

**CAM
PATHWAY
ADVANTAGE
OVER
C3 & C4**





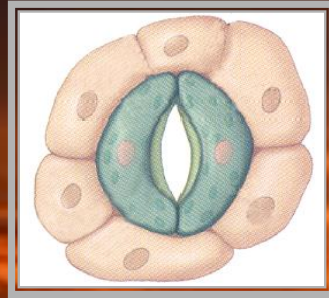
CAM PATHWAY DARK HOURS



CAM PATHWAY LIGHT HOURS

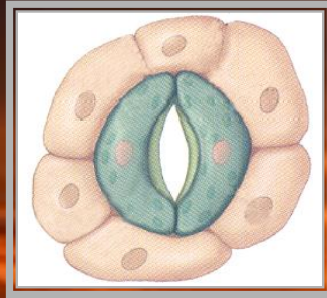


CAM PATHWAY DARK HOURS



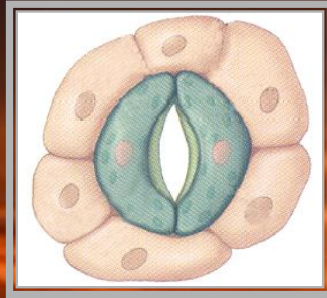
STOMATES
OPEN

CAM PATHWAY DARK HOURS



HIGH
HUMIDITY

CAM PATHWAY DARK HOURS

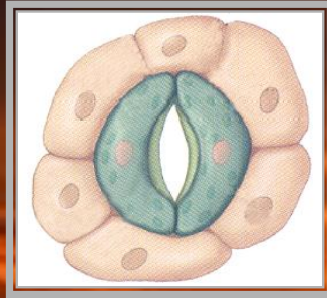


TRANSPIRATION
POTENTIAL

CAM PATHWAY DARK HOURS

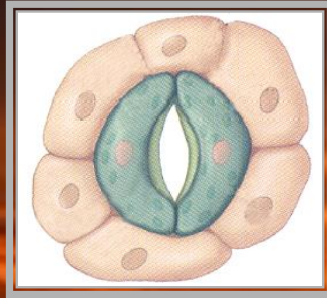
CO₂

F



VERY LOW
TRANSPIRATION
POTENTIAL

CAM PATHWAY DARK HOURS



CAM PLANTS
UNDERGO
CO₂ FIXATION





CAM ADVANTAGE

LESS

TRANSPIRATION

PER GLUCOSE

THAN C3 OR C4

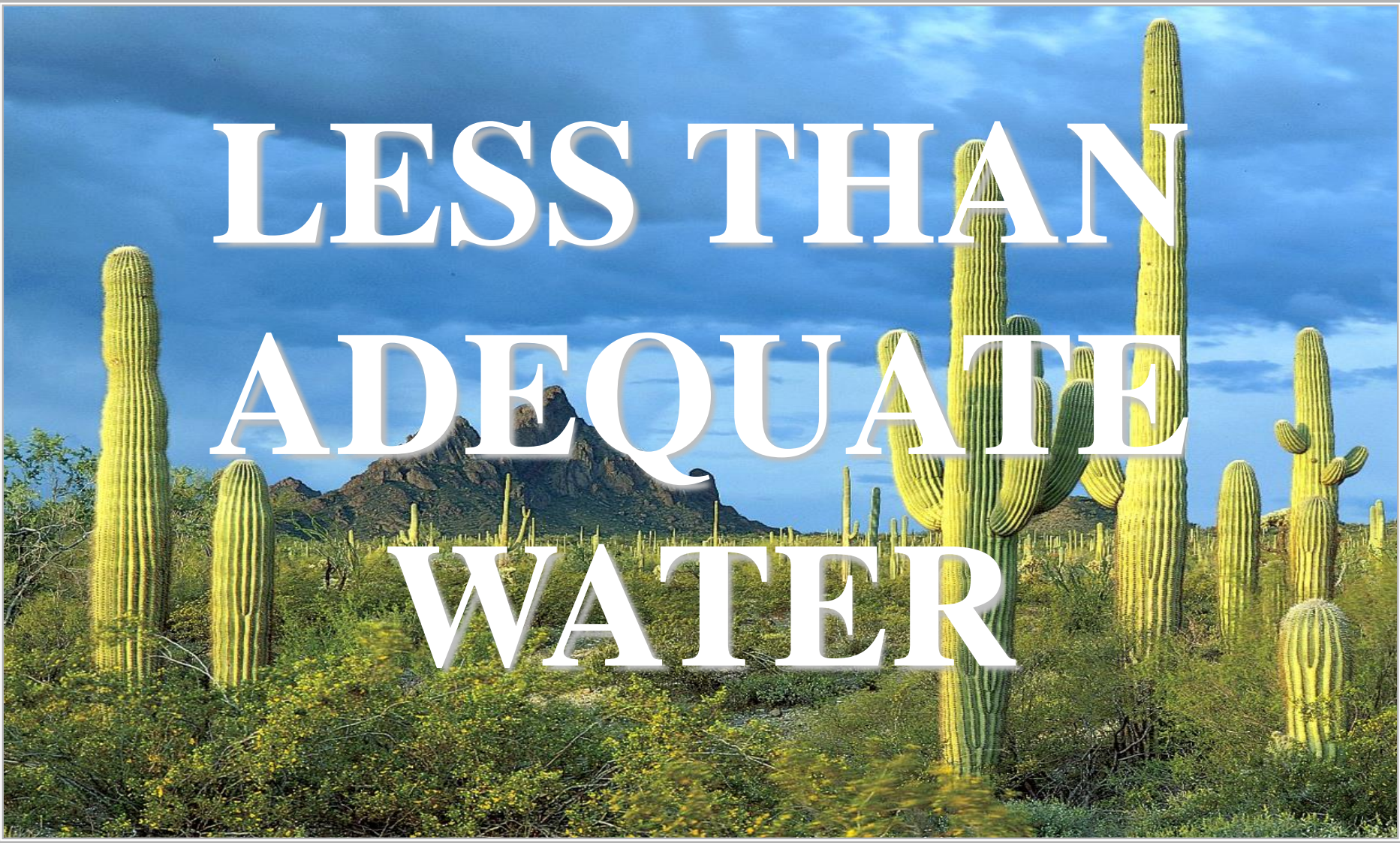


CAM PATHWAY ECOLOGY

