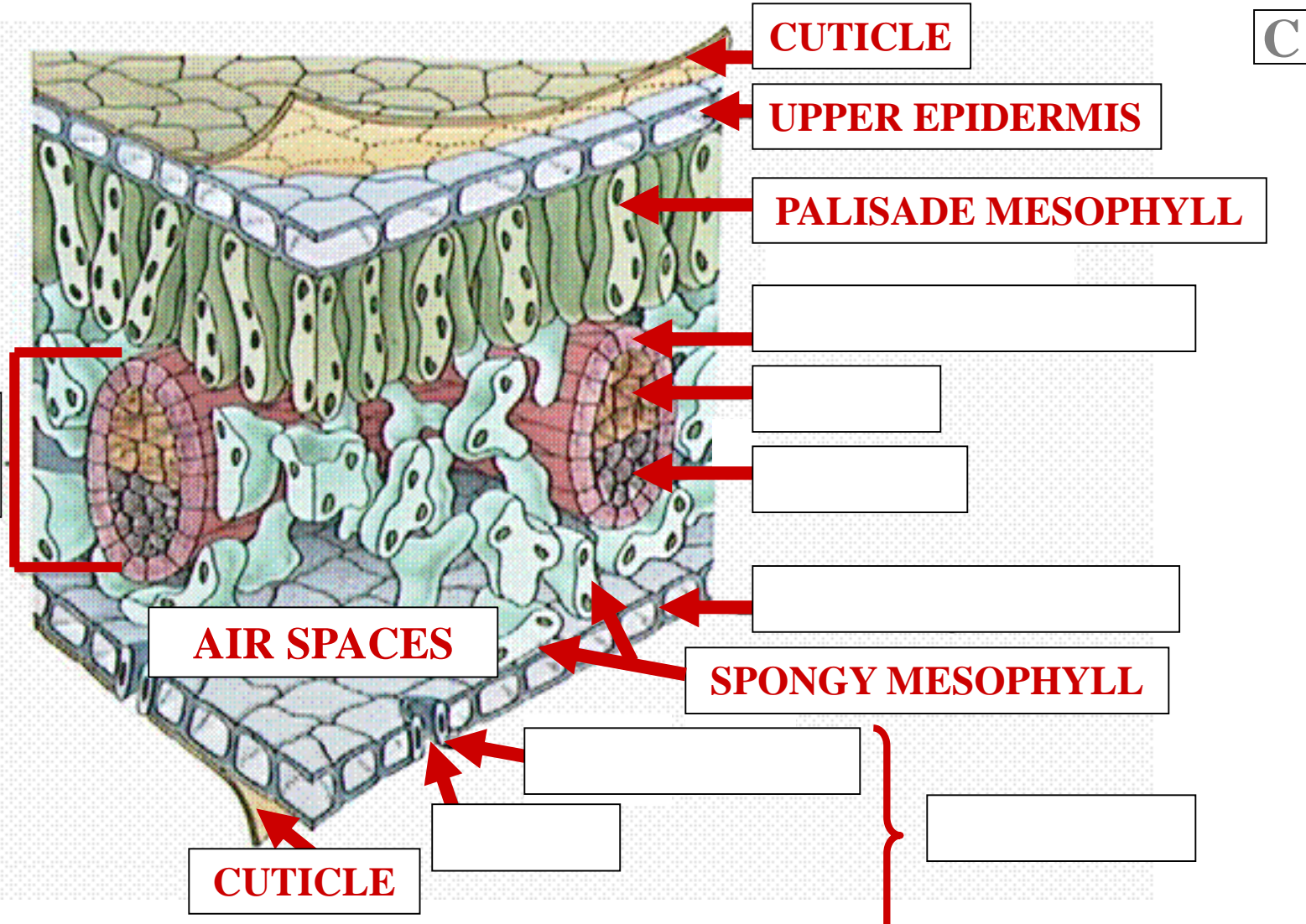


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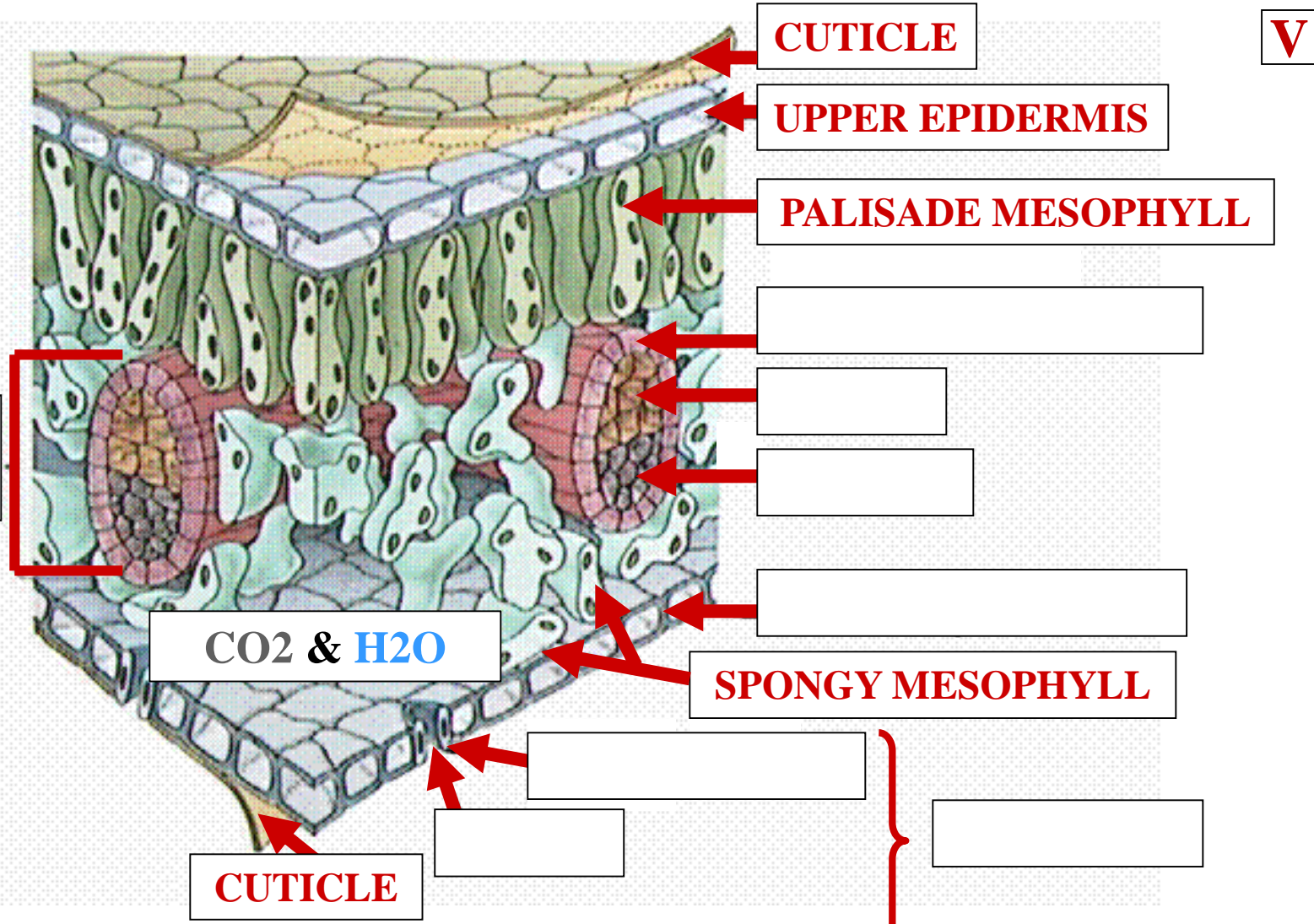
LEAF ANATOMY



C.S.

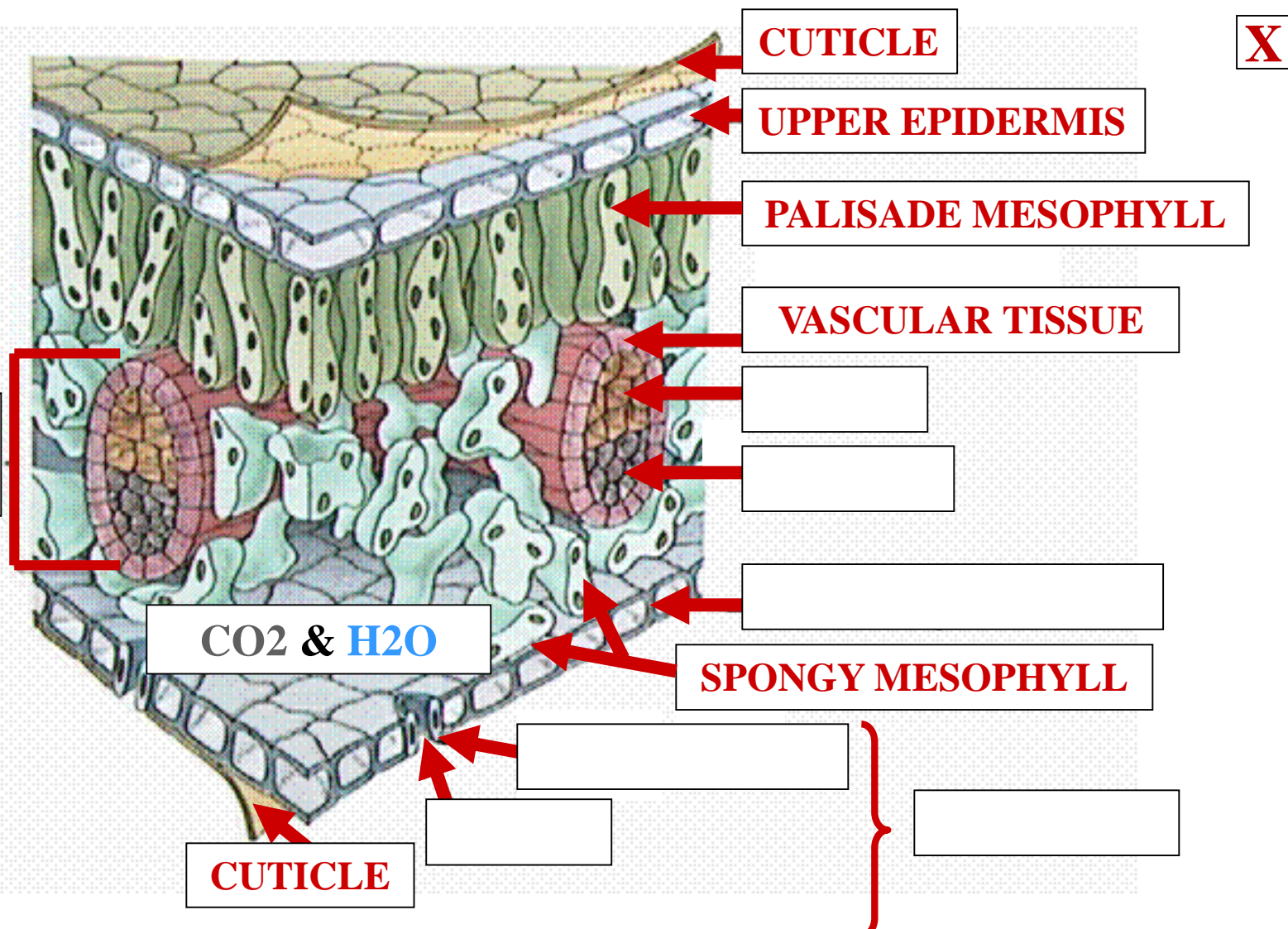


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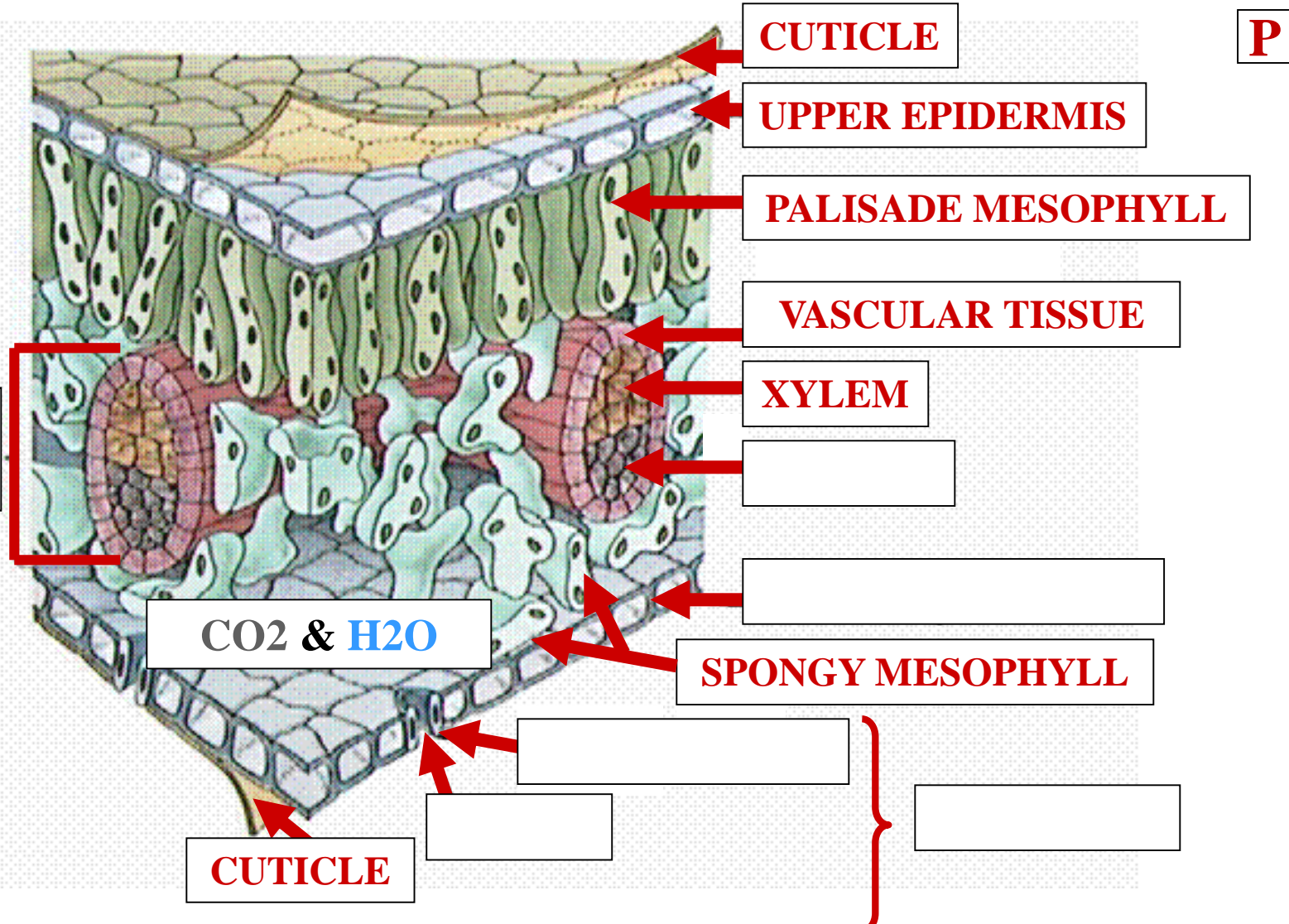
LEAF ANATOMY





LEAF ANATOMY

P



VASCULAR TISSUE

CO₂ & H₂O

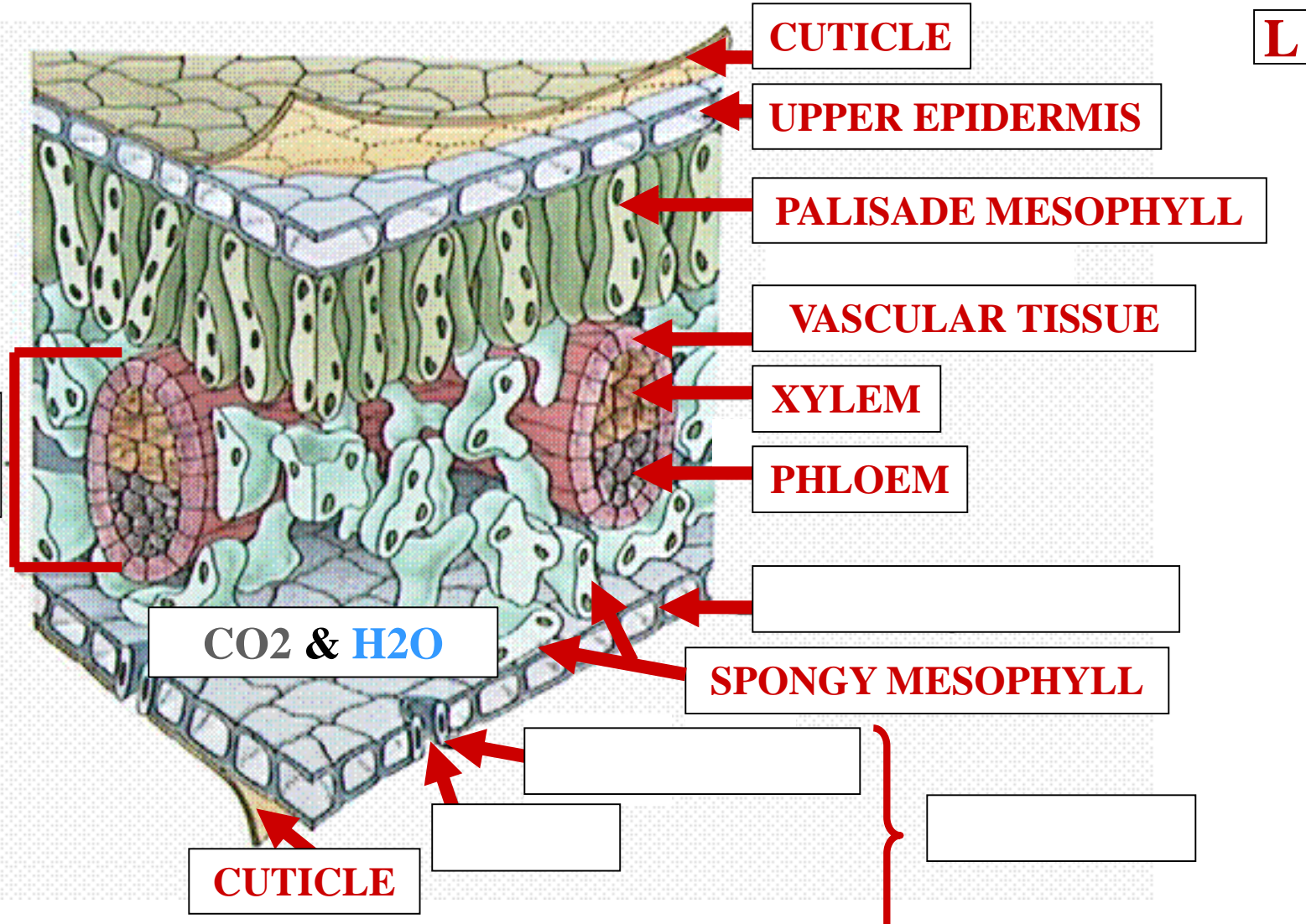
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LEAF ANATOMY



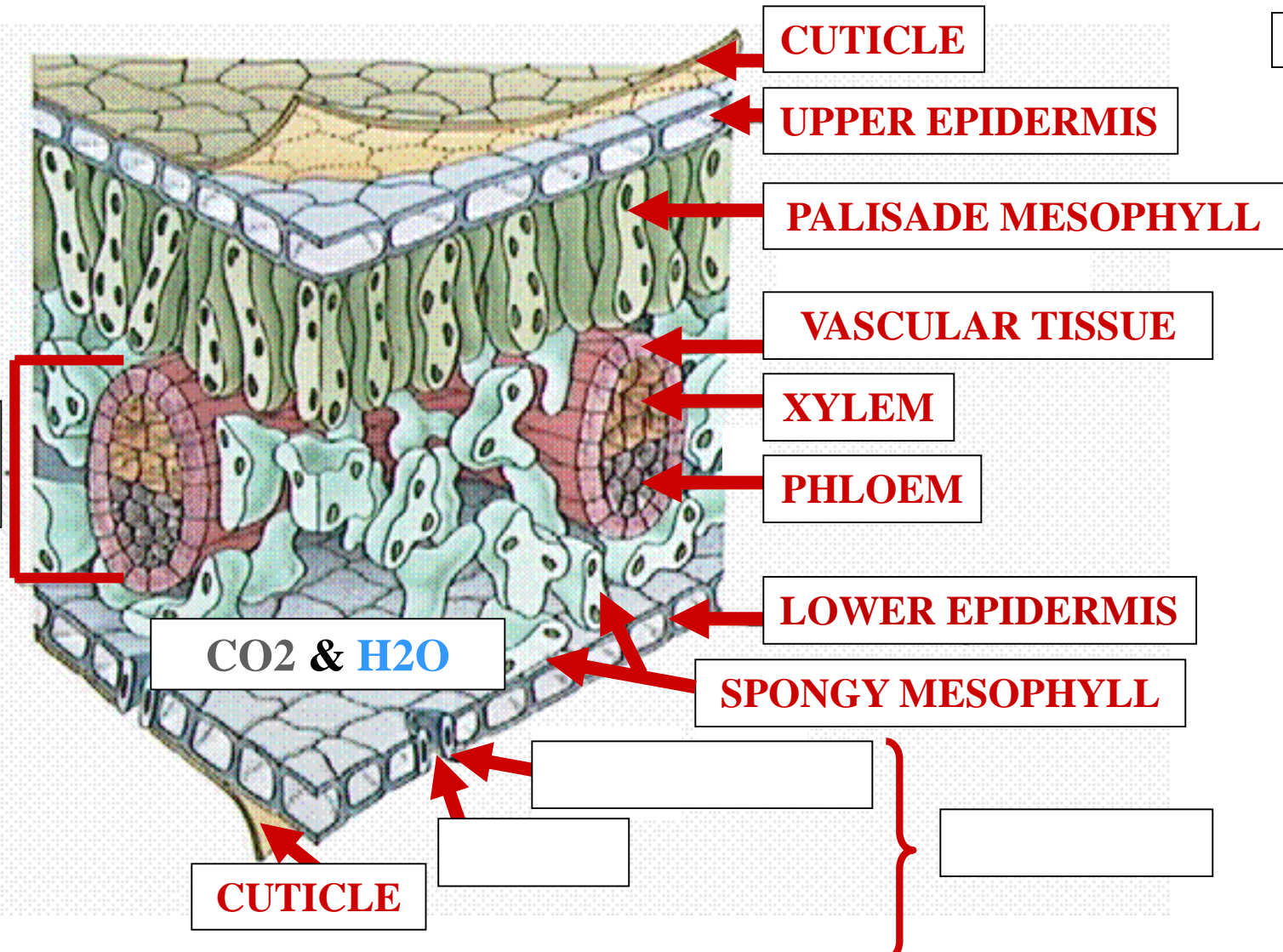
VASCULAR TISSUE





LEAF ANATOMY

S



VASCULAR TISSUE

CUTICLE

UPPER EPIDERMIS

PALISADE MESOPHYLL

VASCULAR TISSUE

XYLEM

PHLOEM

LOWER EPIDERMIS

SPONGY MESOPHYLL

CO2 & H2O

C.S.