A photograph of a desert landscape featuring several tall saguaro cacti of various sizes. The cacti are green with distinct ribs and are scattered across a field of low-lying green and yellow shrubs. In the background, there are dark, rocky mountains under a bright blue sky with some light clouds. The text 'CAM PLANTS', 'VERY XERIC', and 'HABITATS' is overlaid in large, white, serif font across the center of the image.

CAM PLANTS
VERY XERIC
HABITATS

VERY XERIC HABITATS



LESS THAN
ADEQUATE
WATER

VERY XERIC HABITATS

DESERTS



VERY XERIC HABITATS

PHOTOSYNTHESIS



DARK REACTION SUMMARY

DARK REACTION



ALABAMA FORESTS

MESIC HABITATS


DARK REACTION



C3 PATHWAY PLANTS

MESIC HABITATS

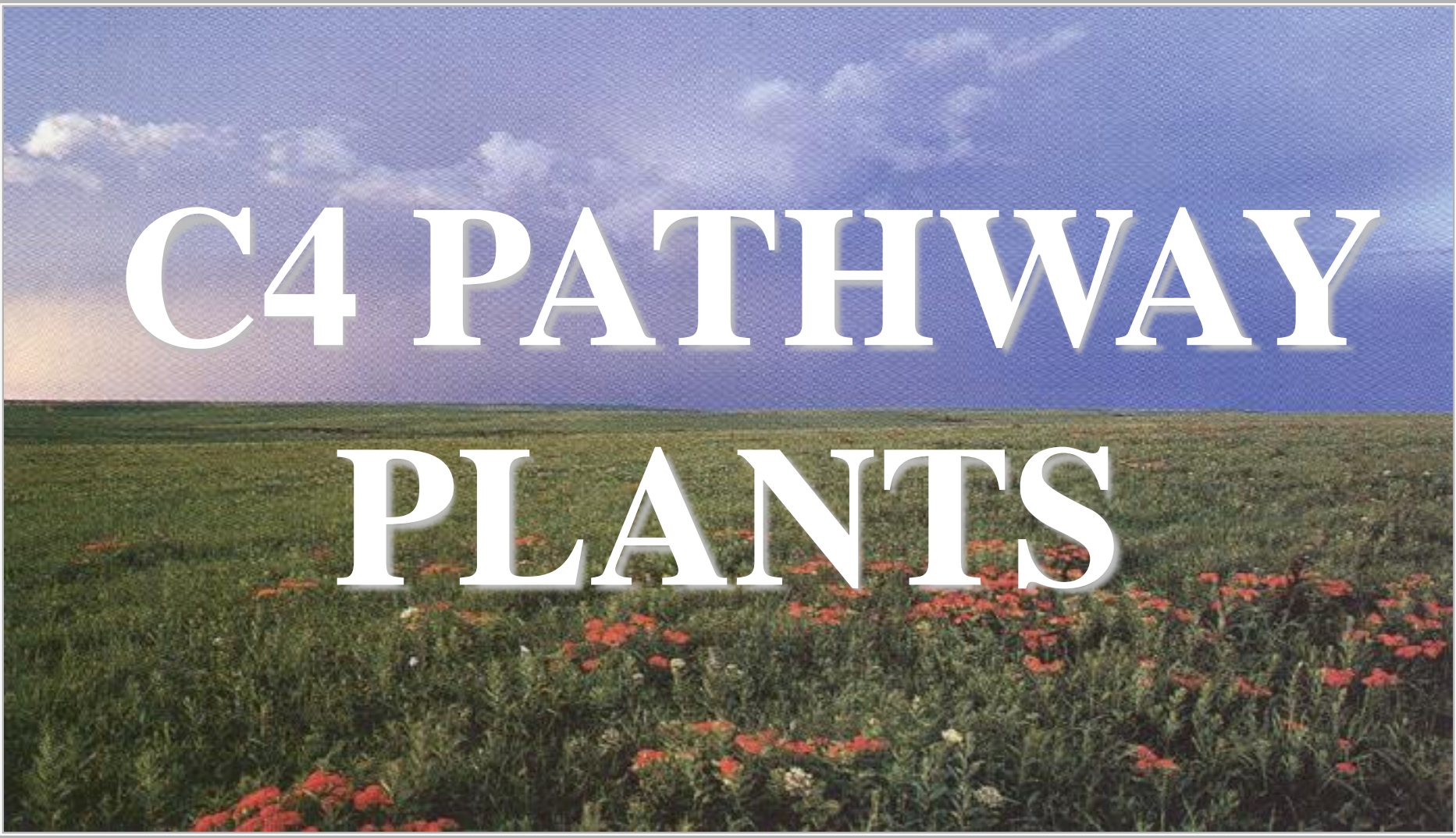
DARK REACTION

A photograph of a vast grassland with red flowers under a blue sky with clouds. The text "MIDWEST GRASSLANDS" is overlaid in large white letters with a drop shadow.

MIDWEST GRASSLANDS

XERIC HABITATS

DARK REACTION



C4 PATHWAY PLANTS

XERIC HABITATS

DARK REACTION

A photograph of a desert landscape featuring several tall saguaro cacti in the foreground and middle ground. In the background, there are rugged, rocky mountains under a blue sky with scattered white clouds. The text "SOUTH WEST" is written in large, white, serif capital letters across the upper middle of the image, and "DESERT" is written in the same style across the lower middle. The overall scene is brightly lit, suggesting a sunny day.

**SOUTH WEST
DESERT**

VERY XERIC HABITATS

DARK REACTION

A photograph of a desert landscape featuring several tall saguaro cacti of various sizes. The ground is covered with low-lying green and yellow shrubs. In the background, there are rugged, rocky mountains under a blue sky with scattered white clouds. The text 'CAM PATHWAY PLANTS' is overlaid in large, white, serif font across the center of the image.

CAM PATHWAY PLANTS

VERY XERIC HABITATS

PHOTO-RESPIRATION

PHOTO-RESPIRATION



PHOTO-RESPIRATION

LIGHT & OXYGEN FORMATION
OF PHOSPHOGLYCOLATE WITH
SUBSEQUENT PHOSPHOGLYCOLATE
BREAK-DOWN TO CARBON DIOXIDE
AND PHOSPHOGLYCERATE

PHOTO-RESPIRATION



ENZYME

RIBULOSE BISPHTHOSPHATE

(RUBP-ASE)



**RUBBP-ASE
CARBOXYLASE
OR
RUBBP-ASE
OXYGENASE**



**CO₂
HIGH CONCENTRATION
CHLOROPLAST STROMA**



RIBULOSE BISPHOSEPHATE / (RUBP)



**RIBULOSE BISPHOSEPHATE
ENZYME
(RUBP-ASE)**



CR



CO₂
HIGH CONCENTRATION
CHLOROPLAST STROMA

CO₂ + **RIBULOSE BISPHOSEPHATE / (RUBP)**

RIBULOSE BISPHOSEPHATE
CARBOXYLASE
(RUBP-CARBOXYLASE)

UNSTABLE 6C COMPOUND



^

RUBP-ASE: ACTS AS AN CARBOXYLASE



O₂
HIGH CONCENTRATION
CHLOROPLAST STROMA



RIBULOSE BISPHOSEPHATE / (RUBP)



RIBULOSE BISPHOSEPHATE
ENZYME
(RUBP-ASE)



OX



O₂
HIGH CONCENTRATION
CHLOROPLAST STROMA

O₂ + RIBULOSE BISPHOSEPHATE / (RUBP)

RIBULOSE BISPHOSEPHATE
OXYGENASE
(RUBP-OXYGENASE)