CUTICLE

[Empty box]

[Empty box]

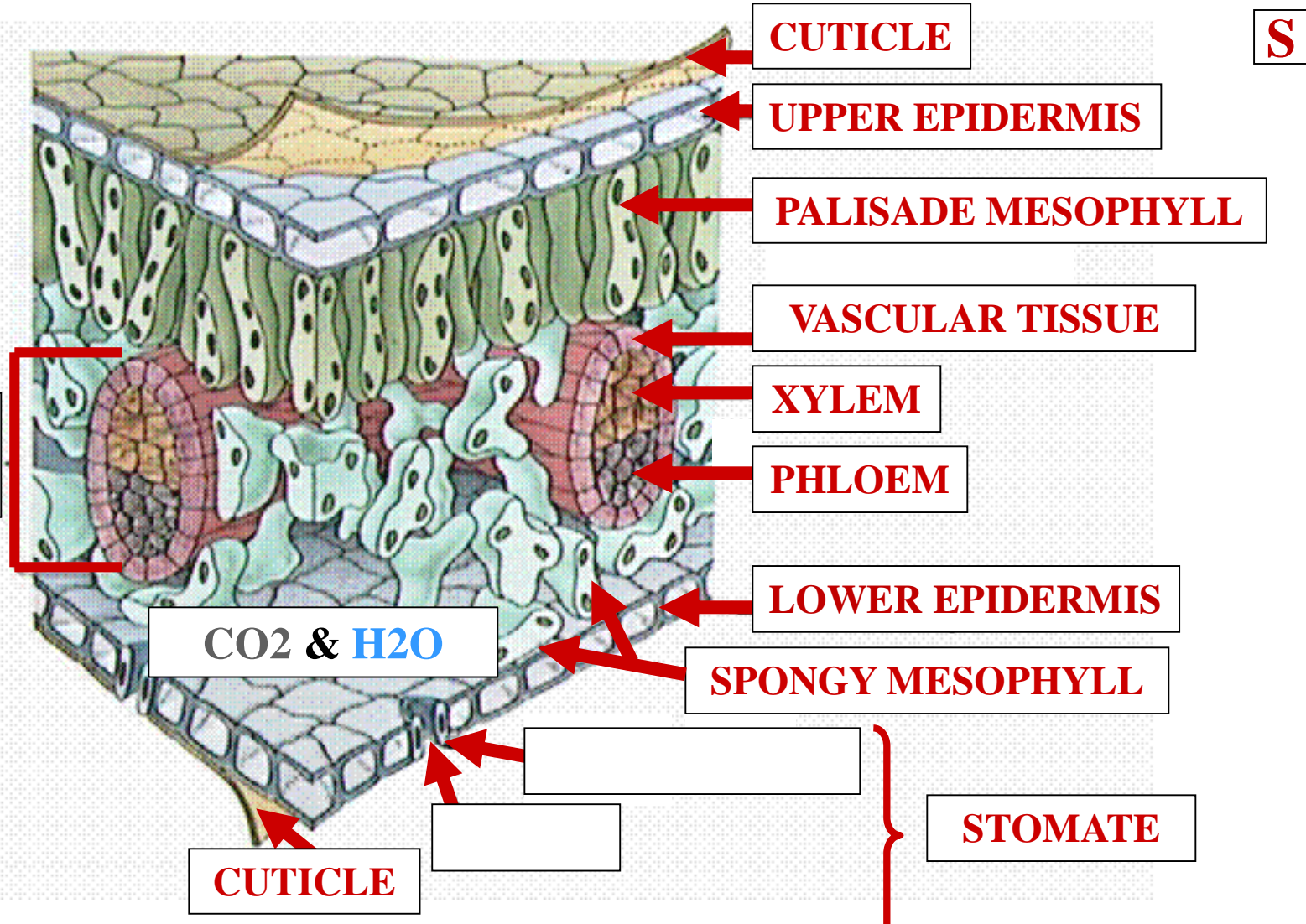
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LEAF ANATOMY



VASCULAR TISSUE



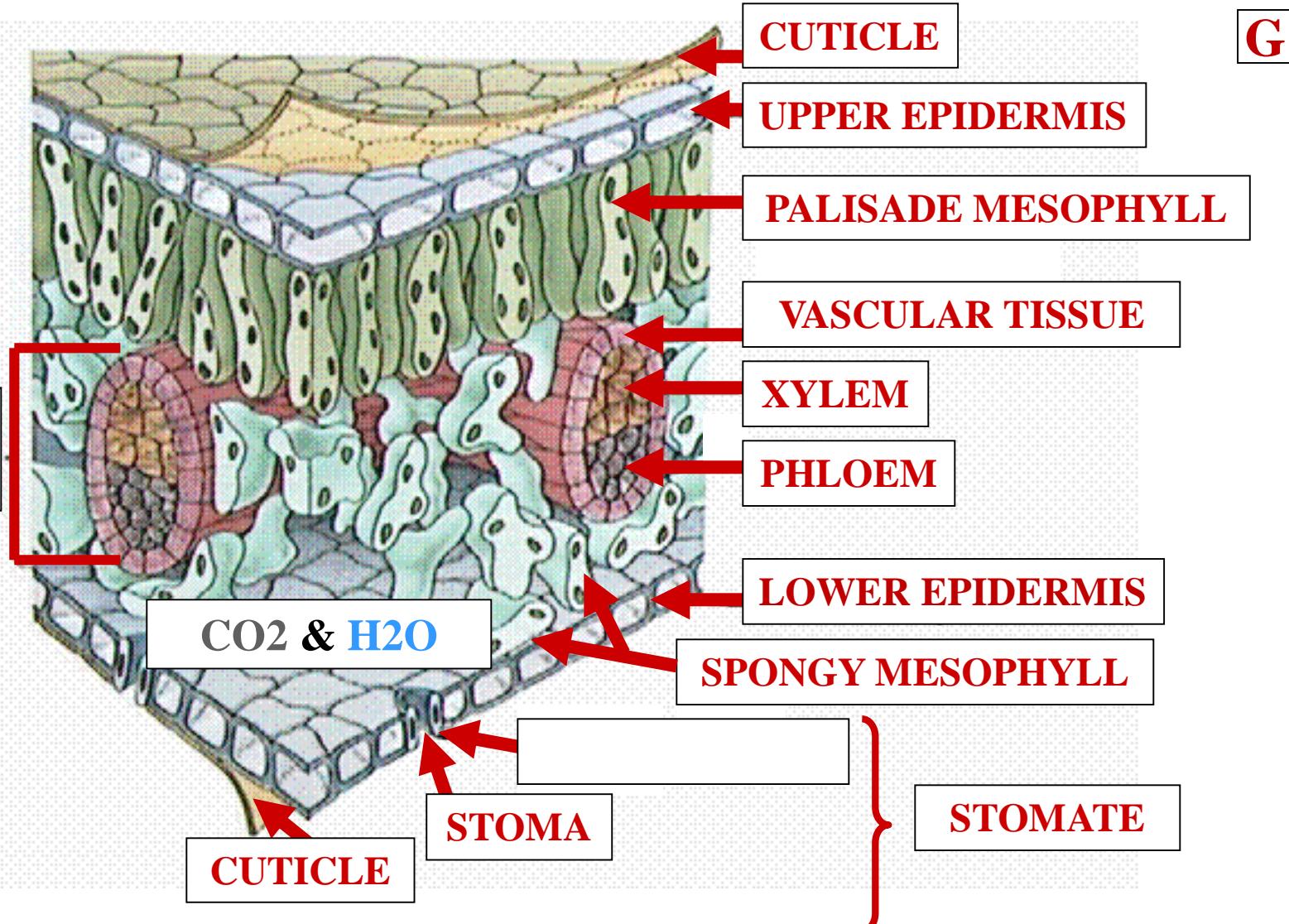


LEAF ANATOMY

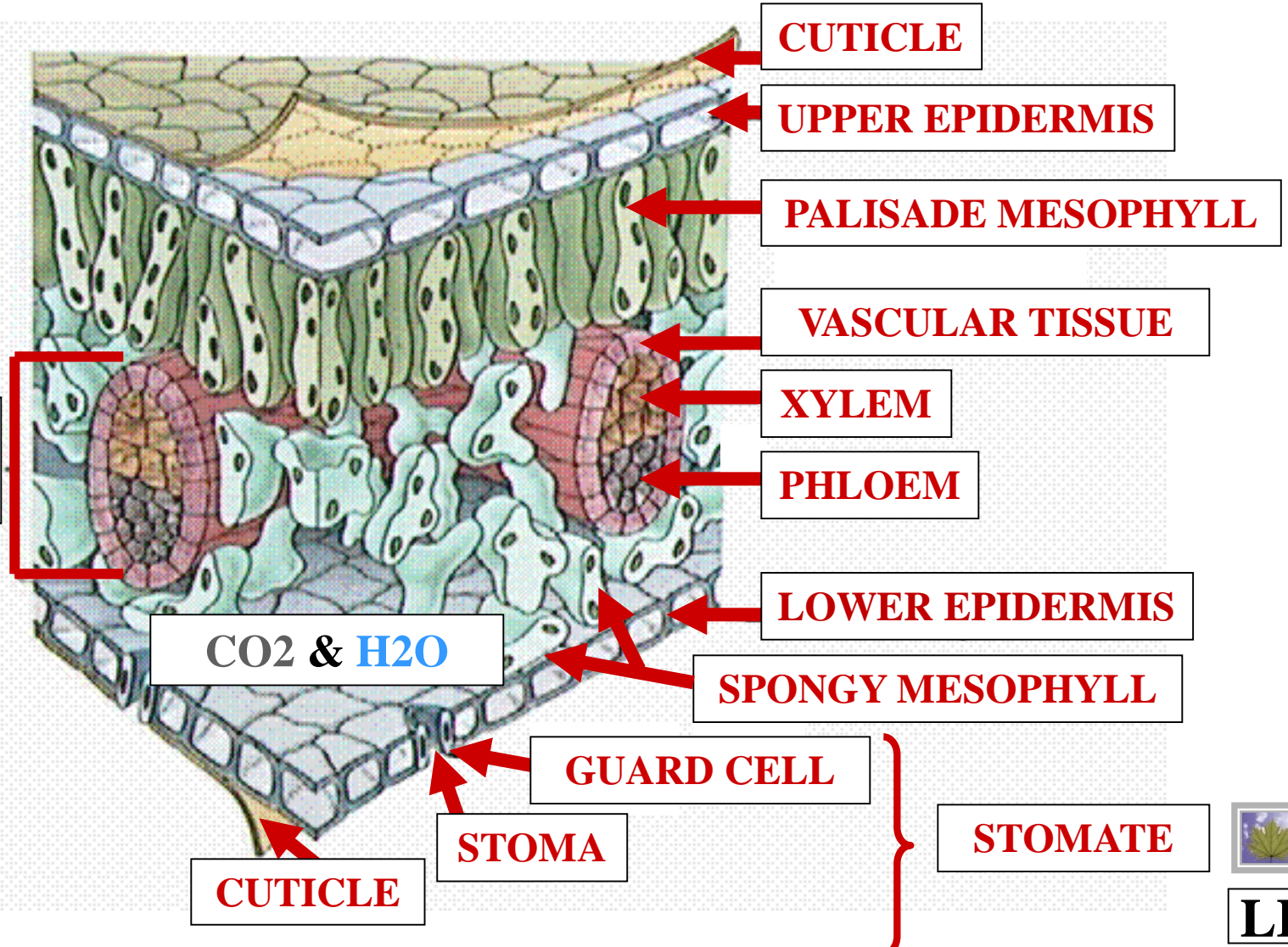


G

VASCULAR TISSUE



LEAF ANATOMY



VASCULAR TISSUE

CUTICLE

UPPER EPIDERMIS

PALISADE MESOPHYLL

VASCULAR TISSUE

XYLEM

PHLOEM

LOWER EPIDERMIS

SPONGY MESOPHYLL

GUARD CELL

STOMA

STOMATE

CO₂ & H₂O

C.S.

CUTICLE



LE

PHOTOSYNTHESIS



**LOWER
EPIDERMIS
LEAF
STOMATE**

LOWER EPIDERMIS



?



LEAF

W.M.

LEAF STOMATE

LOWER EPIDERMIS



S

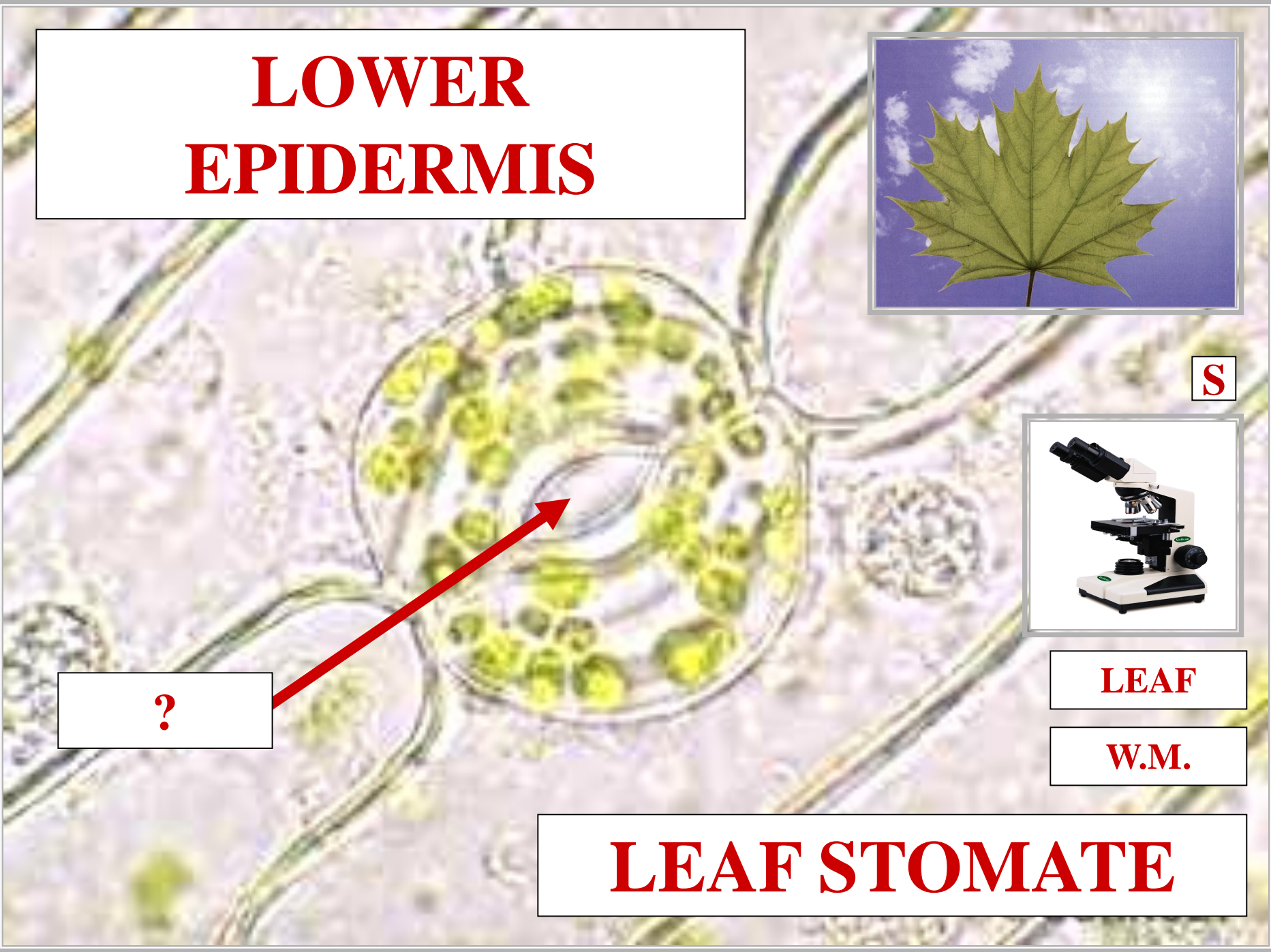


LEAF

W.M.

?

LEAF STOMATE



LOWER EPIDERMIS



?

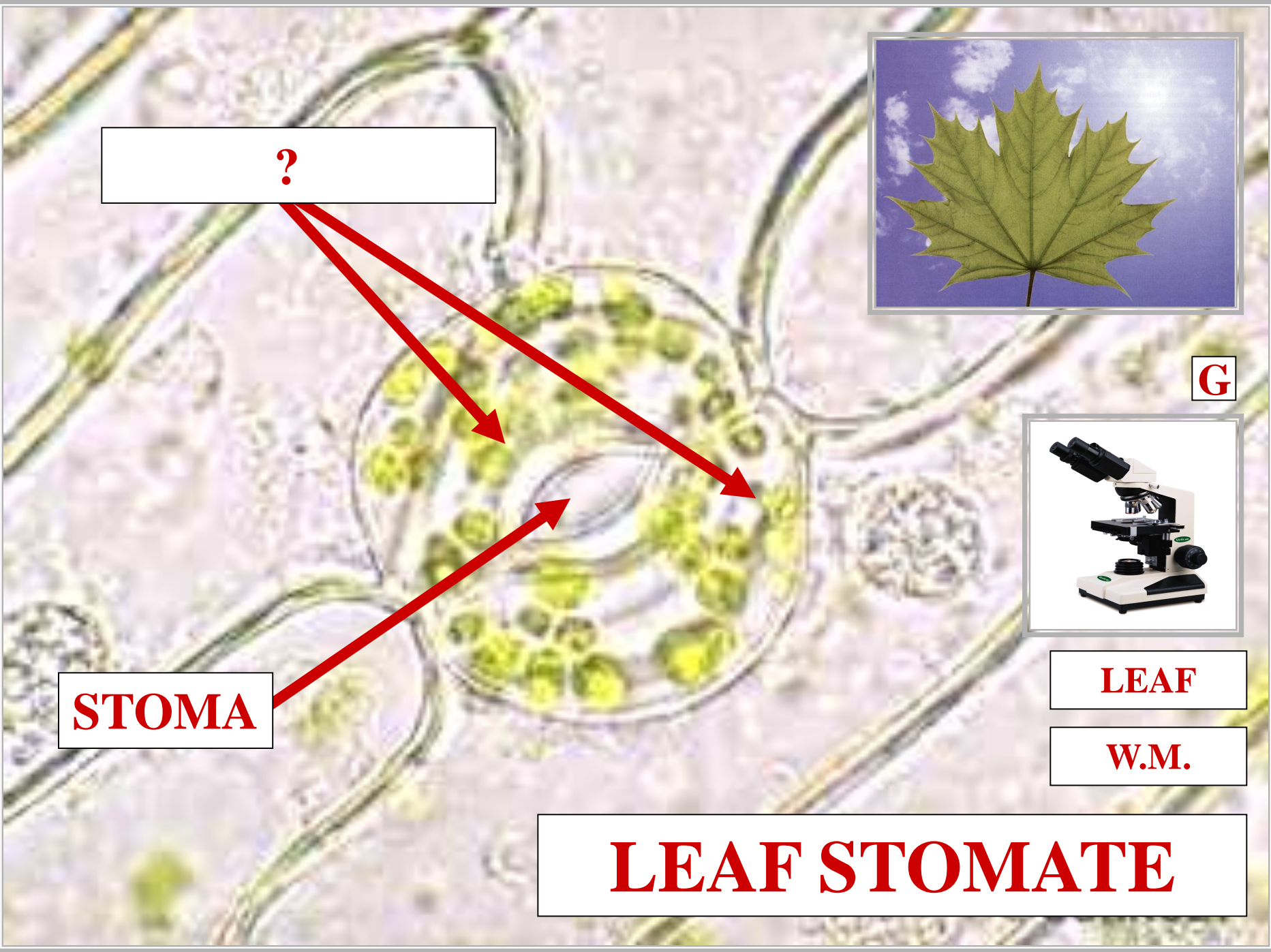


STOMA

LEAF

W.M.

LEAF STOMATE



?



G



STOMA

LEAF

W.M.

LEAF STOMATE

GUARD CELLS



STOMA

LEAF

W.M.