RUBP-ASE: ACTS AS AN OXYGENASE

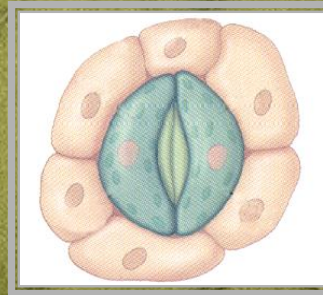
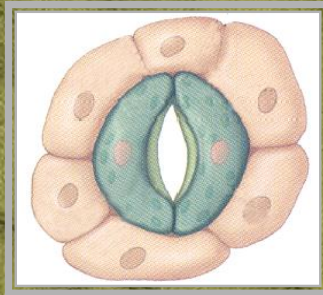
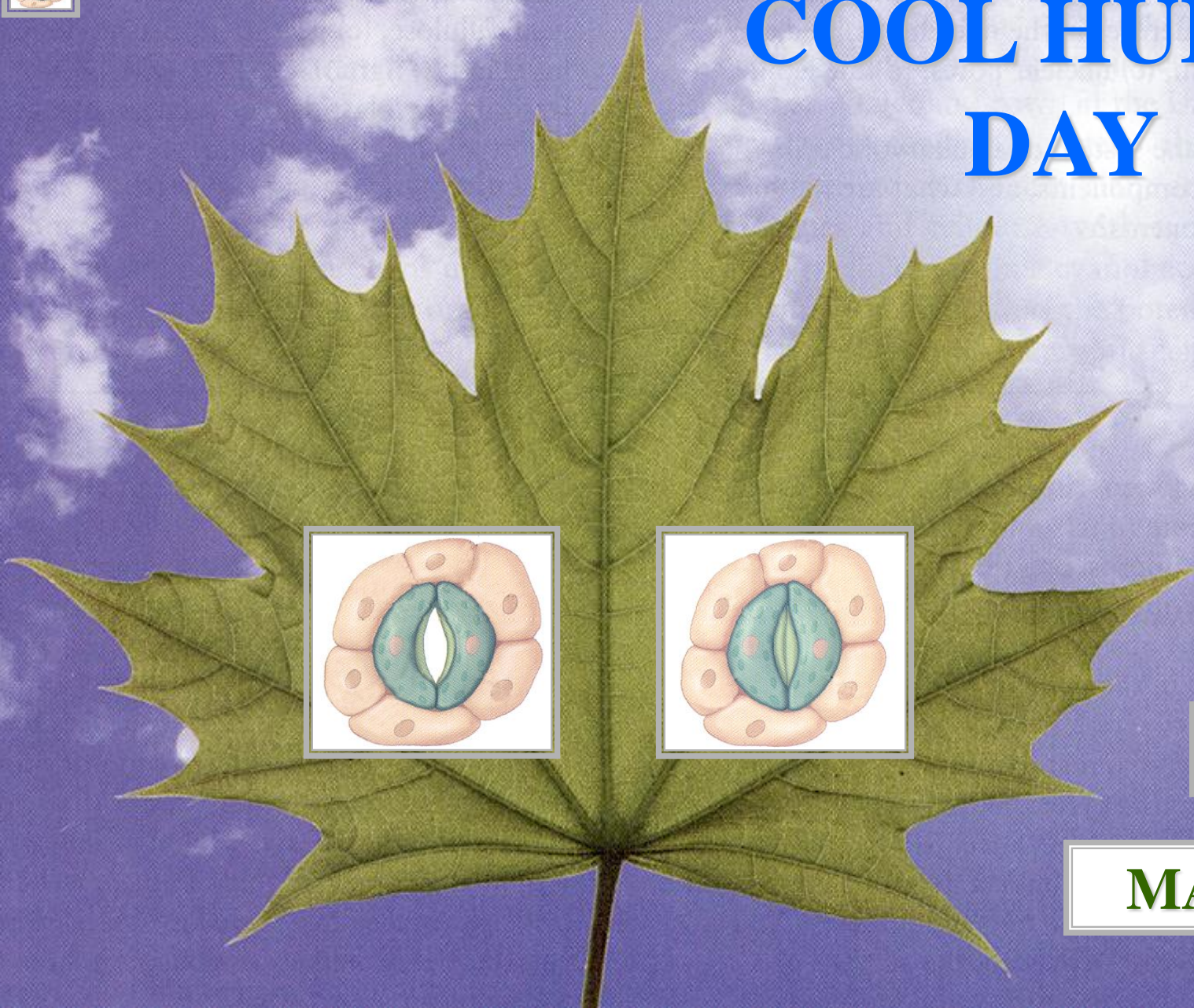


RUBP-ASE

CARBOXYLASE



COOL HUMID DAY



C3

MAPLE

ATMOSPHERE

LEAF STOMATE

ATMOSPHERE

CO₂

CO₂

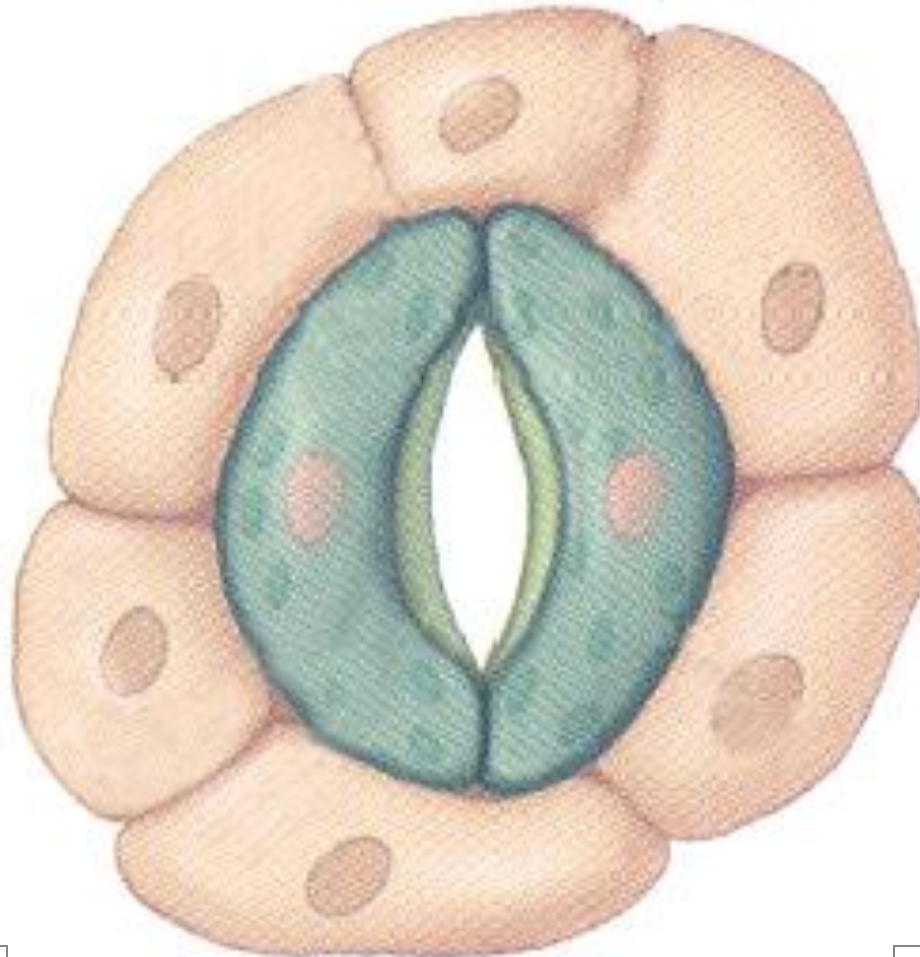


CO₂

CO₂

DIFFUSION

DIFFUSION





ATMOSPHERE

LEAF STOMATE

ATMOSPHERE

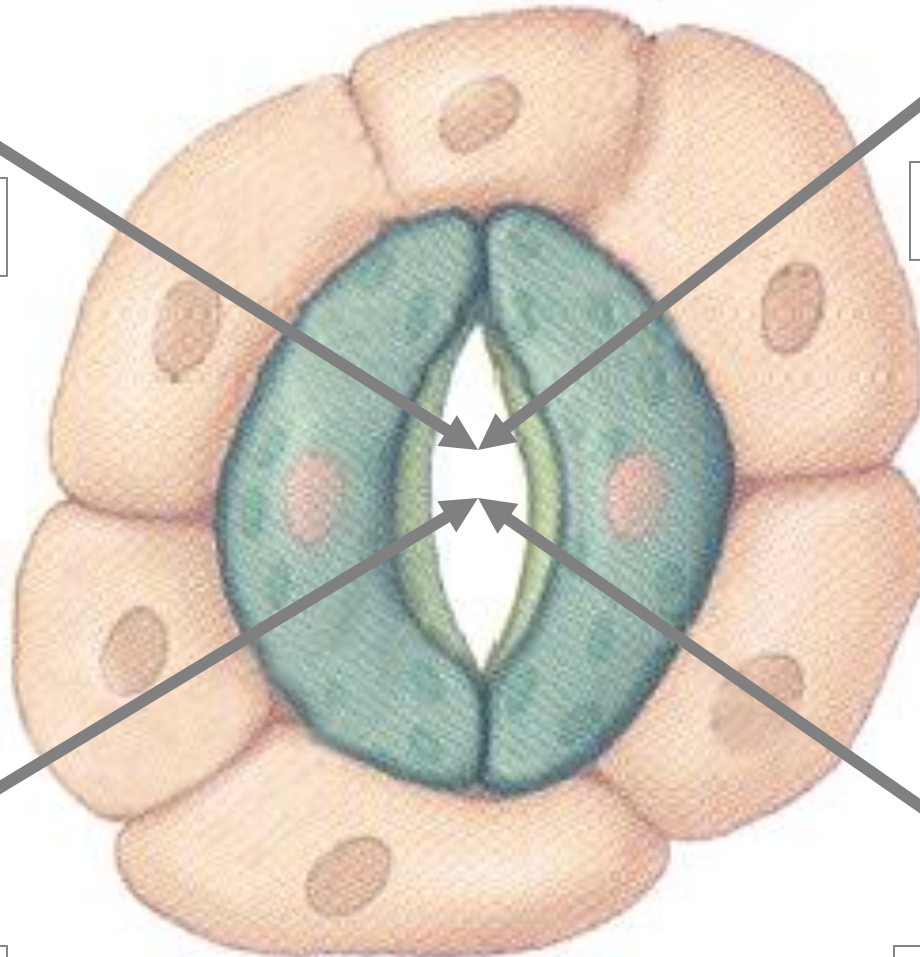
CO₂

DIFFUSION



CO₂

DIFFUSION



CO₂

DIFFUSION



CO₂

DIFFUSION

C3 LEAF

LEAF MESOPHYLL

HIGH CO₂

D

CO₂

CO₂

CO₂

CO₂

CO₂

CO₂

CO₂

CO₂

CO₂



C3 LEAF

LEAF MESOPHYLL

HIGH CO₂



CO₂