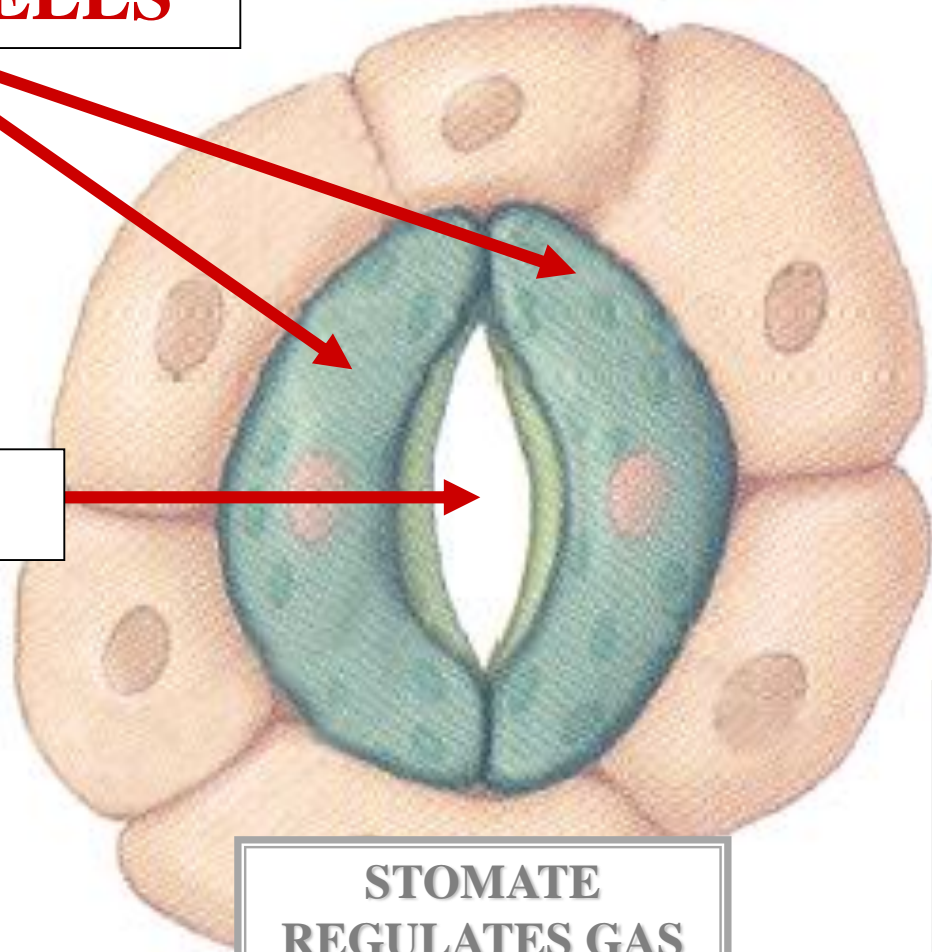
LEAF STOMATE

LEAF STOMATE

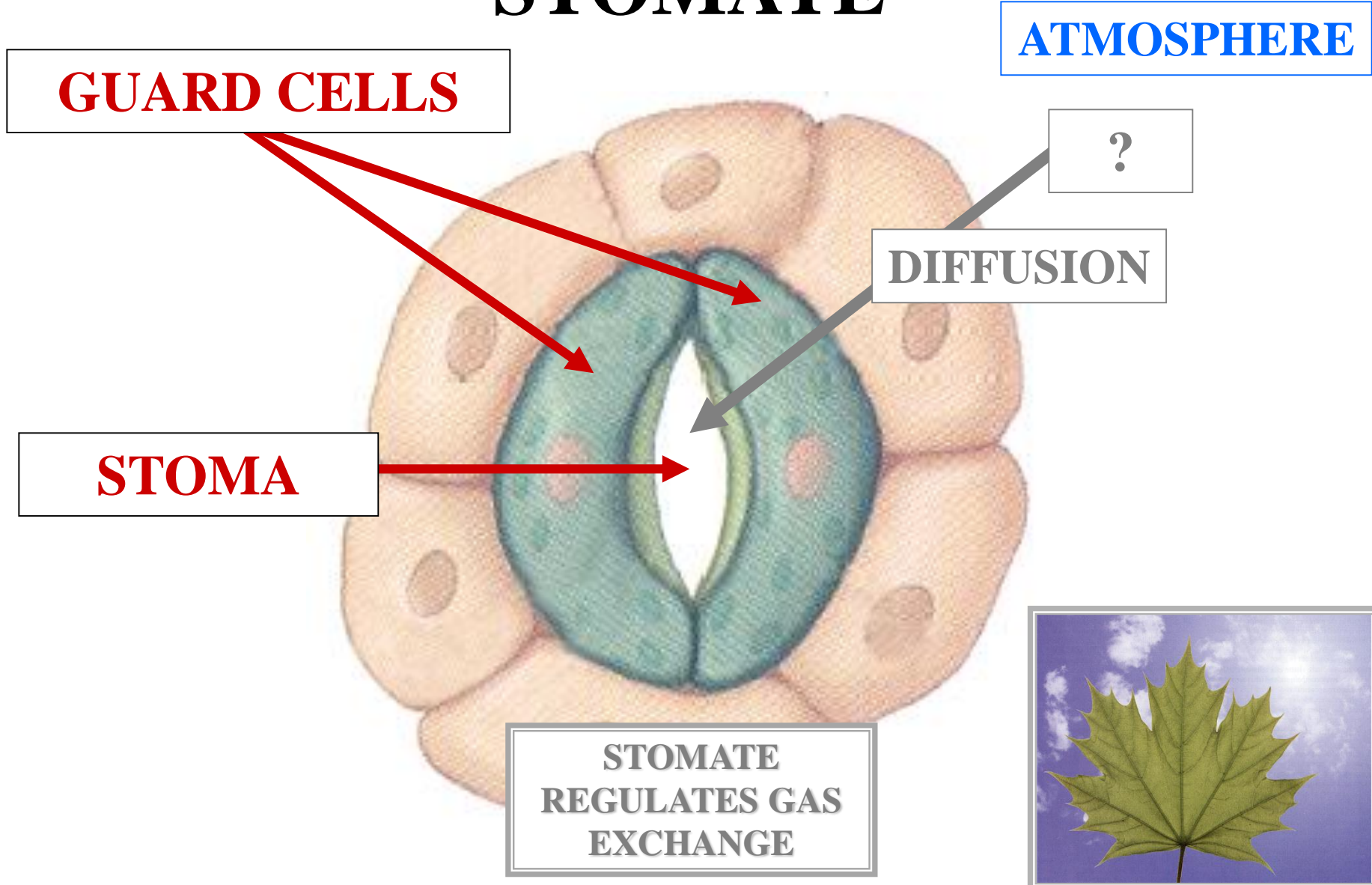
GUARD CELLS

STOMA

**STOMATE
REGULATES GAS
EXCHANGE**



LEAF STOMATE



GUARD CELLS

ATMOSPHERE

?

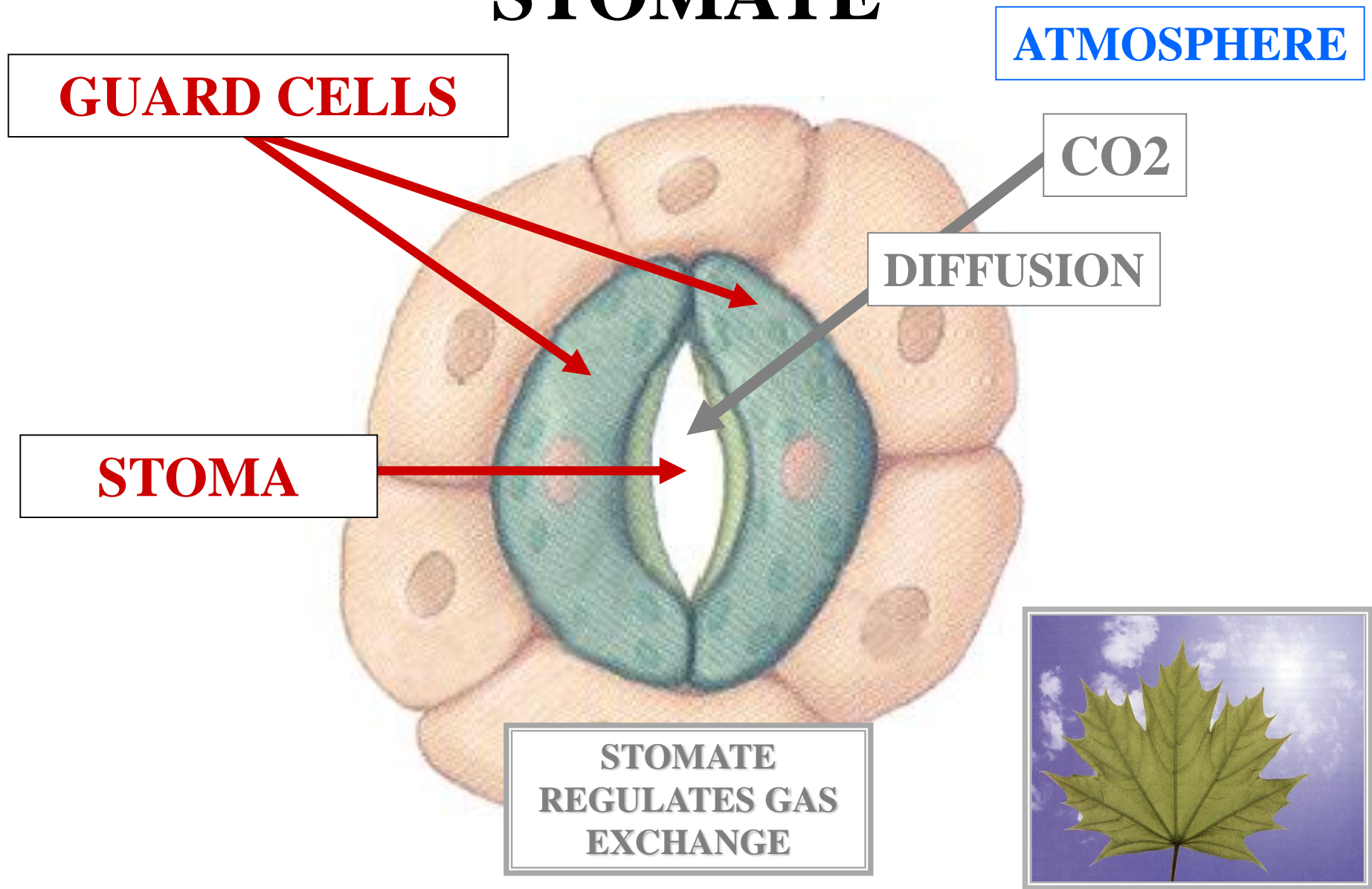
DIFFUSION

STOMA

**STOMATE
REGULATES GAS
EXCHANGE**



LEAF STOMATE



GUARD CELLS

ATMOSPHERE

CO2

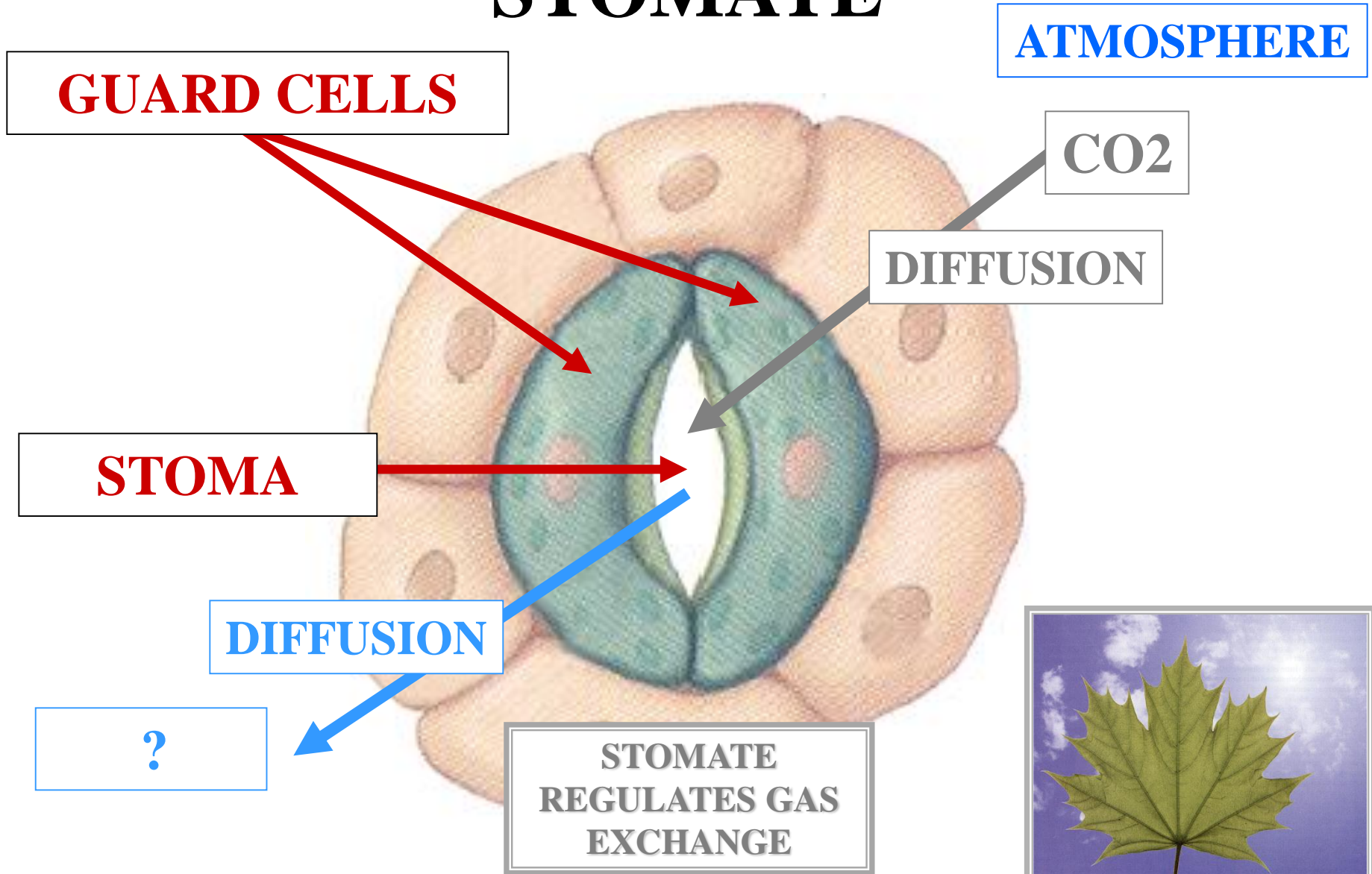
DIFFUSION

STOMA

**STOMATE
REGULATES GAS
EXCHANGE**



LEAF STOMATE



LEAF STOMATE



ATMOSPHERE

GUARD CELLS

CO₂

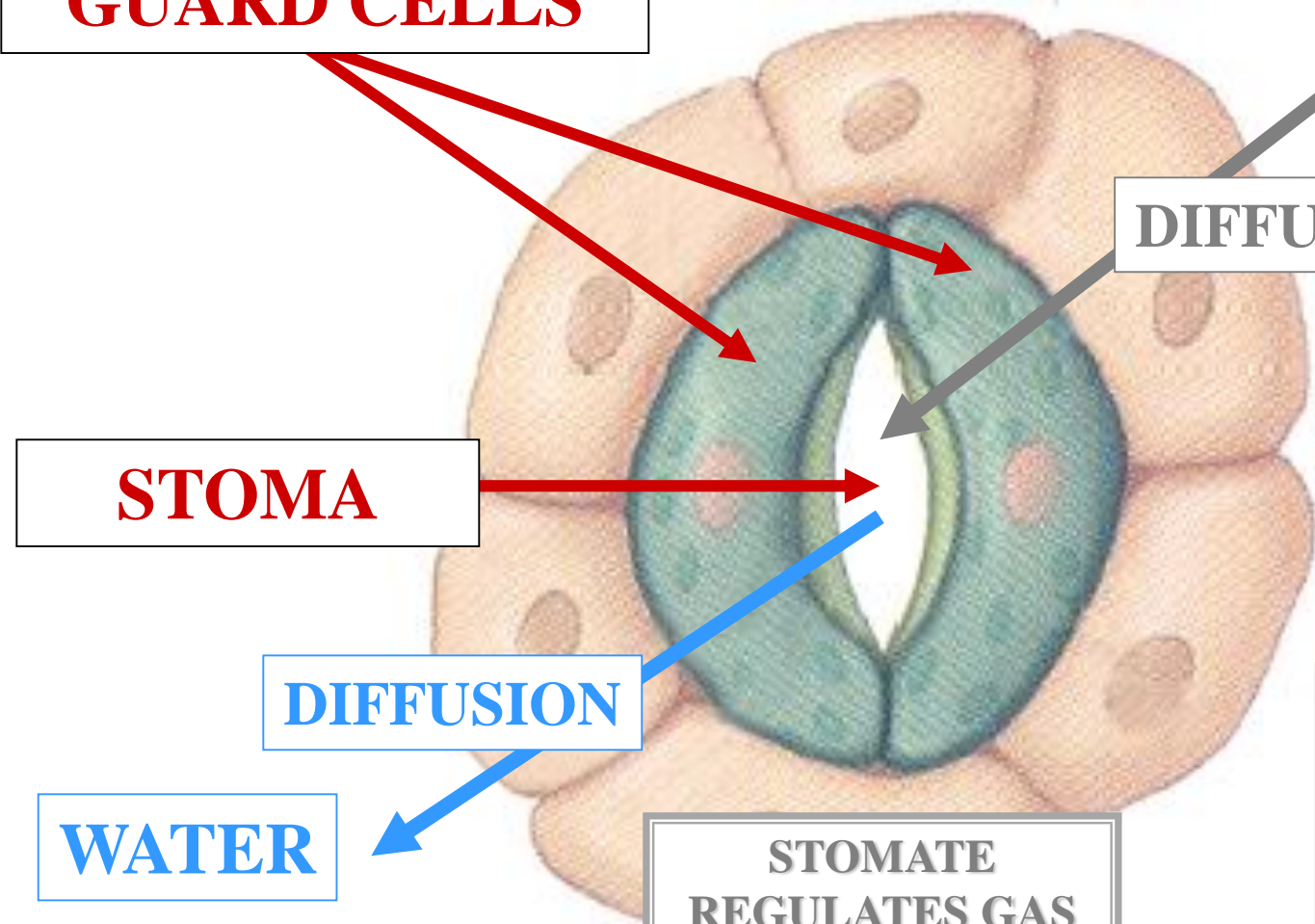
DIFFUSION

STOMA

DIFFUSION

WATER

**STOMATE
REGULATES GAS
EXCHANGE**





*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 sharply pointed.