CO₂

CO₂

DIFFUSION

DIFFUSION

DIFFUSION

CO₂

CO₂

CO₂

DIFFUSION

DIFFUSION

DIFFUSION

CO₂

CO₂

CO₂

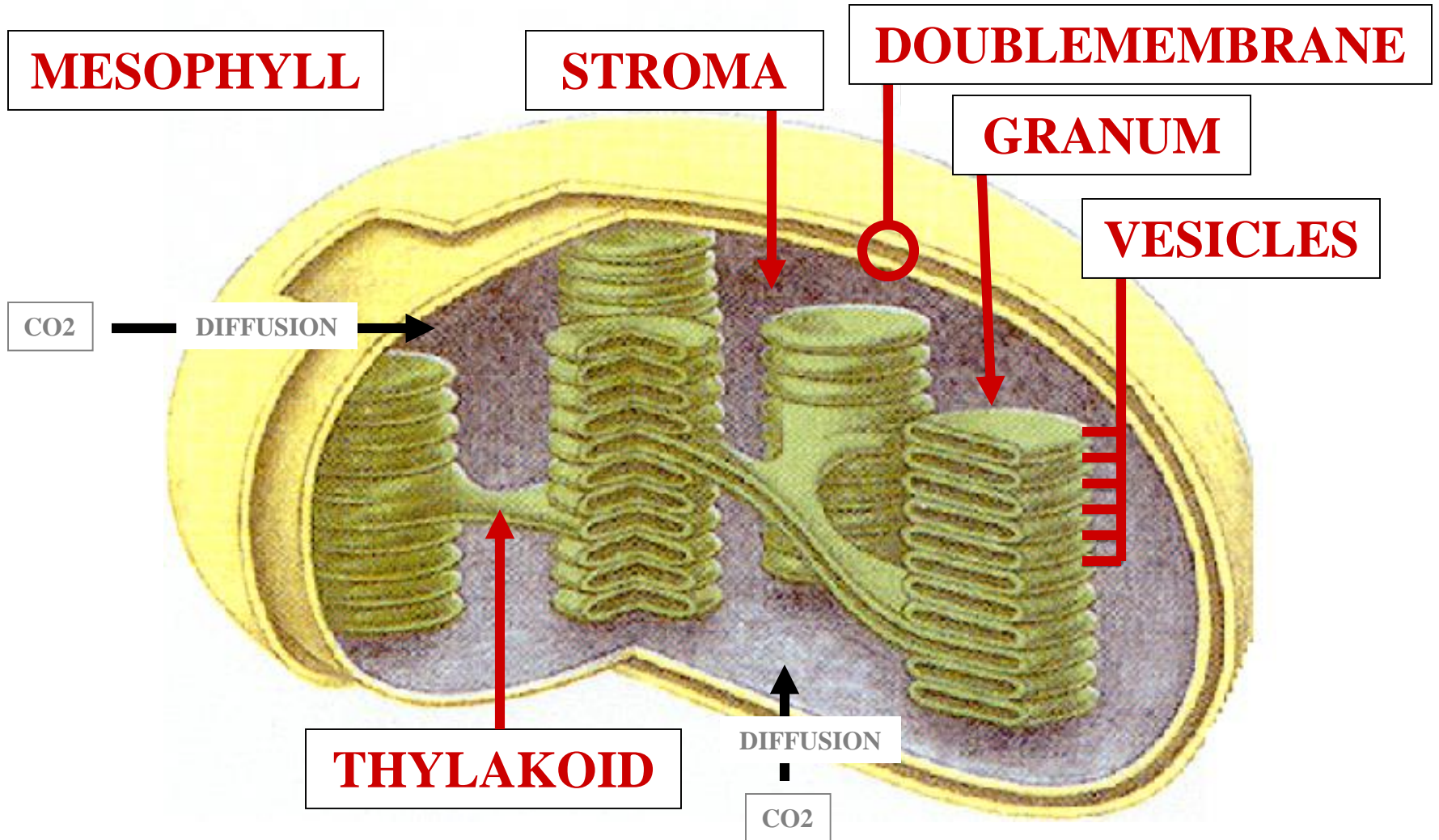
DIFFUSION

DIFFUSION

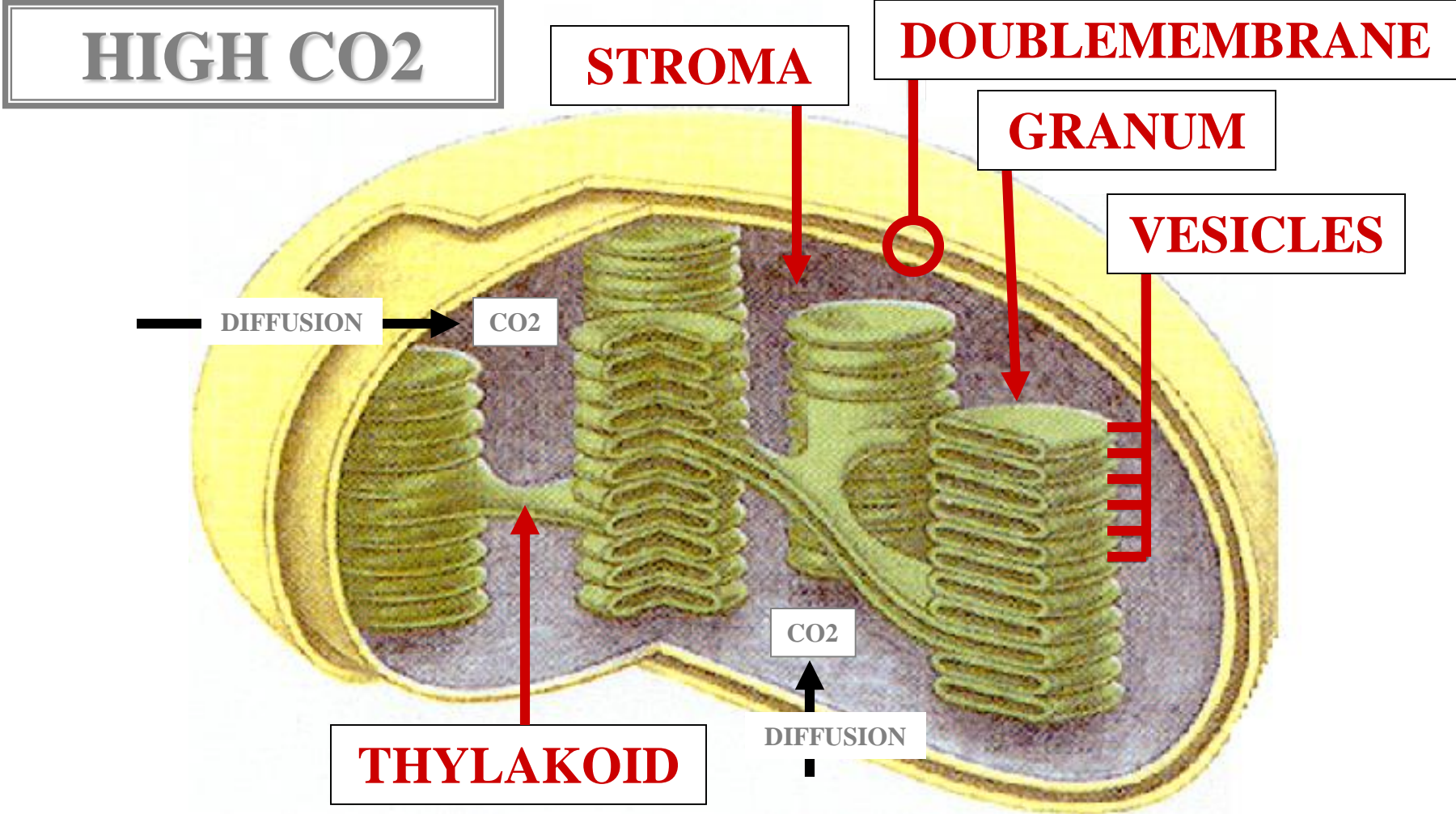
DIFFUSION



CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST ULTRASTRUCTURE





**CO₂
HIGH CONCENTRATION
CHLOROPLAST STROMA**



RIBULOSE BISPHOSEPHATE / (RUBP)



**RIBULOSE BISPHOSEPHATE
ENZYME
(RUBP-ASE)**

HIGH CO₂



CR



CO₂
HIGH CONCENTRATION
CHLOROPLAST STROMA

CO₂ + **RIBULOSE BISPHOSEPHATE / (RUBP)**

RIBULOSE BISPHOSEPHATE
CARBOXYLASE
(RUBP-CARBOXYLASE)

UNSTABLE 6C COMPOUND



P

RUBP-ASE: ACTS AS AN CARBOXYLASE



**CO₂
HIGH CONCENTRATION
CHLOROPLAST STROMA**



CO₂ + RIBULOSE BISPHOSEPHATE / (RUBP)

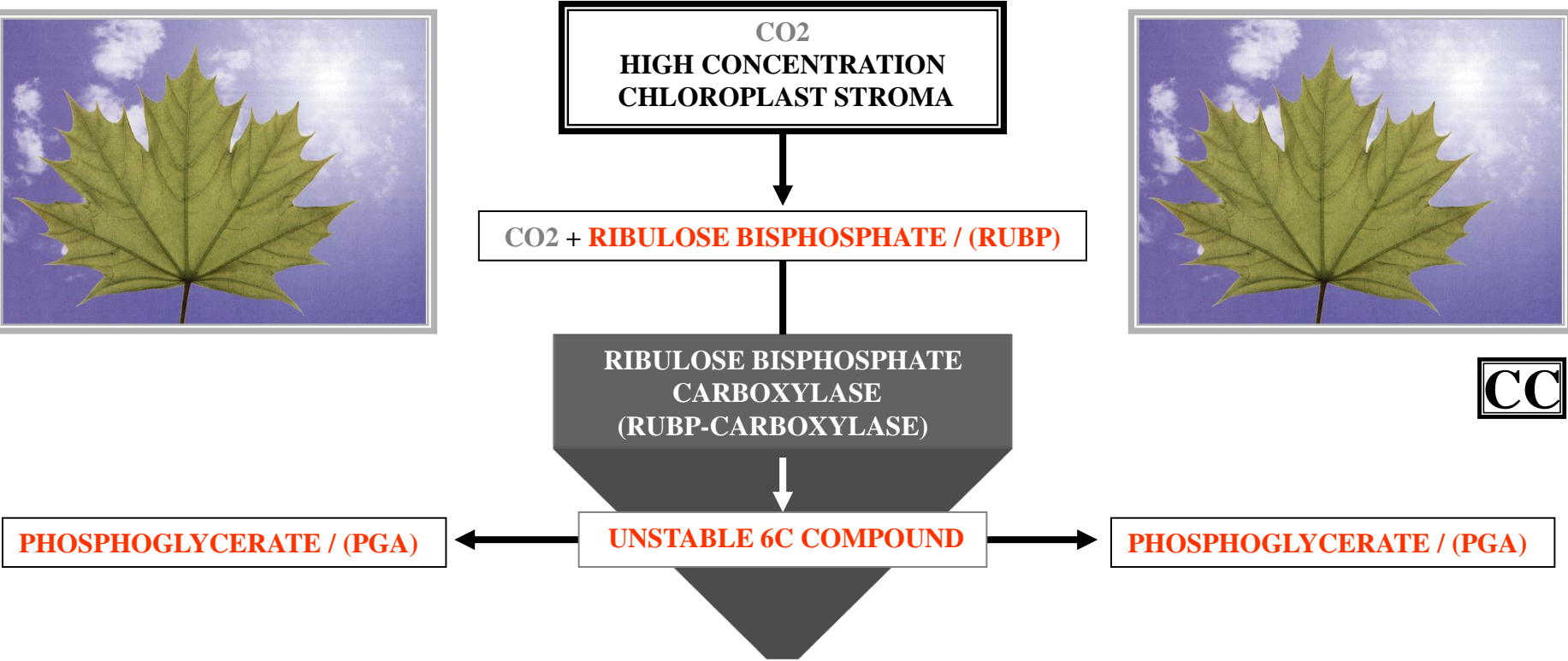
**RIBULOSE BISPHOSEPHATE
CARBOXYLASE
(RUBP-CARBOXYLASE)**



PHOSPHOGLYCERATE / (PGA)

UNSTABLE 6C COMPOUND

PHOSPHOGLYCERATE / (PGA)