ORGANIZATION INCREASES



*ENTROPY
DECREASES*

P

W

+



HOMEOSTASIS

PHOTOSYNTHESIS

WATER

WATER

WATER

LEAF
DESICCATION
OCCURS DURING
PHOTOSYNTHETIC

MAPLE



LEAF STOMATE



CL

ATMOSPHERE

GUARD CELLS

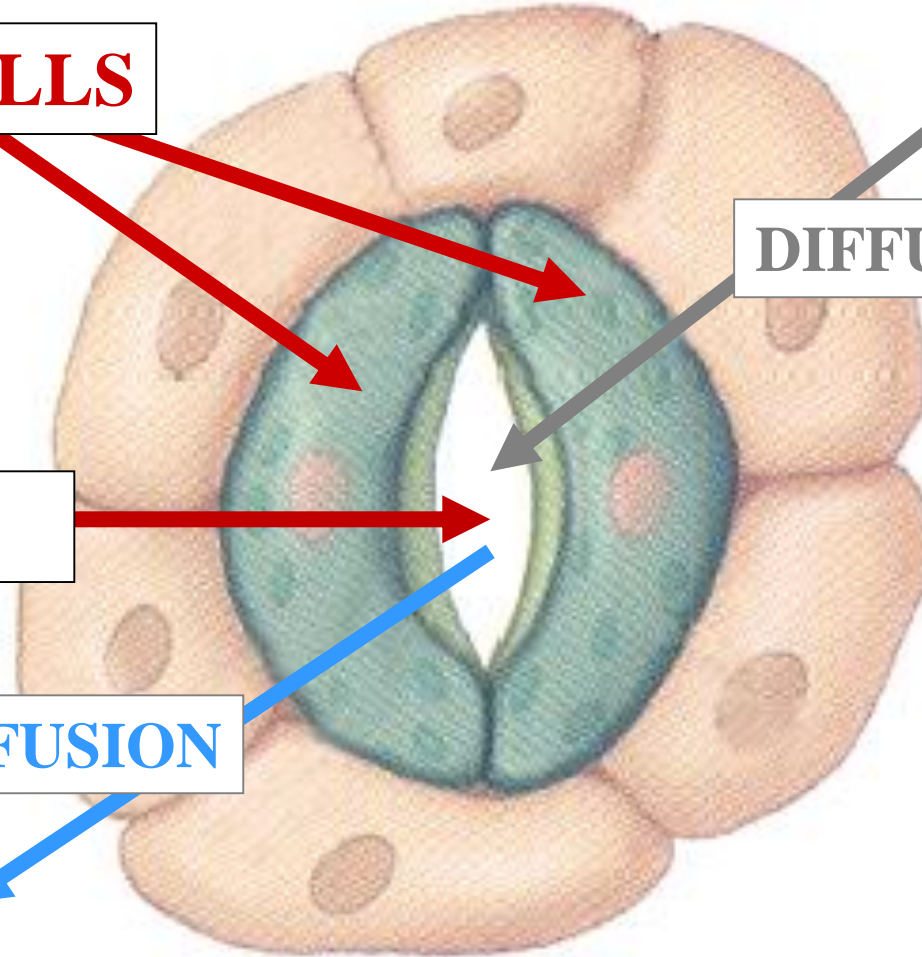
CO₂

DIFFUSION

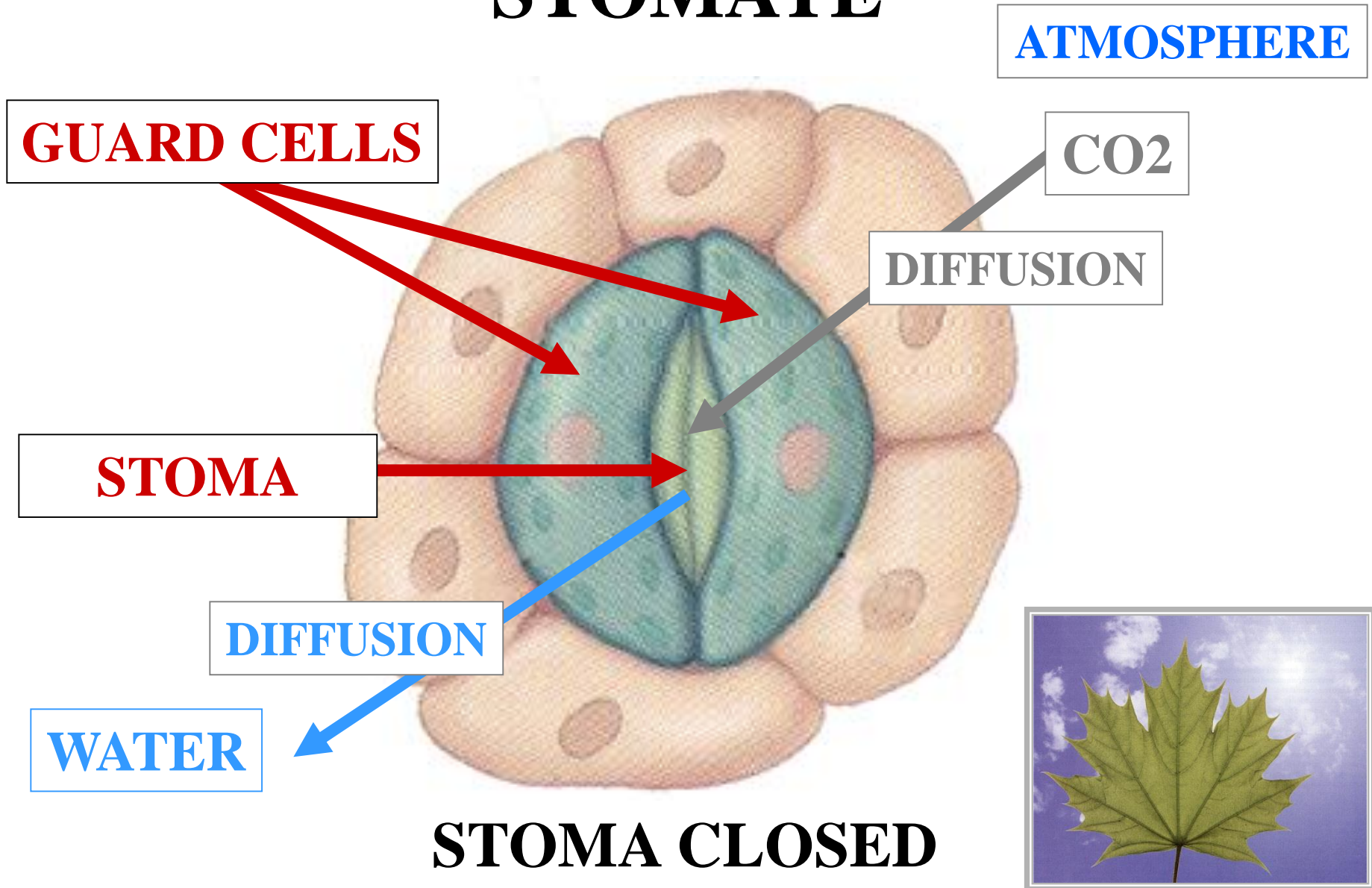
STOMA

DIFFUSION

WATER



LEAF STOMATE



LEAF STOMATE

C
X

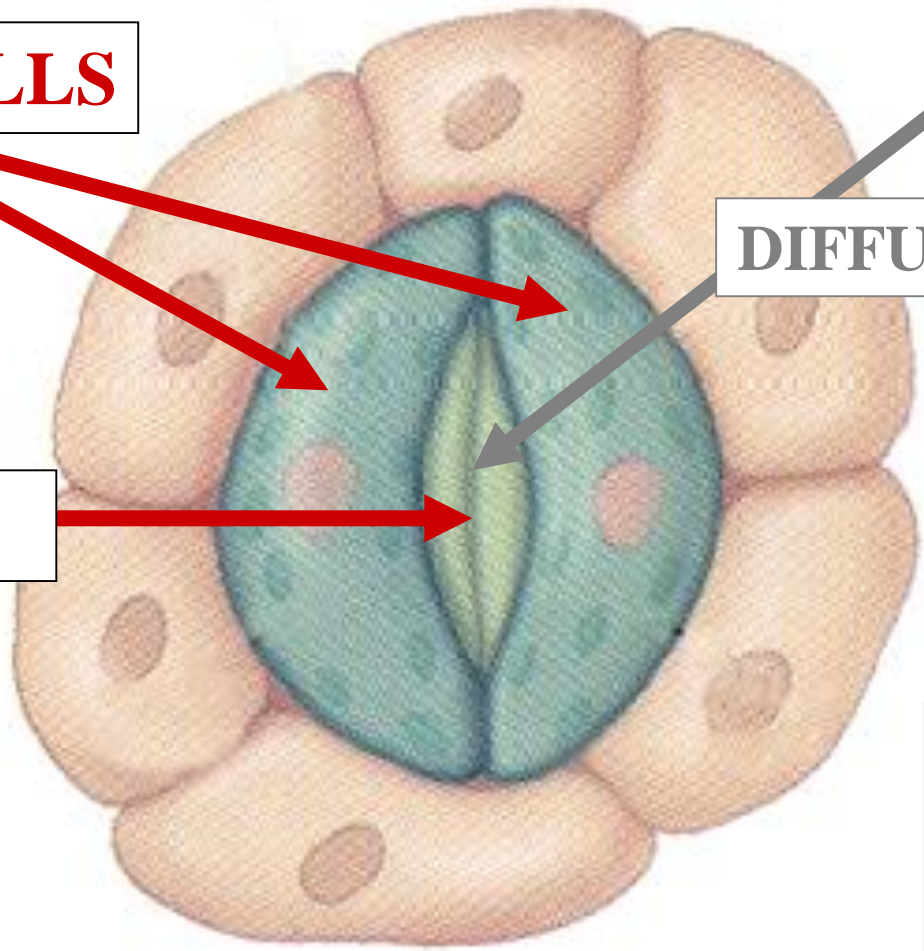
ATMOSPHERE

GUARD CELLS

CO₂

DIFFUSION

STOMA



STOMA CLOSED

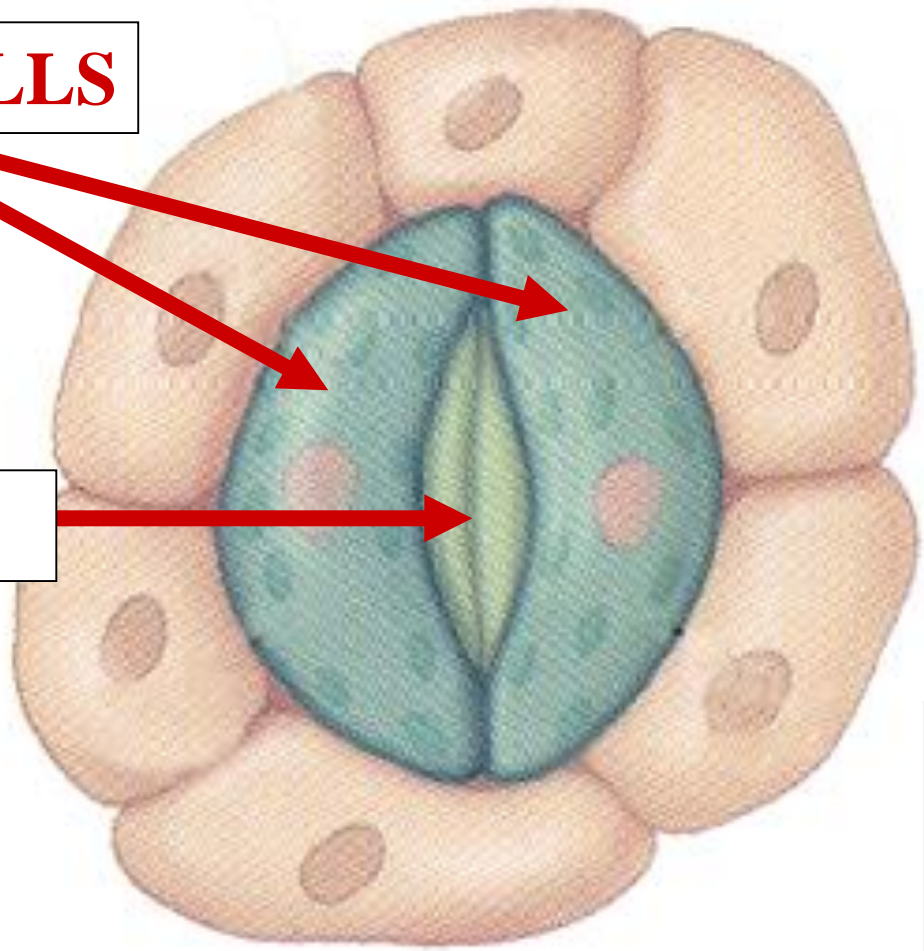


LEAF STOMATE



GUARD CELLS

STOMA



STOMA CLOSED



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

**PHOTOSYNTHESIS
TRADE-OFF
BETWEEN
SUGAR SYNTHESIS
AND
WATER RETENTION**

A 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 lobes are pointed. The overall image has a fine, woven texture.

PHOTOSYNTHESIS SUMMARY

PHOTOSYNTHESIS



LEAF
PRINCIPLE
PHOTOSYNTHETIC
ORGAN

PHOTOSYNTHETIC TISSUE



LEAF

C.S.



MC

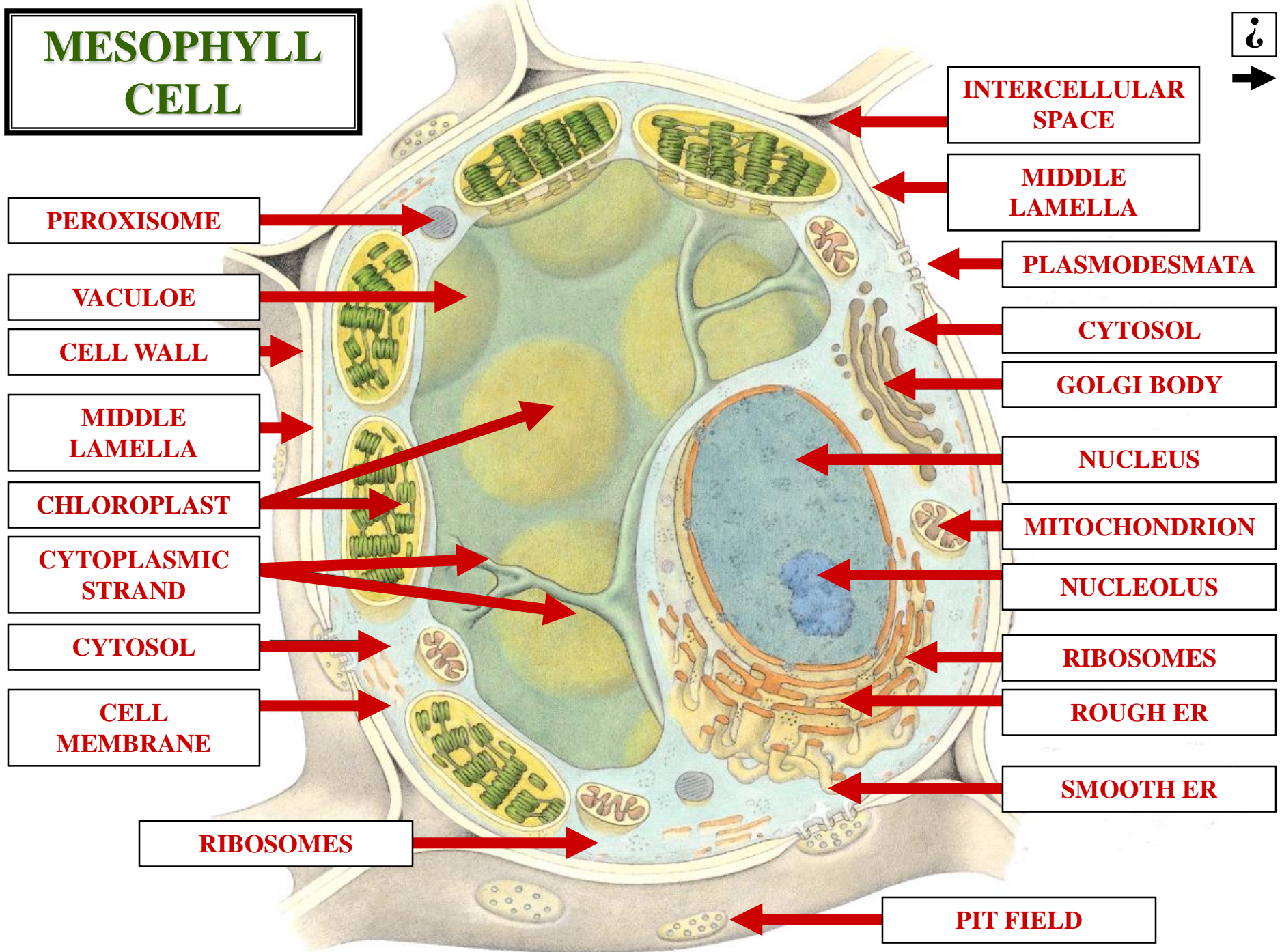
MESOPHYLL PHOTOSYNTHETIC TISSUE



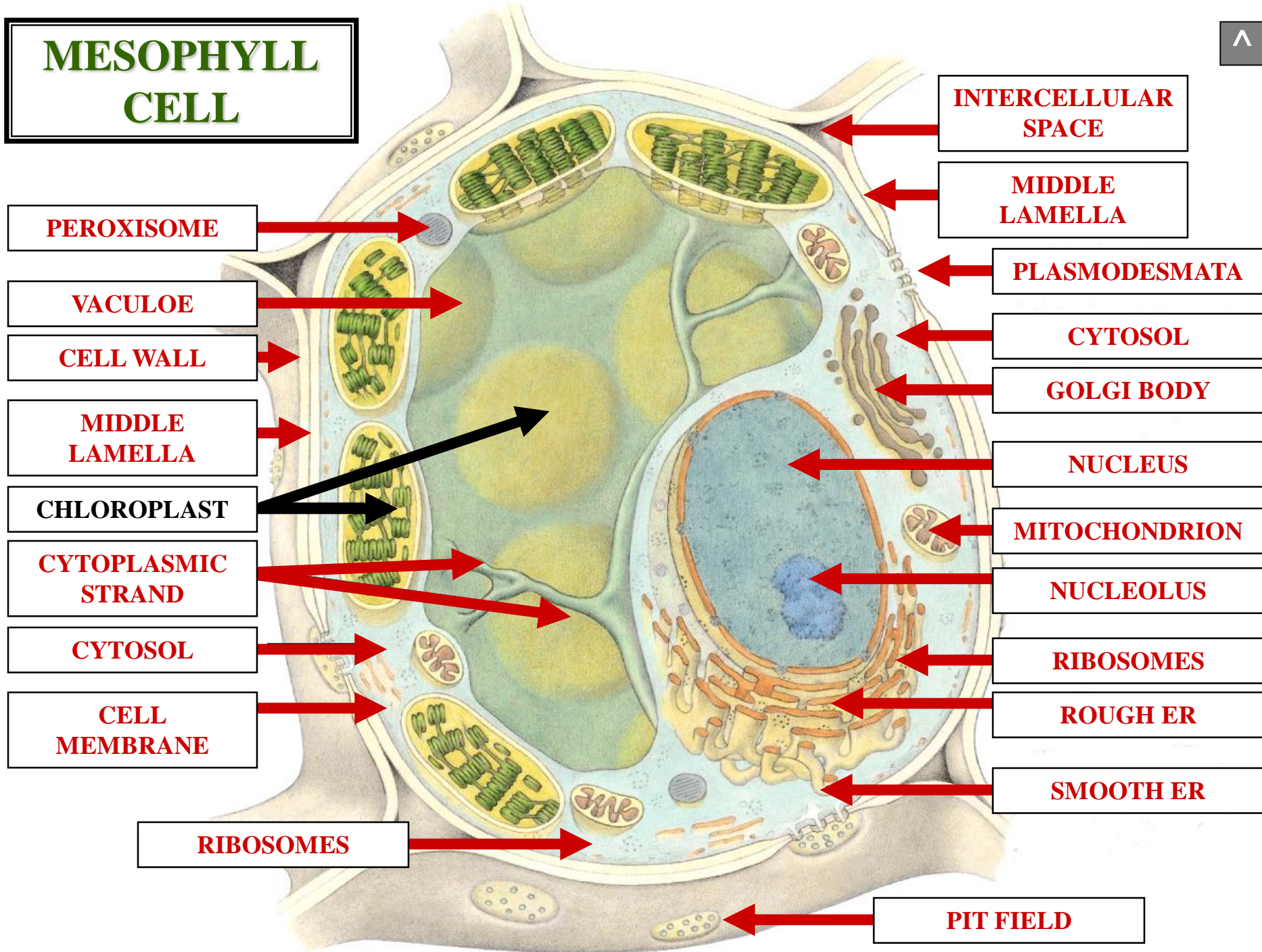
LEAF

C.S.

MESOPHYLL CELL



MESOPHYLL CELL



INTERCELLULAR SPACE

MIDDLE LAMELLA

PLASMODESMATA

CYTOSOL

GOLGI BODY

NUCLEUS

MITOCHONDRION

NUCLEOLUS

RIBOSOMES

ROUGH ER

SMOOTH ER

PEROXISOME

VACUOLE

CELL WALL

MIDDLE LAMELLA

CHLOROPLAST

CYTOPLASMIC STRAND

CYTOSOL

CELL MEMBRANE

RIBOSOMES

PIT FIELD



CHLOROPLAST

CHLOROPLAST

CHLOROPLAST

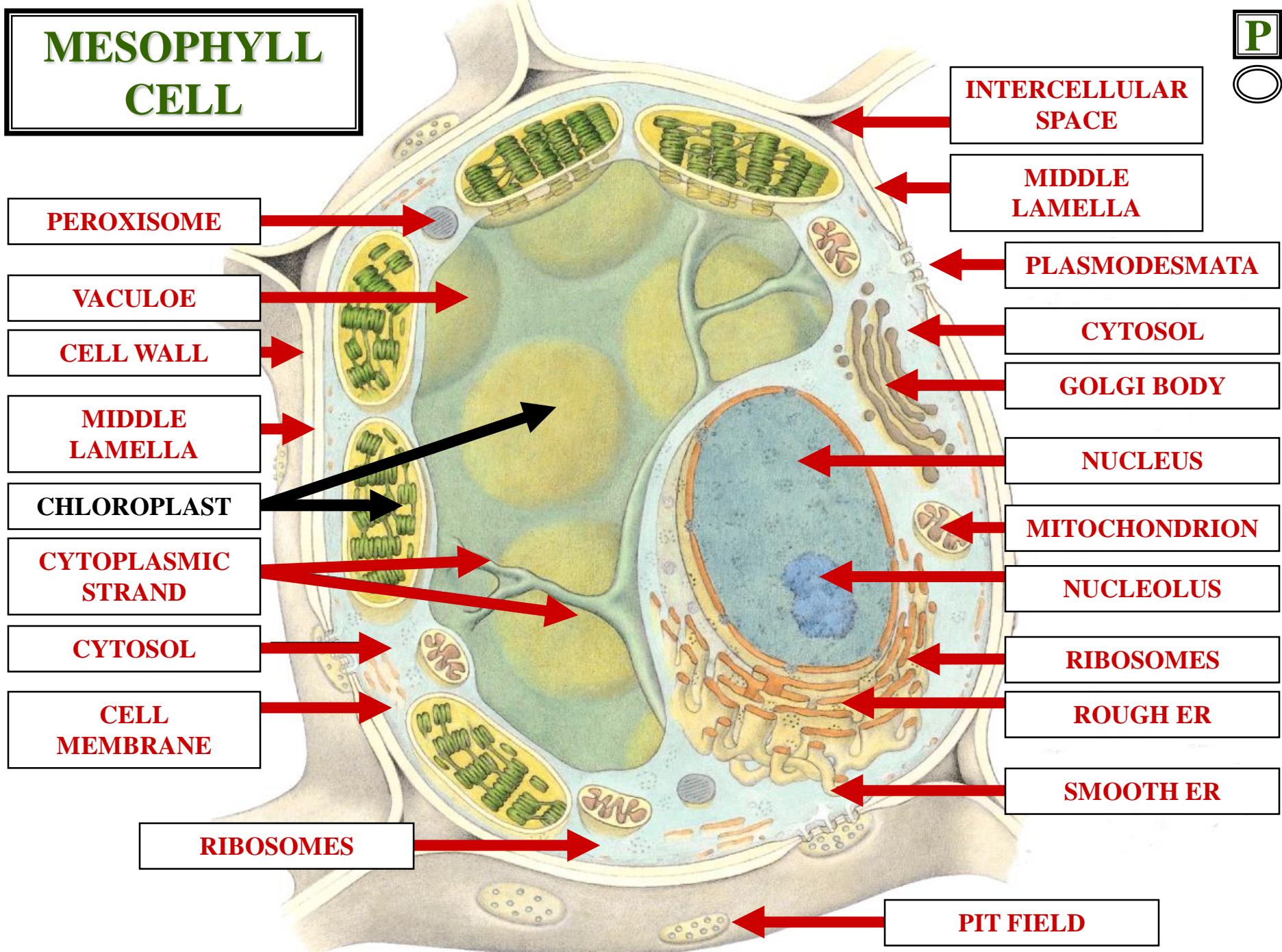


MC

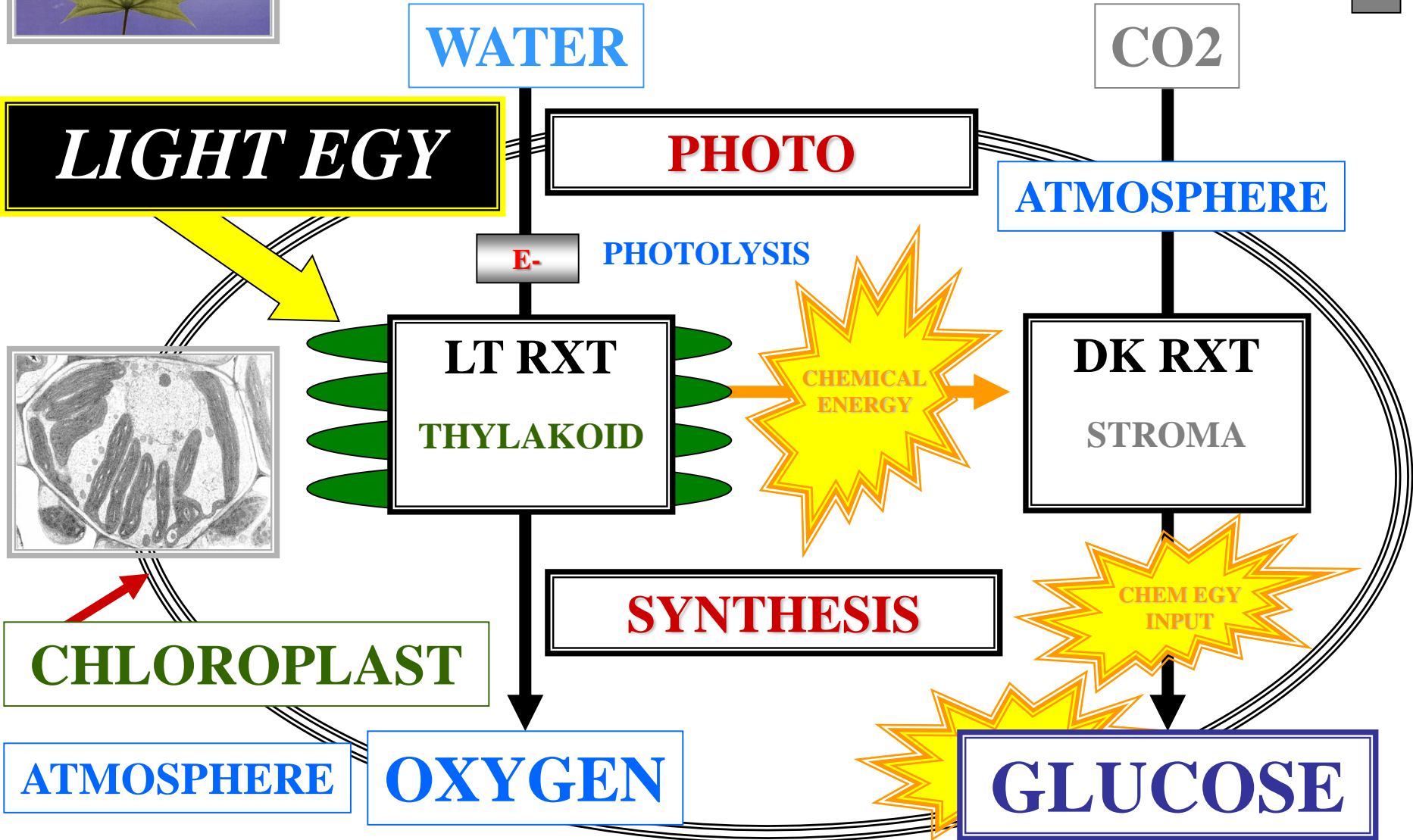
SITE: PHOTOSYNTHESIS

CHLOROPLAST

MESOPHYLL CELL



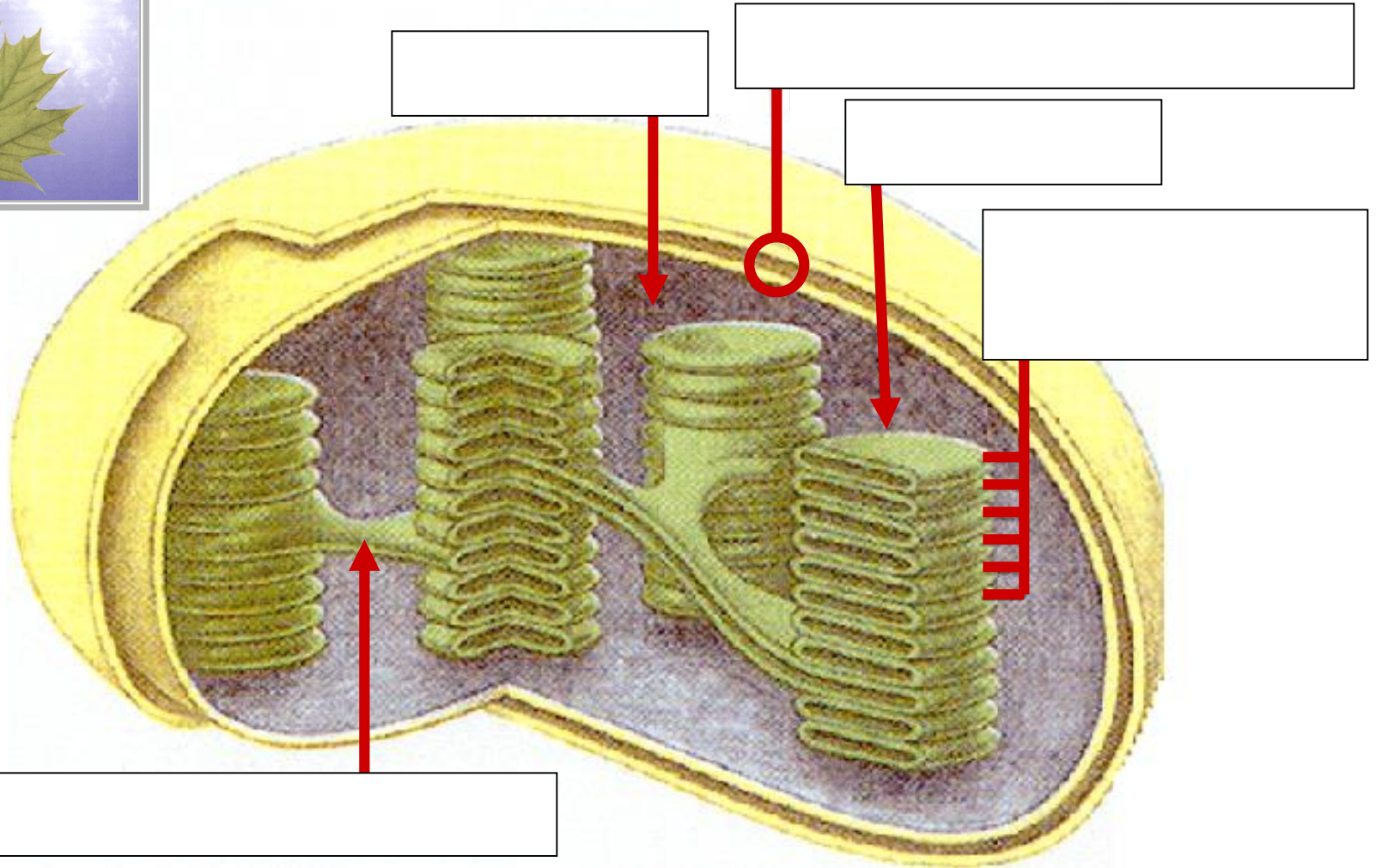
PHOTOSYNTHESIS



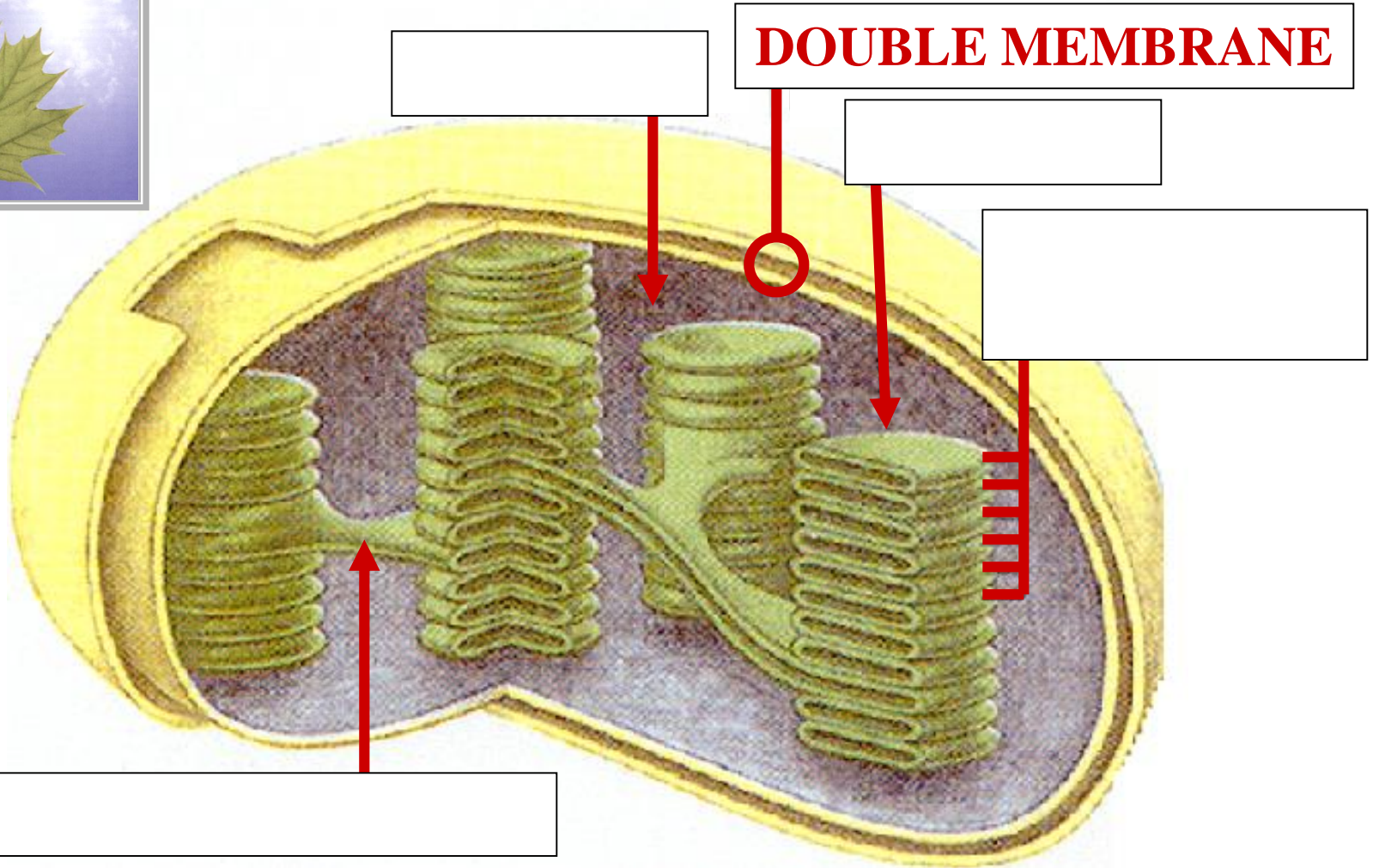


CHLOROPLAST ULTRASTRUCTURE

CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST ULTRASTRUCTURE



THYLAKOID MEMBRANE



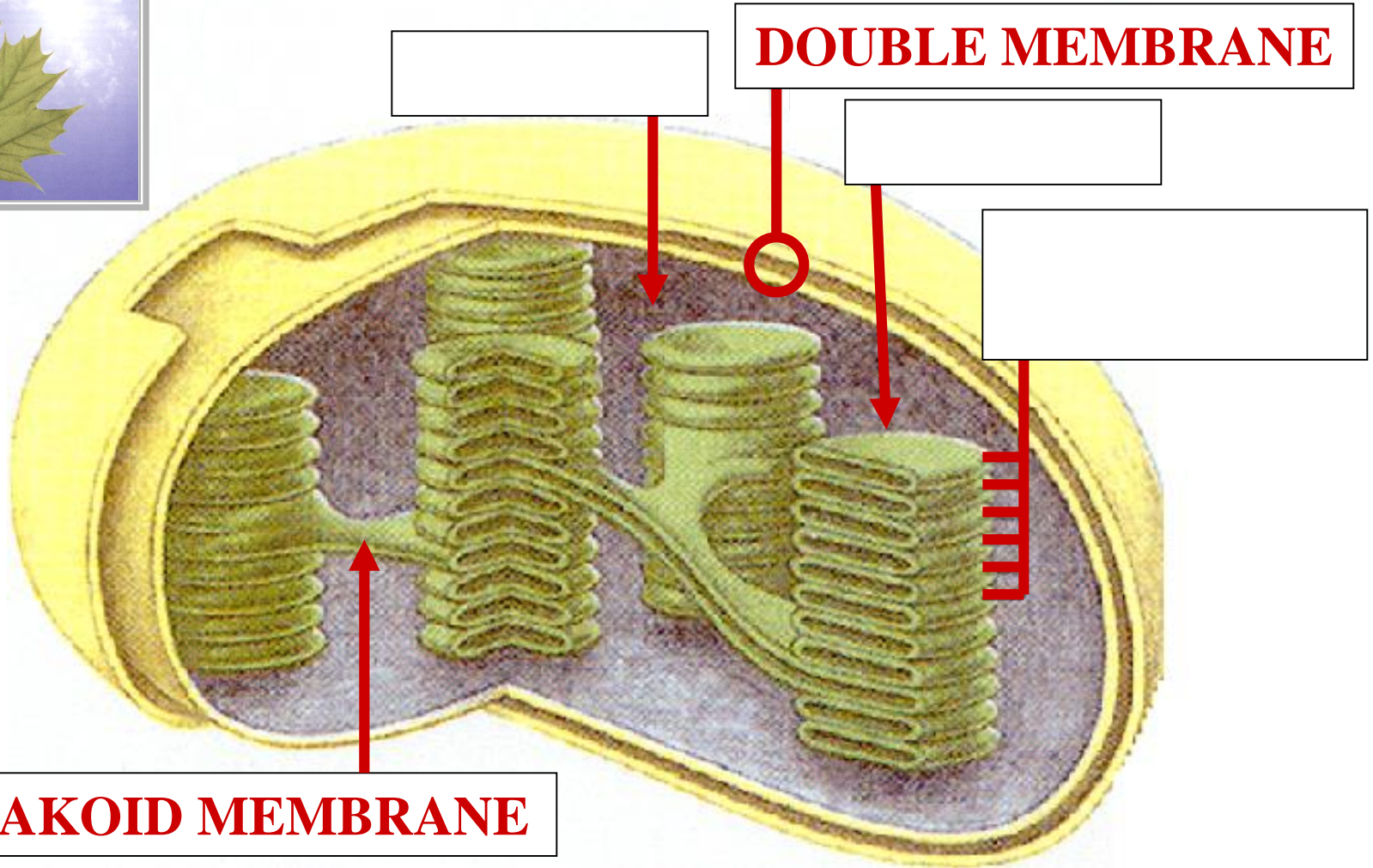
THYLAKOID MEMBRANE

CHLOROPLAST

**PIGMENTED INNERMOST
MEMBRANE**

THYLAKOID MEMBRANE

CHLOROPLAST ULTRASTRUCTURE



THYLAKOID VESICLES

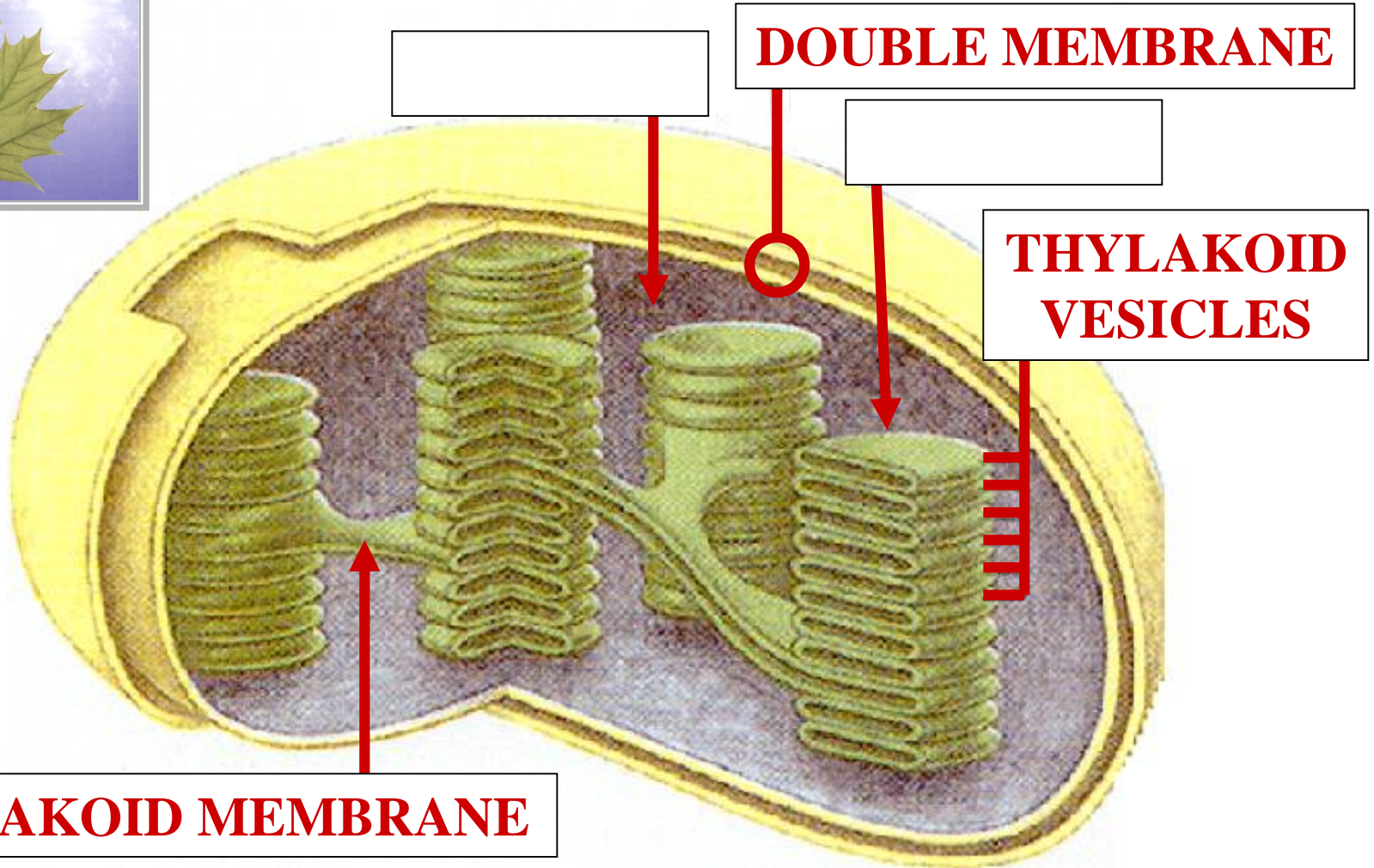


THYLAKOID VESICLES

THYLAKOID VESICLES
COMPRISE
THYLAKOID MEMBRANE

THYLAKOID VESICLES

CHLOROPLAST ULTRASTRUCTURE



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

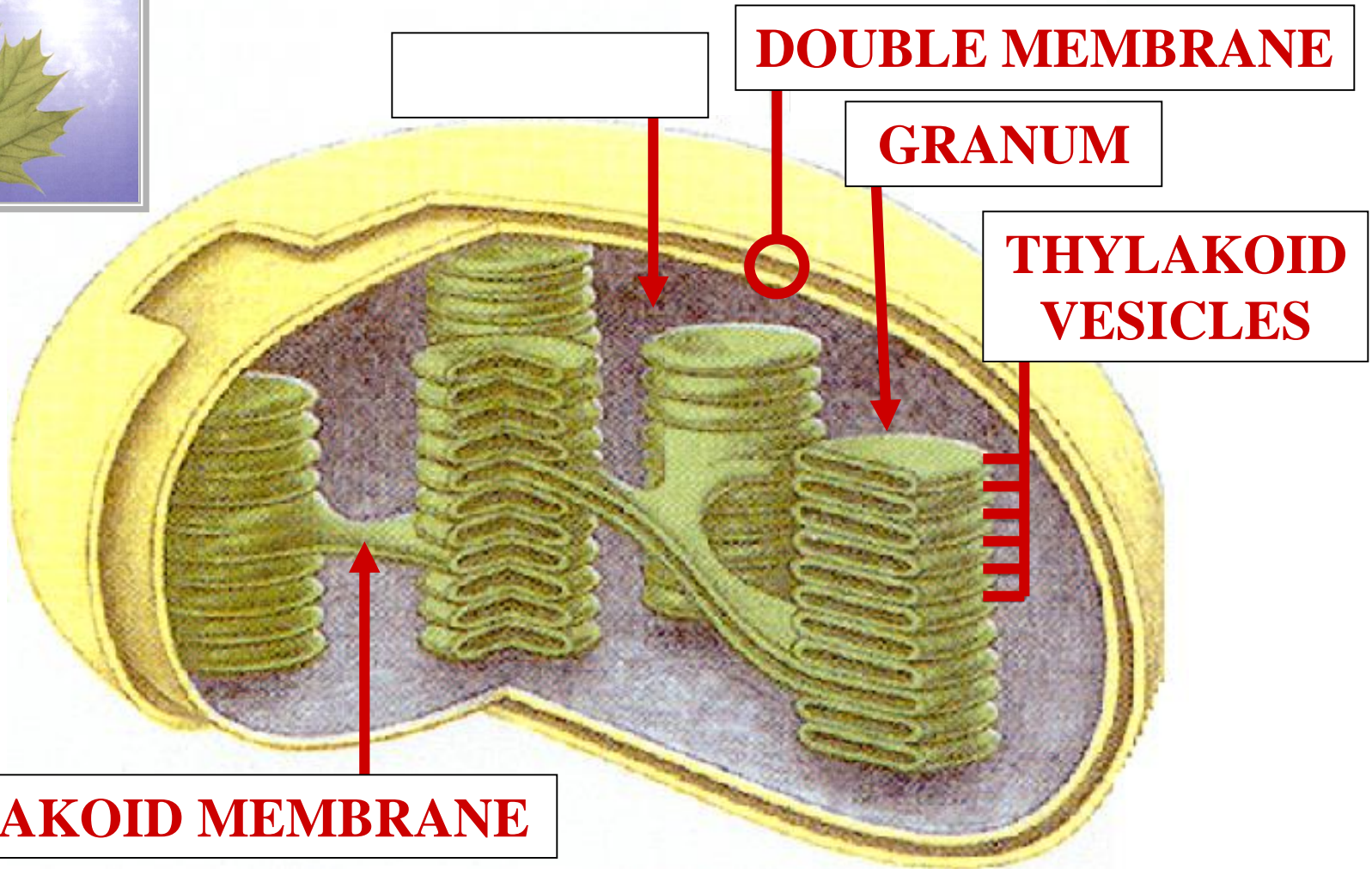
SITE: LIGHT RXT

DERIVES ATP

THYLAKOID GRANUM



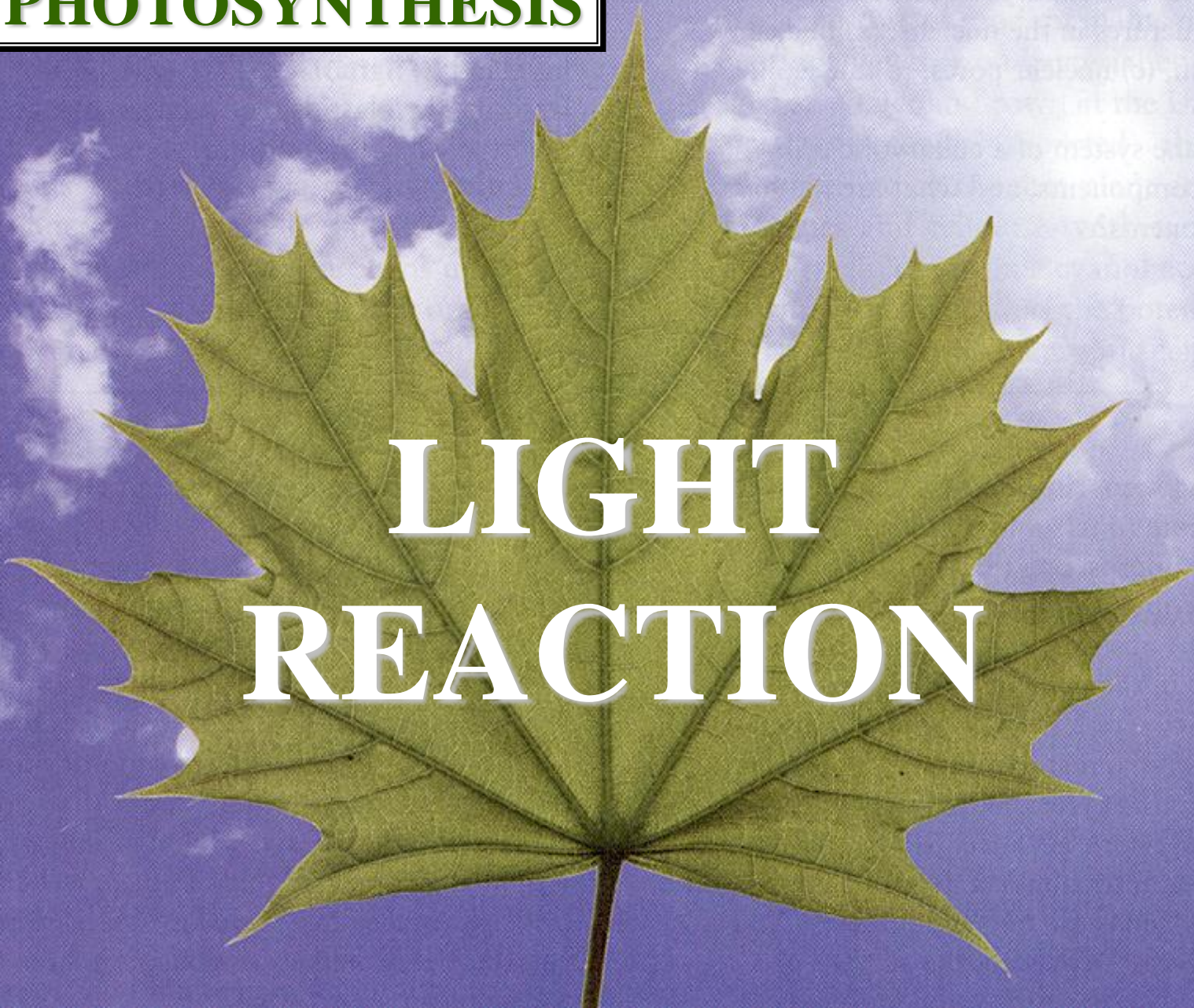
CHLOROPLAST ULTRASTRUCTURE



PHOTOSYNTHESIS

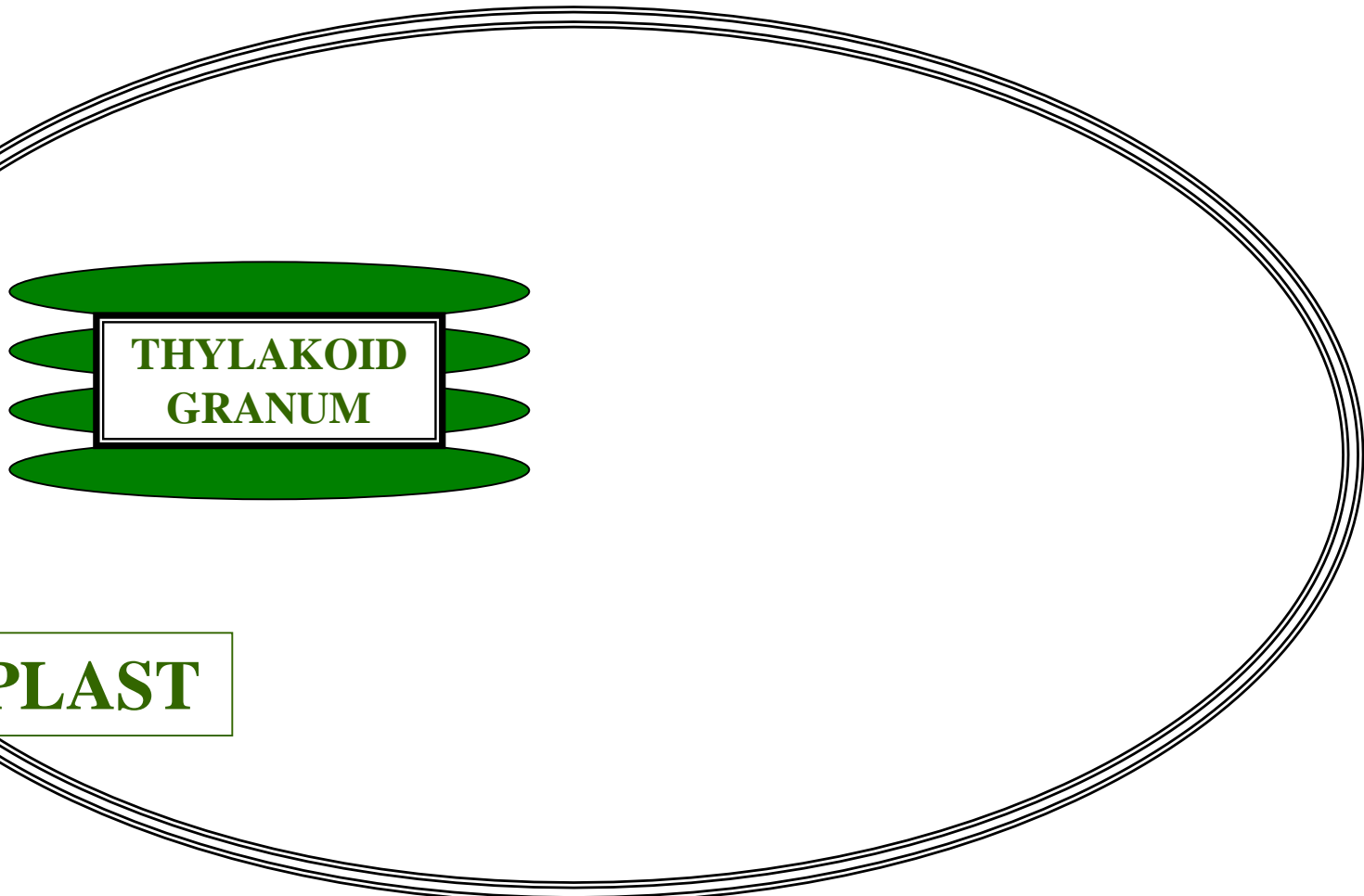


LIGHT REACTION



PHOTOSYNTHESIS

LR



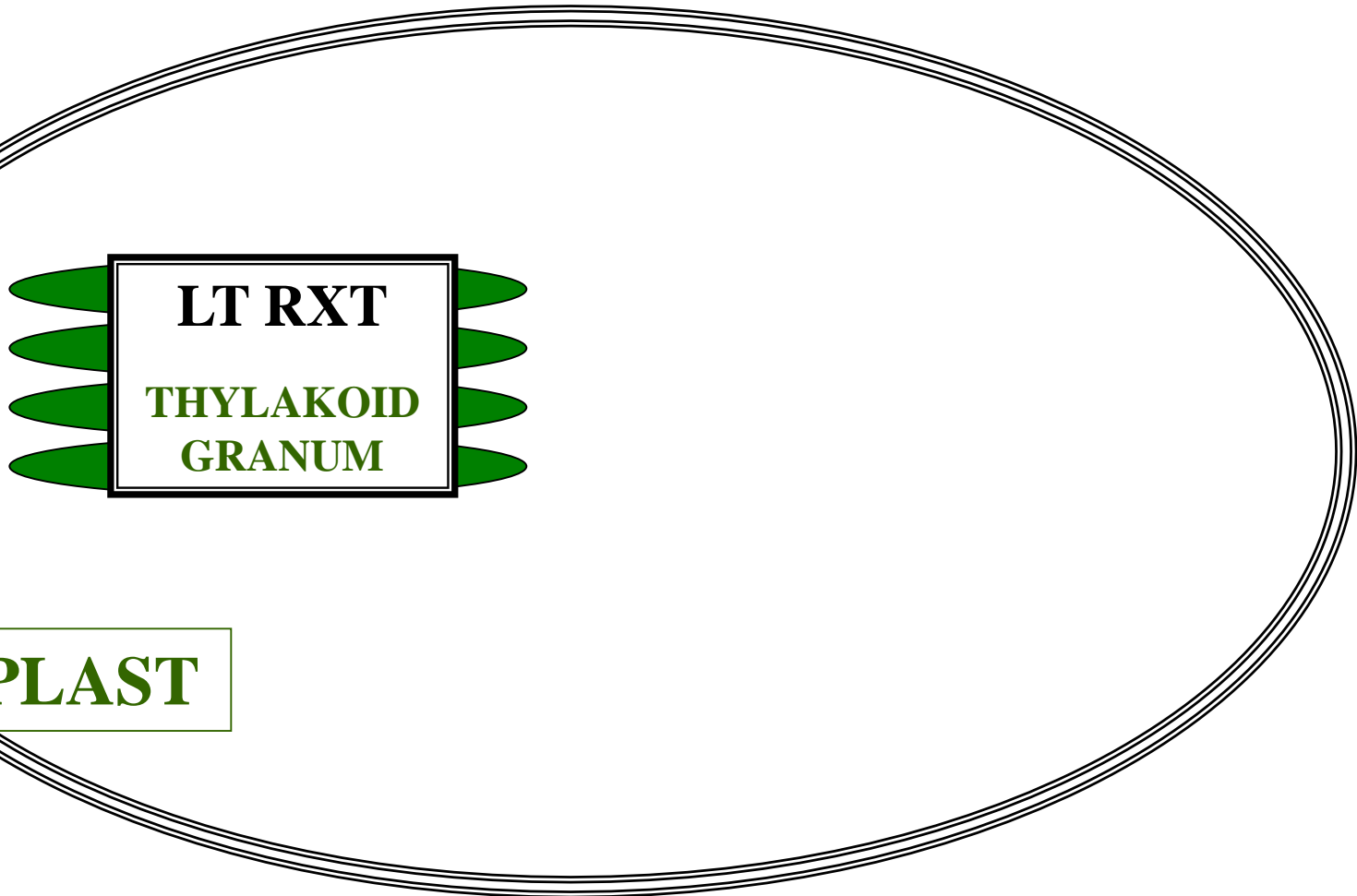
THYLAKOID
GRANUM

CHLOROPLAST



PHOTOSYNTHESIS

LT



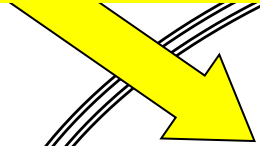
CHLOROPLAST

PHOTOSYNTHESIS

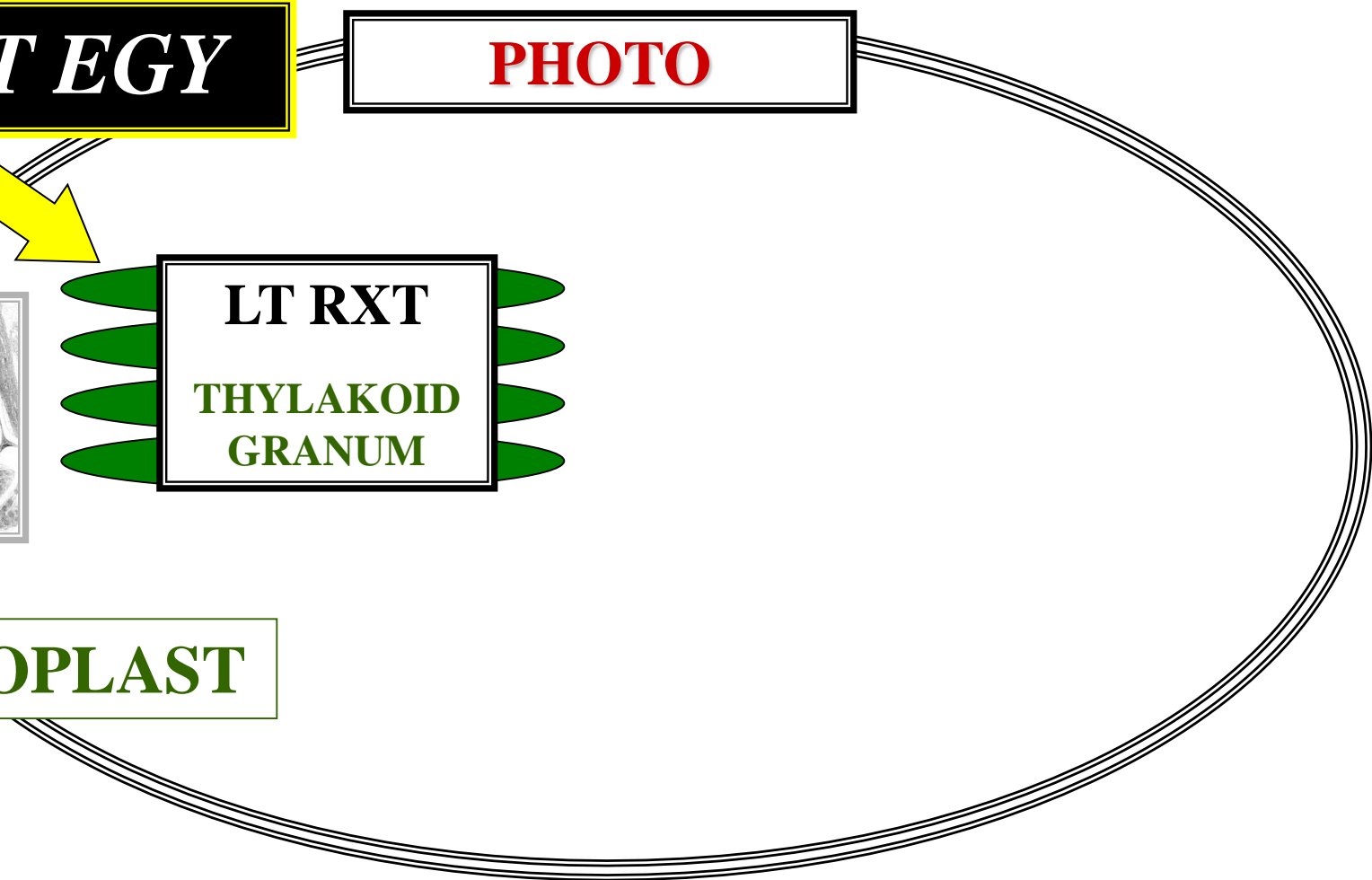


LIGHT ENERGY

PHOTO



CHLOROPLAST



PHOTOSYNTHESIS

C



WATER

LIGHT ENERGY

PHOTO

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

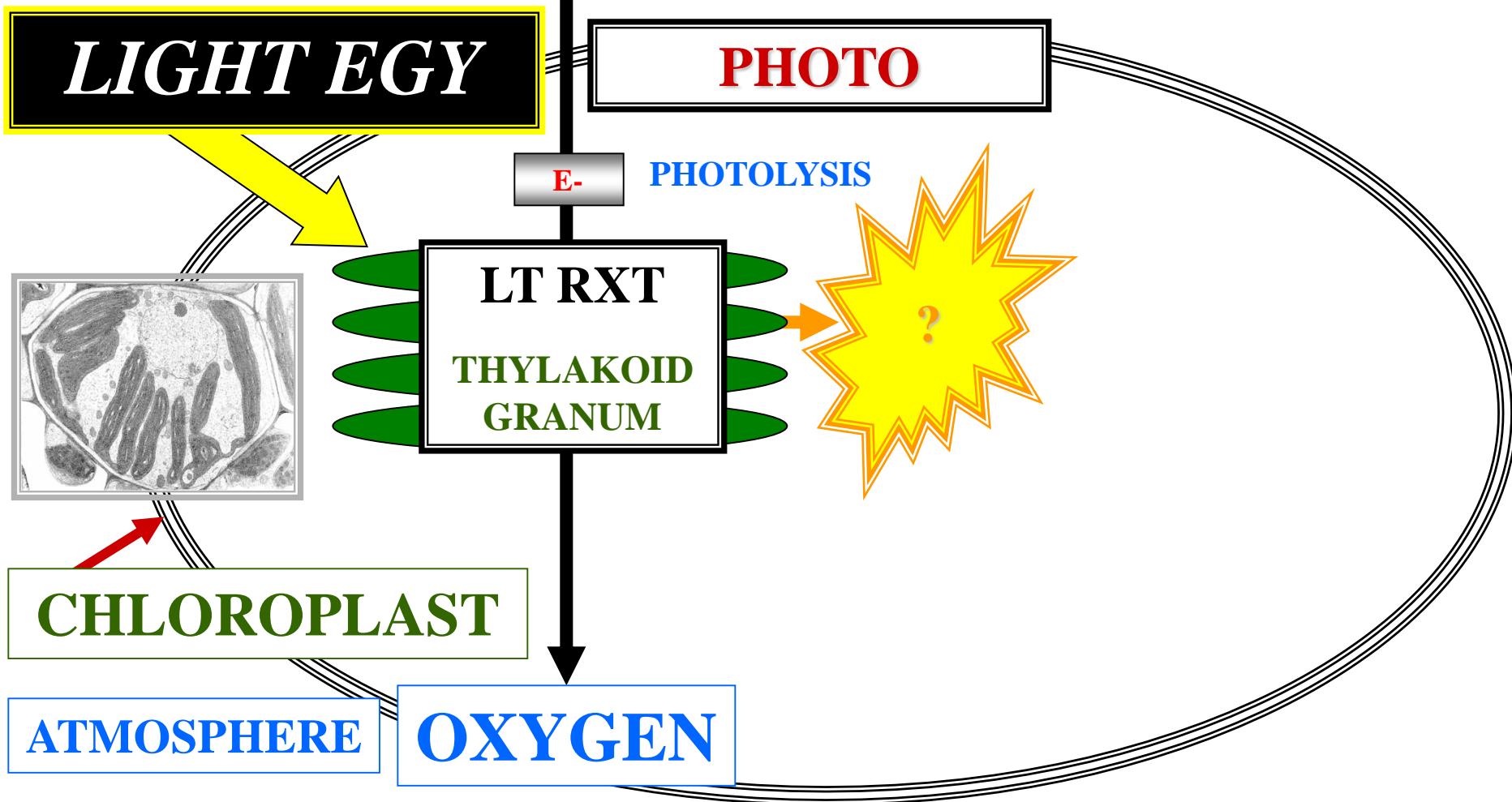
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CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS

A



WATER

LIGHT ENERGY

PHOTO

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

CHEMICAL
ENERGY

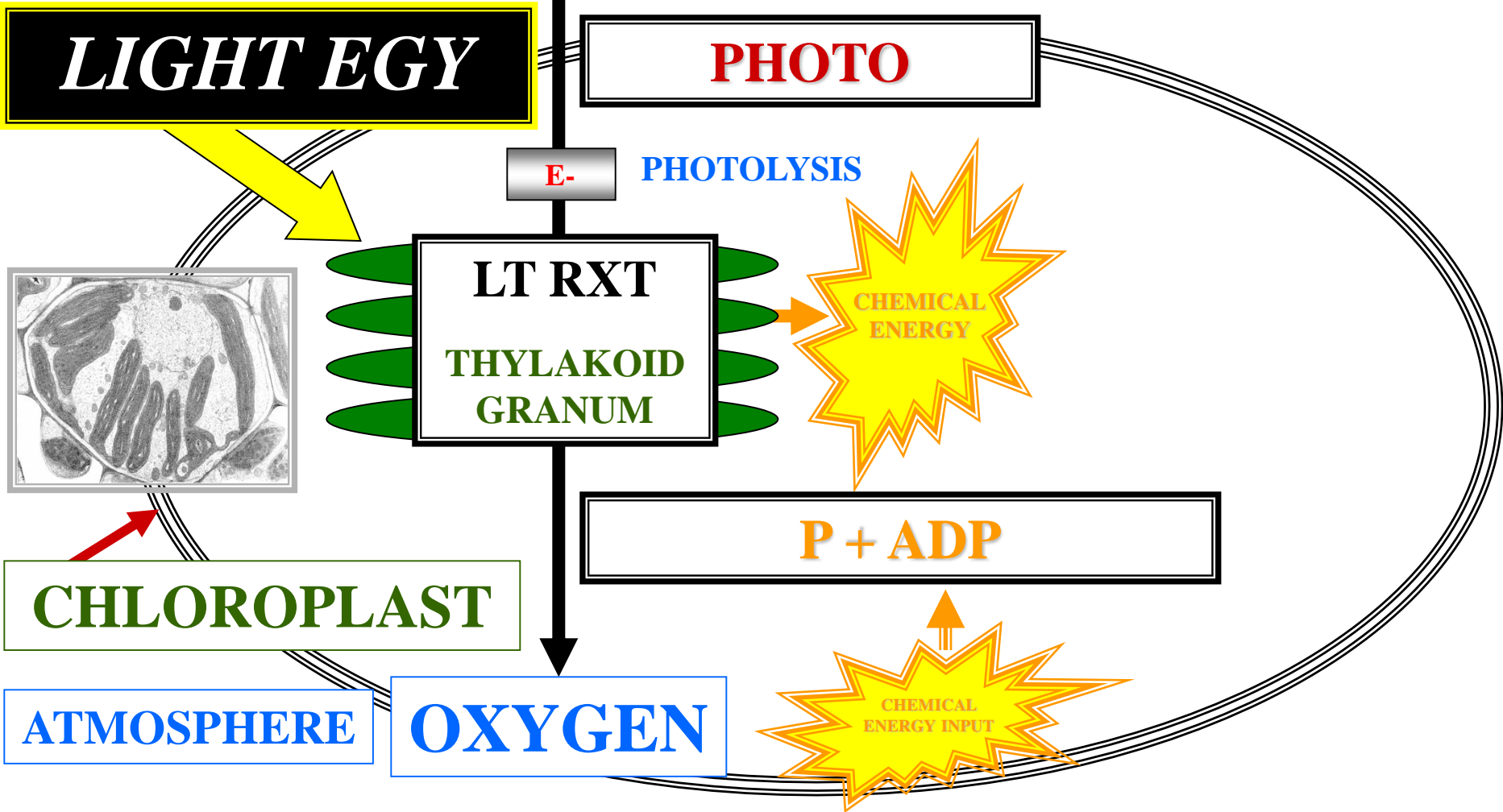
P + ADP

CHLOROPLAST

ATMOSPHERE

OXYGEN

CHEMICAL
ENERGY INPUT



PHOTOSYNTHESIS

P



WATER

LIGHT ENERGY

PHOTO

E-

PHOTOLYSIS

LT RXT

**THYLAKOID
GRANUM**

ATP

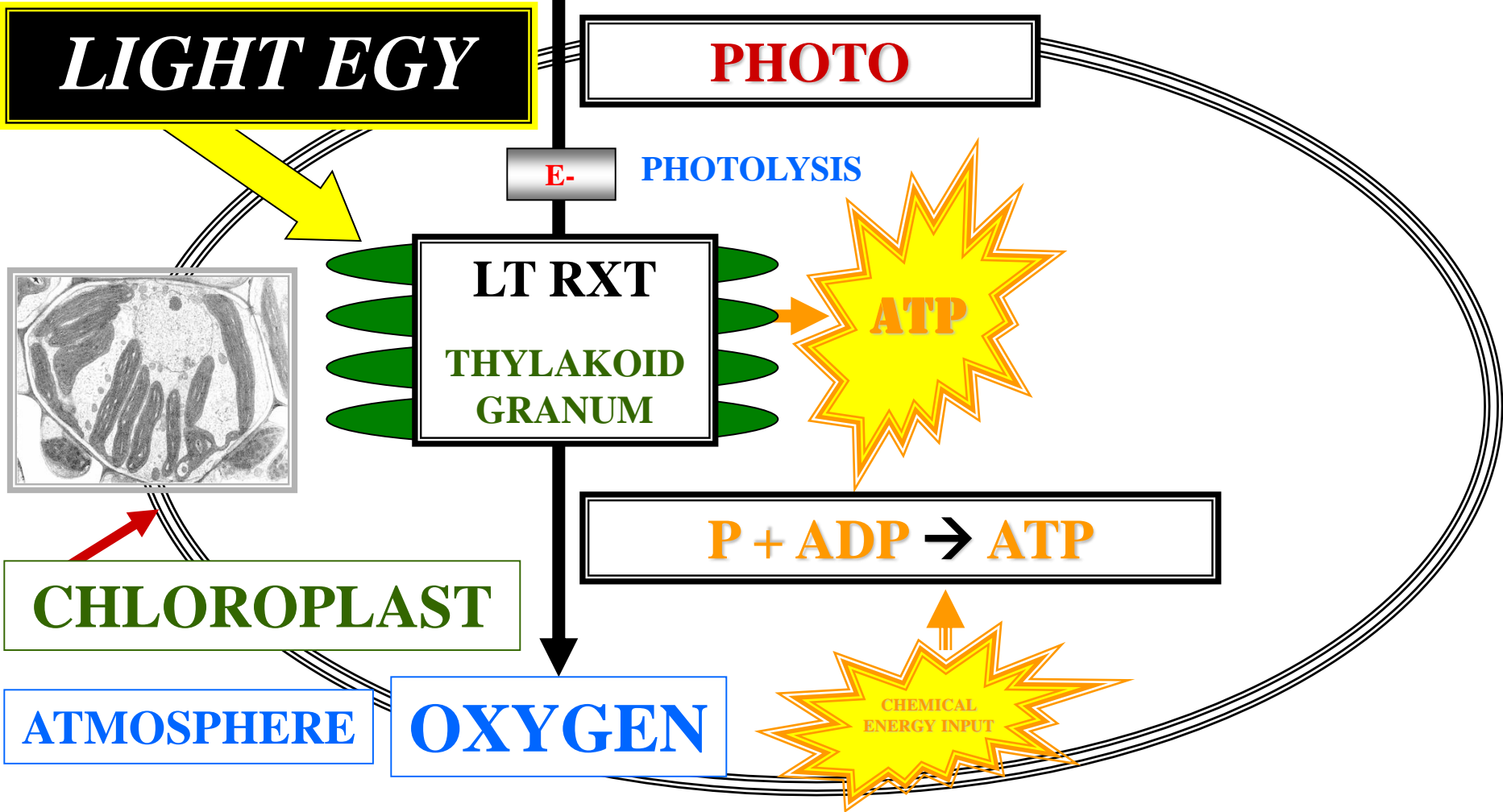
P + ADP → ATP

CHLOROPLAST

ATMOSPHERE

OXYGEN

**CHEMICAL
ENERGY INPUT**



PHOTOSYNTHESIS



F

WATER

LIGHT ENERGY

PHOTO

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

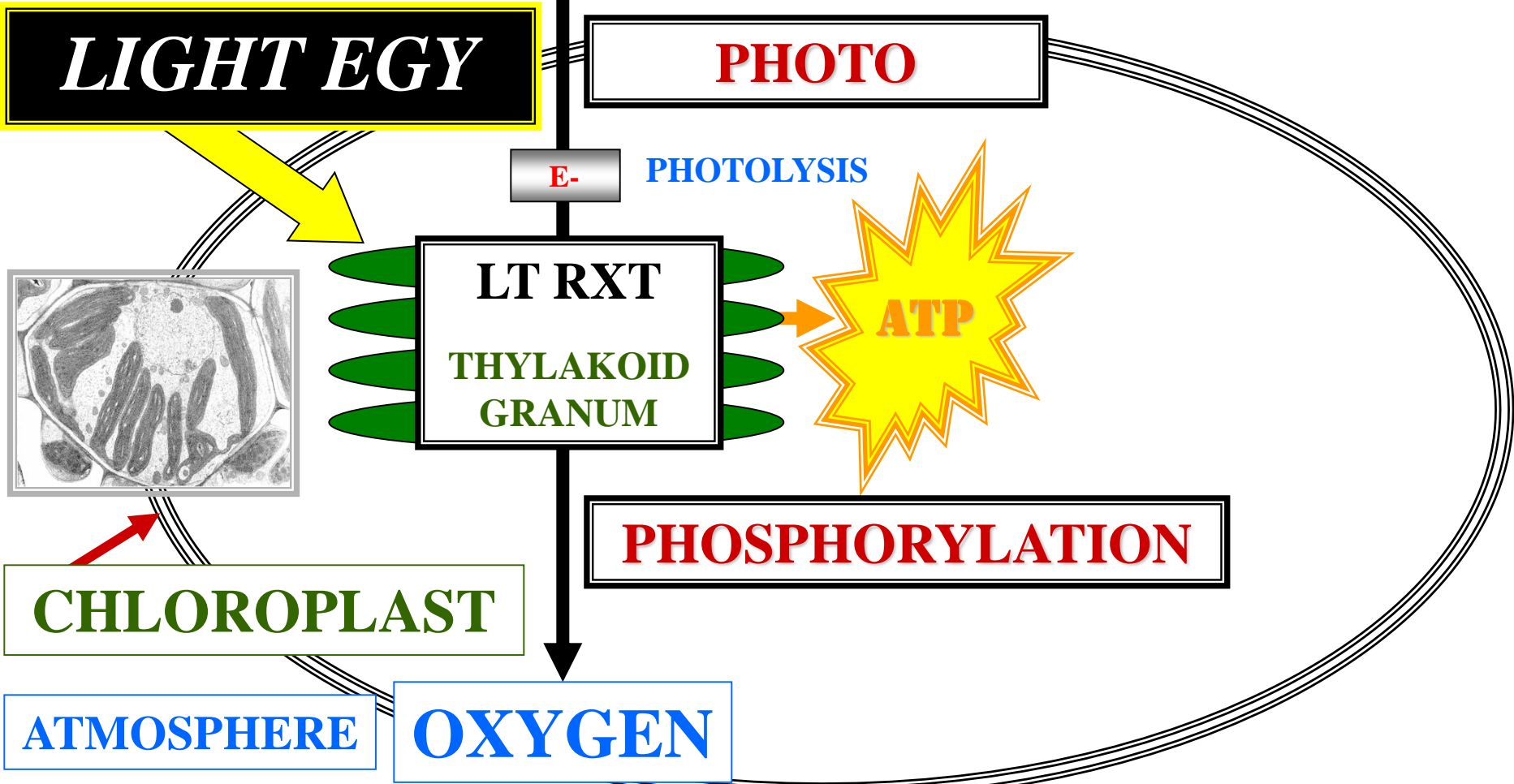
ATP

PHOSPHORYLATION

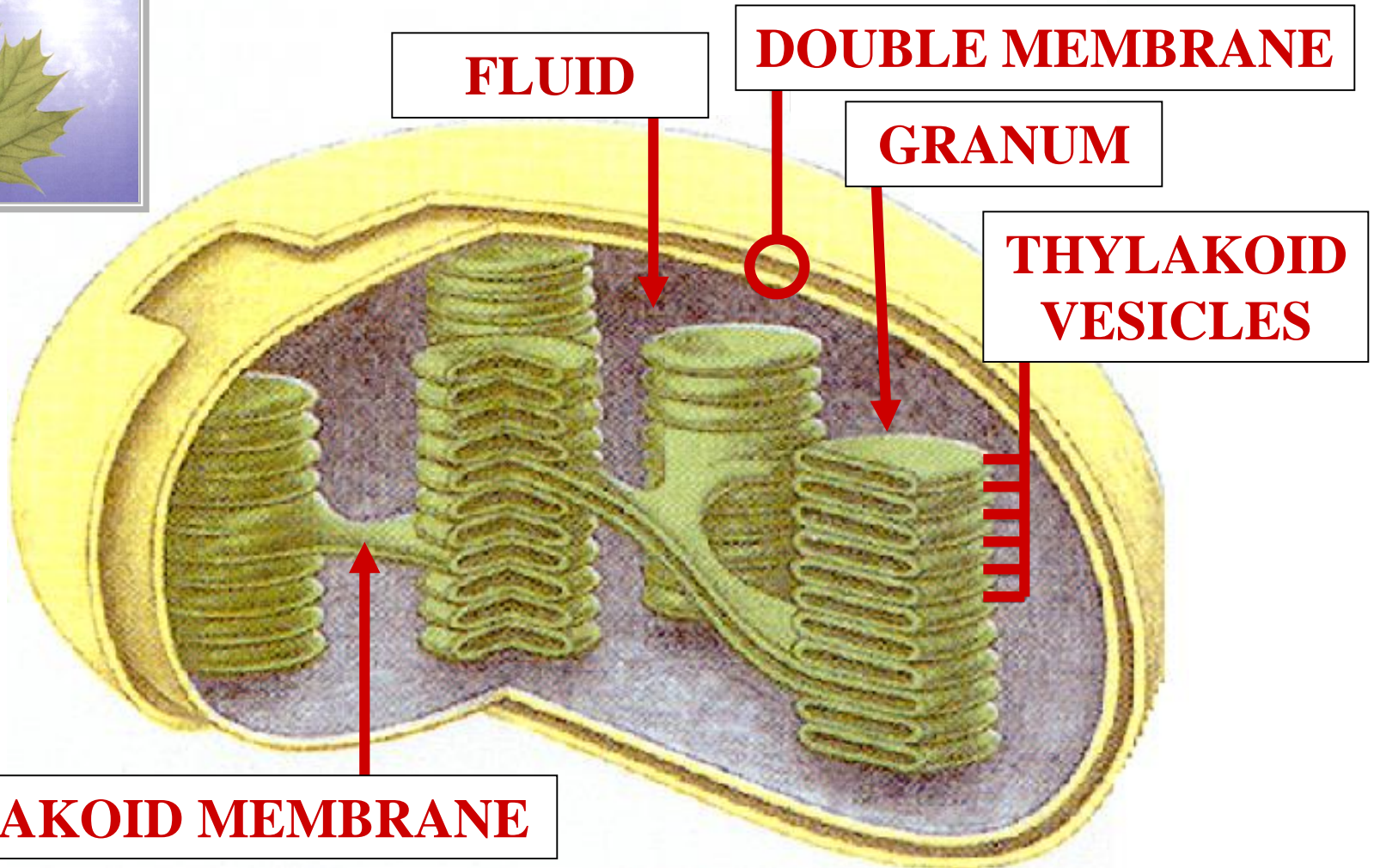
CHLOROPLAST

ATMOSPHERE

OXYGEN



CHLOROPLAST ULTRASTRUCTURE



THYLAKOID MEMBRANE

FLUID

DOUBLE MEMBRANE

GRANUM

**THYLAKOID
VESICLES**

STROMA

STROMA



**CHLOROPLAST
FLUID MATRIX**

STROMA

STROMA



**CHLOROPLAST
FLUID MATRIX**

SITE: DARK RXT

STROMA

STROMA



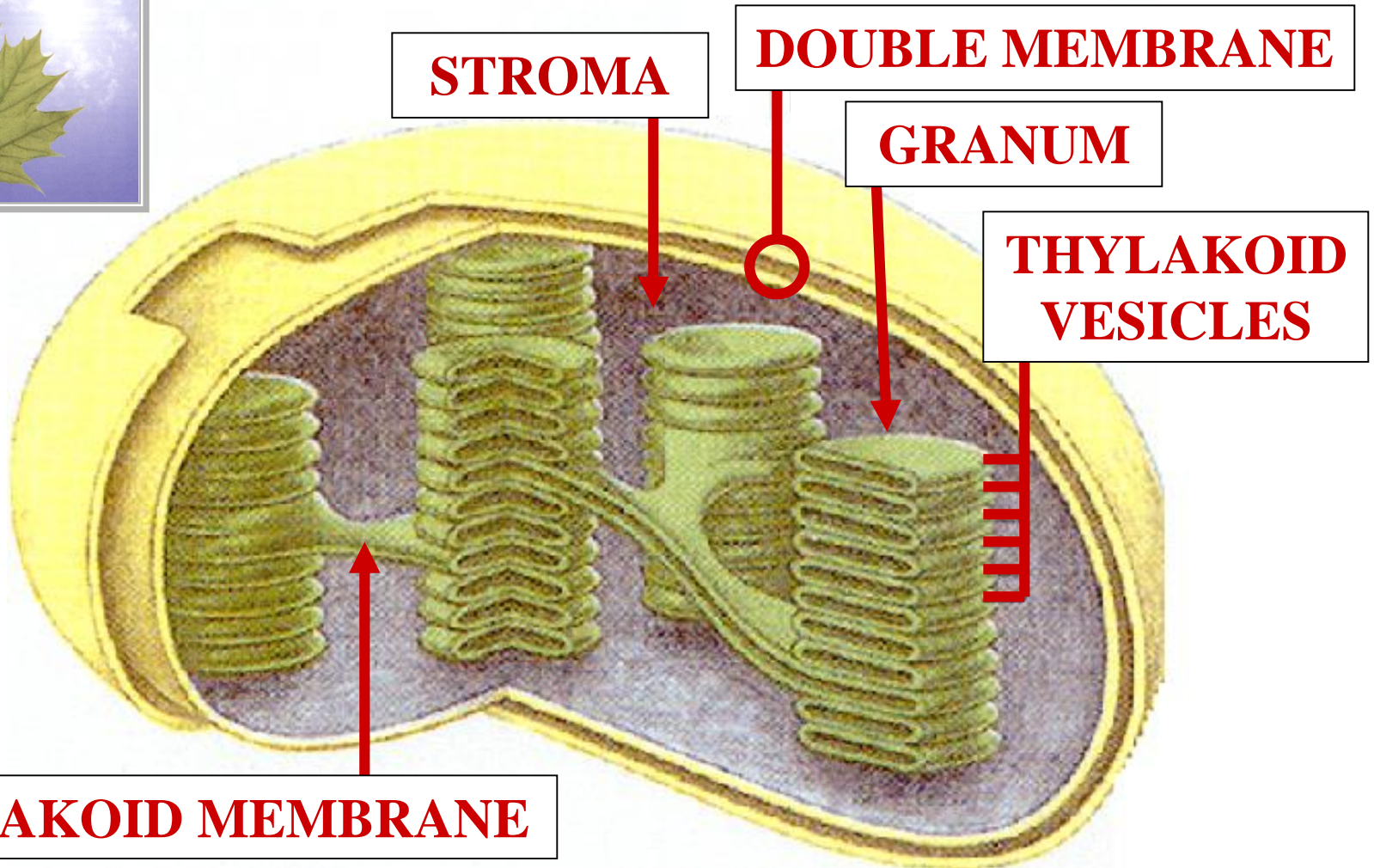
CHLOROPLAST
FLUID MATRIX

SITE: DARK RXT
DERIVES GLUCOSE

STROMA



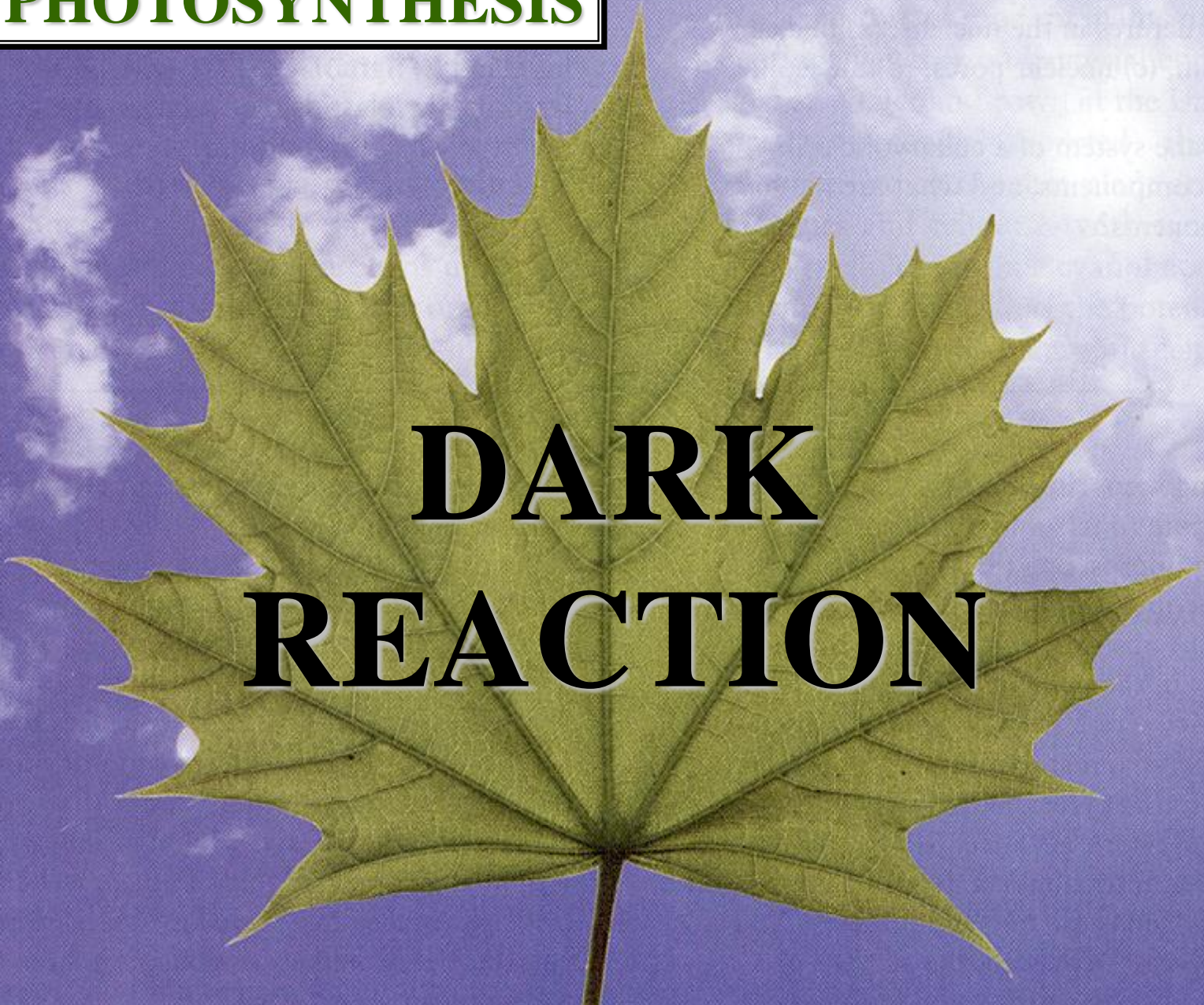
CHLOROPLAST ULTRASTRUCTURE



PHOTOSYNTHESIS



DARK REACTION



PHOTOSYNTHESIS

DR



WATER

LIGHT ENERGY

PHOTO

E-

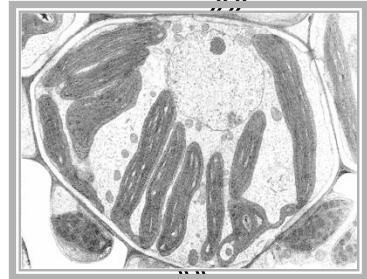
PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

ATP

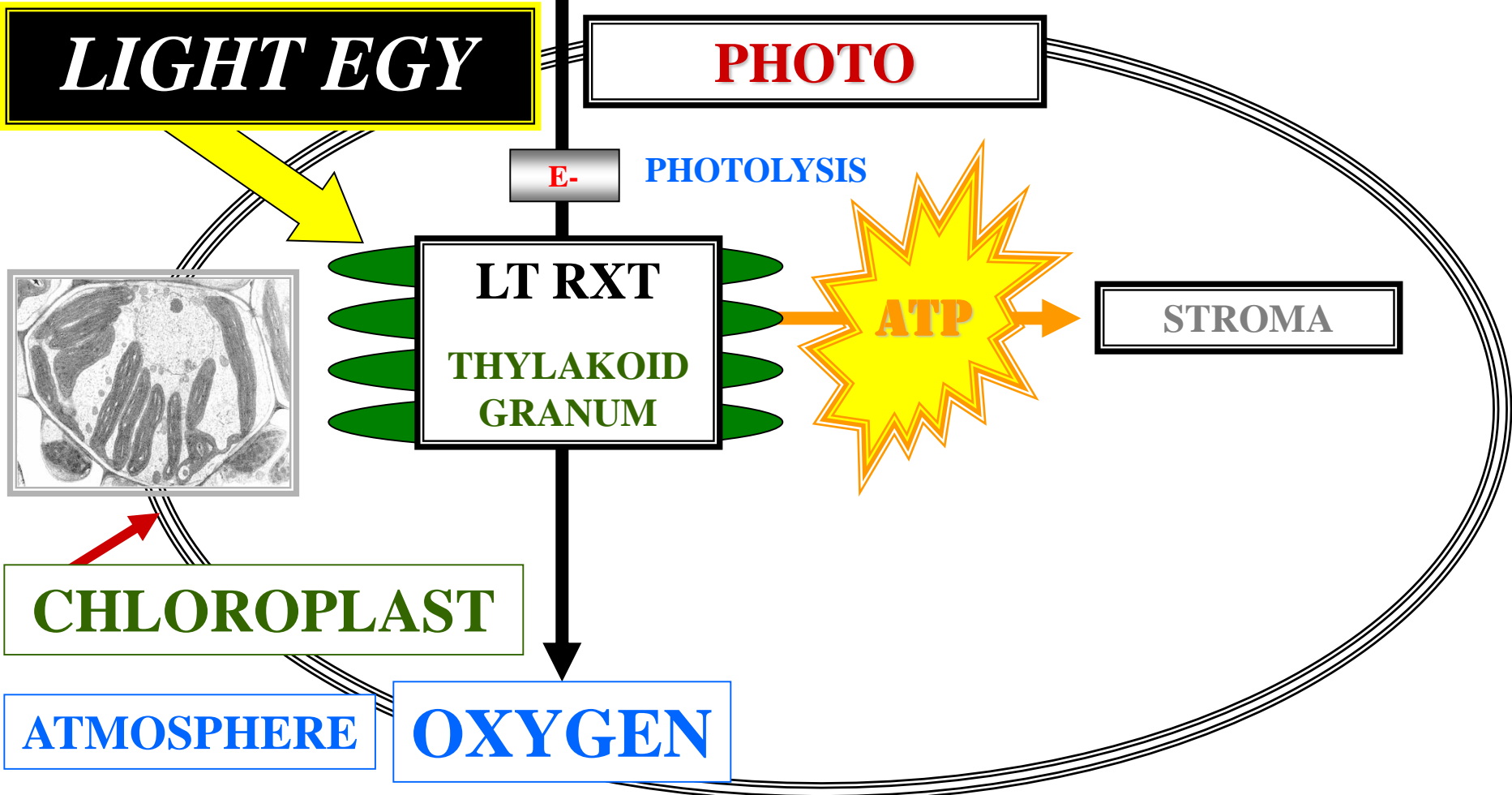
STROMA



CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS



?

C

WATER

LIGHT ENERGY

PHOTO

E-

PHOTOLYSIS

LT RXT

**THYLAKOID
GRANUM**

ATP

DK RXT

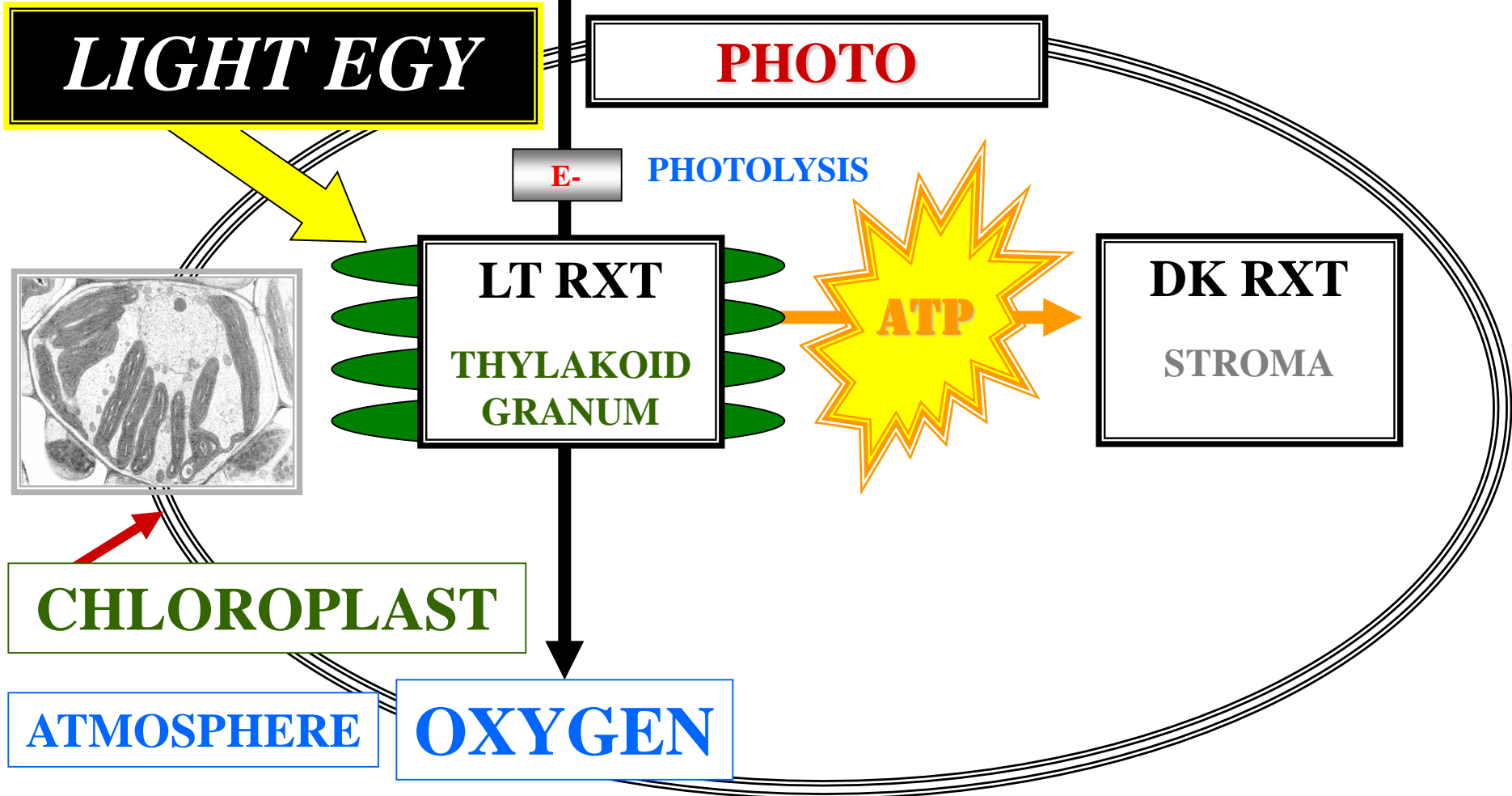
STROMA



CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS

C



WATER

?

LIGHT ENERGY

PHOTO

ATMOSPHERE

E- PHOTOLYSIS



LT RXT
THYLAKOID
GRANUM

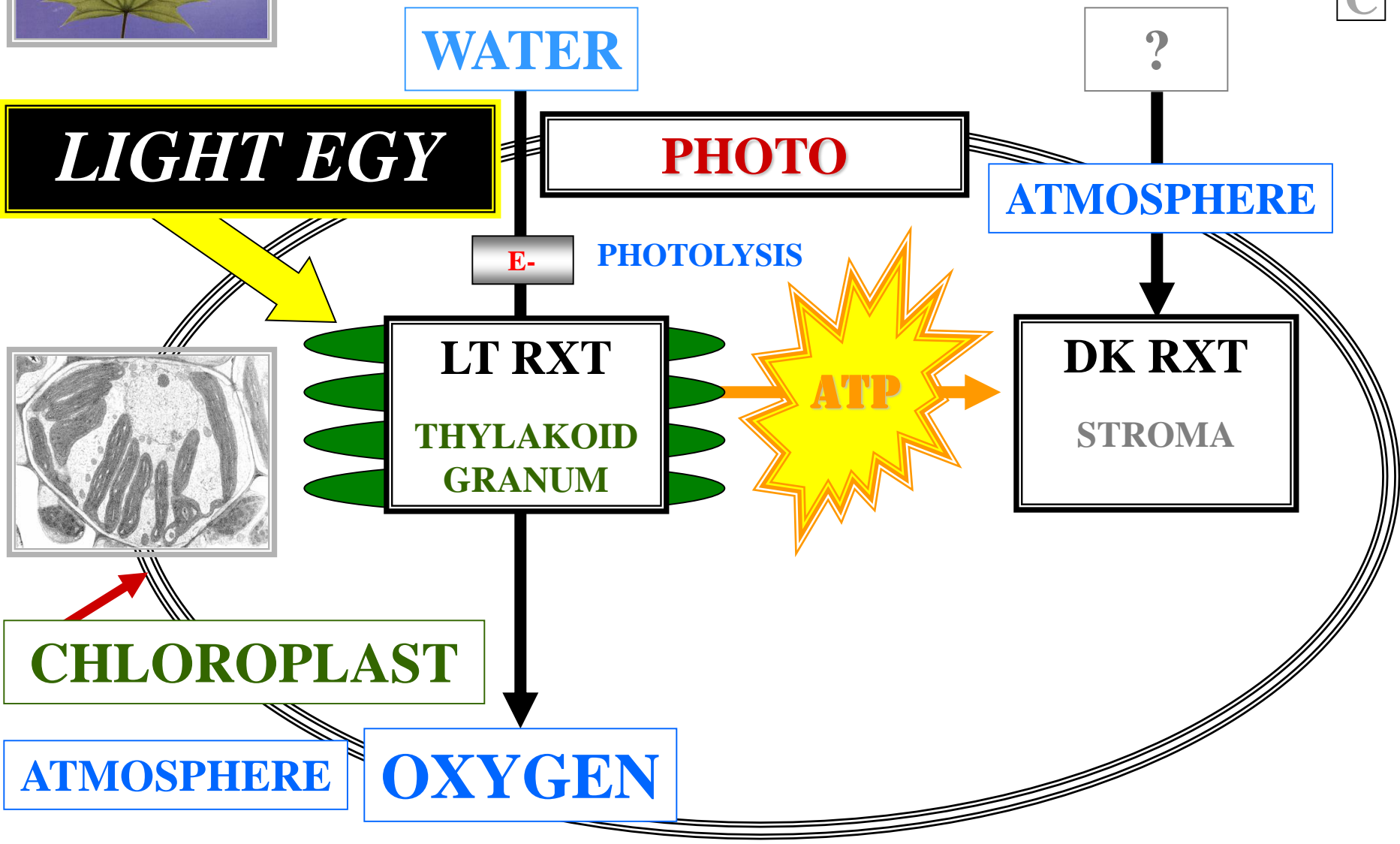


DK RXT
STROMA

CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS



?

S

WATER

CO₂

LIGHT ENERGY

PHOTO

ATMOSPHERE

E-

PHOTOLYSIS

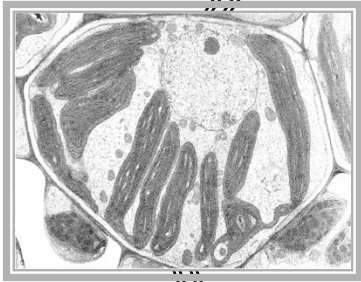
LT RXT

THYLAKOID
GRANUM

ATP

DK RXT

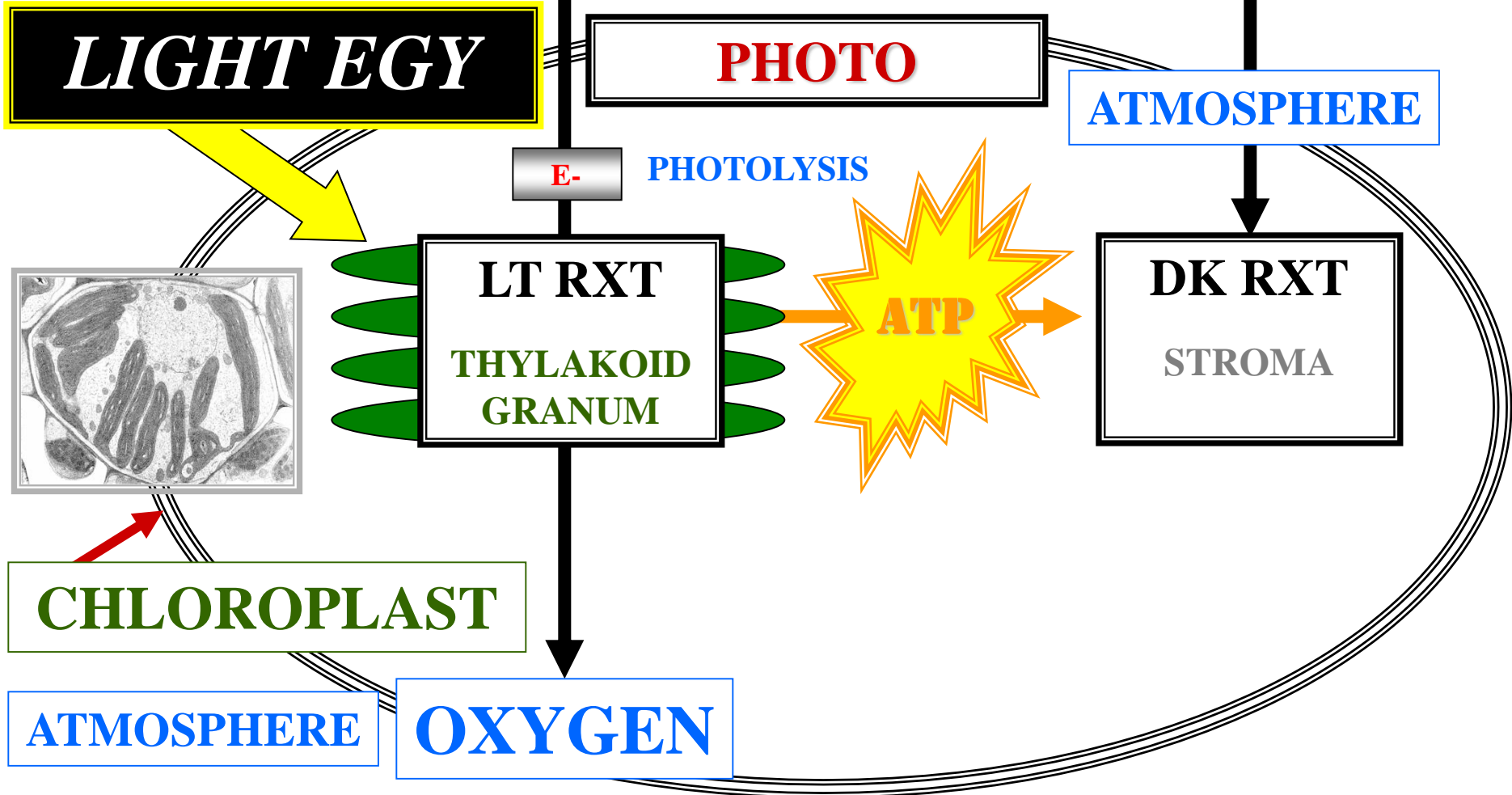
STROMA



CHLOROPLAST

ATMOSPHERE

OXYGEN



PHOTOSYNTHESIS

G



WATER

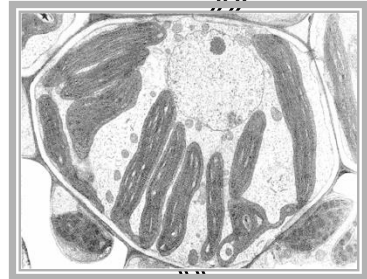
CO₂

LIGHT ENERGY

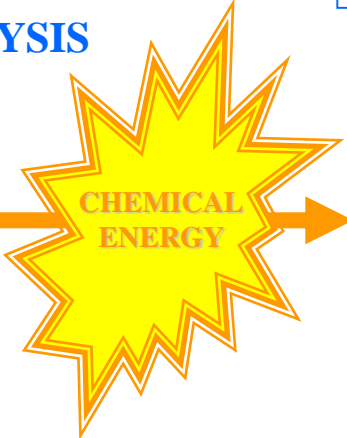
PHOTO

ATMOSPHERE

E- PHOTOLYSIS



LT RXT
THYLAKOID
GRANUM



DK RXT
STROMA

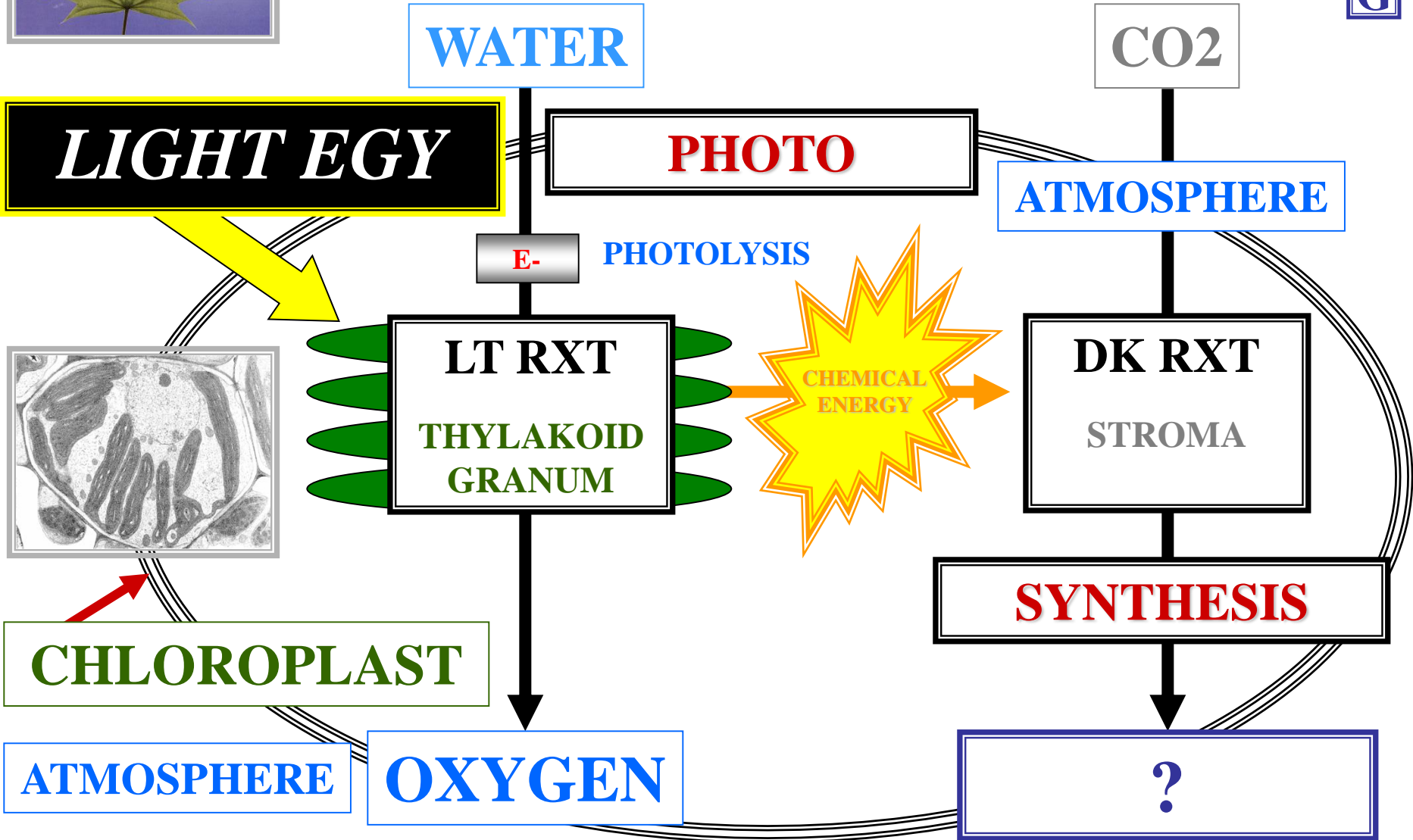
SYNTHESIS

CHLOROPLAST

ATMOSPHERE

OXYGEN

?



PHOTOSYNTHESIS



LT



WATER

CO₂

LIGHT ENERGY

PHOTO

ATMOSPHERE

E-

PHOTOLYSIS

LT RXT

**THYLAKOID
GRANUM**

**CHEMICAL
ENERGY**

DK RXT

STROMA

SYNTHESIS

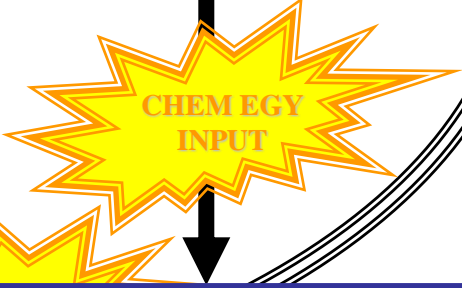
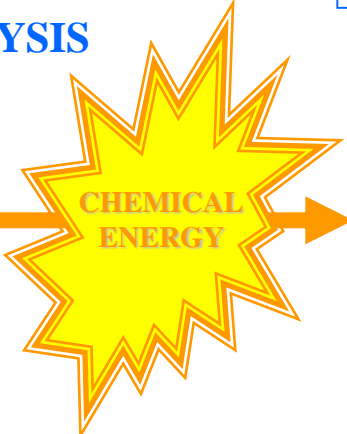
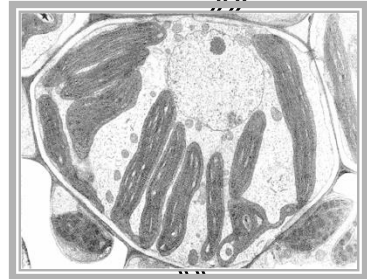
**CHEMICAL
INPUT**

CHLOROPLAST

ATMOSPHERE

OXYGEN

GLUCOSE



PHOTOSYNTHESIS



PHOTOSYNTHESIS
LIGHT ENERGY
INITIAL ENERGY
SOURCE