**CO₂
HIGH CONCENTRATION
CHLOROPLAST STROMA**



CO₂ + RIBULOSE BISPHOSEPHATE / (RUBP)

**RIBULOSE BISPHOSEPHATE
CARBOXYLASE
(RUBP-CARBOXYLASE)**

G

PHOSPHOGLYCERATE / (PGA)

UNSTABLE 6C COMPOUND

PHOSPHOGLYCERATE / (PGA)

**CALVIN
CYCLE**

**CALVIN
CYCLE**

C₃

CALVIN CYCLE



**CO₂
HIGH CONCENTRATION
CHLOROPLAST STROMA**



CO₂ + RIBULOSE BISPHOSEPHATE / (RUBP)

**RIBULOSE BISPHOSEPHATE
CARBOXYLASE
(RUBP-CARBOXYLASE)**



PHOSPHOGLYCERATE / (PGA)

UNSTABLE 6C COMPOUND

PHOSPHOGLYCERATE / (PGA)

**CALVIN
CYCLE**

**GLUCOSE
ENTERS
METABOLISM**

C₃

**CALVIN
CYCLE**

**GLUCOSE
ENTERS
METABOLISM**

CALVIN CYCLE



RUBP-ASE

CARBOXYLASE

HIGH

PHOTOSYNTHESIS

GLUCOSE OUTPUT

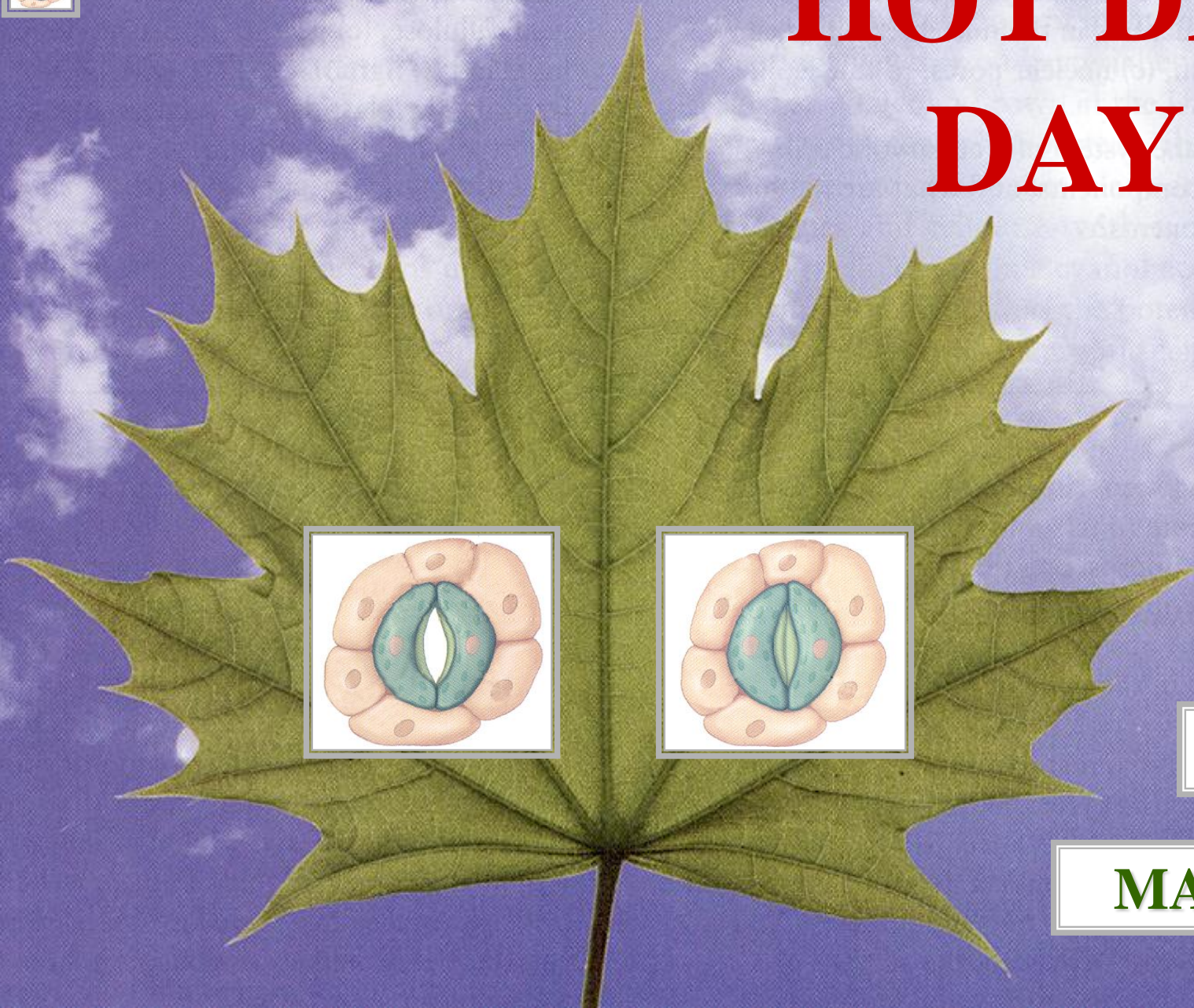
MAPLE



RUBBP-ASE OXYGENASE



HOT DRY DAY



C3

MAPLE

ATMOSPHERE

LEAF STOMATE

ATMOSPHERE

CO₂

CO₂

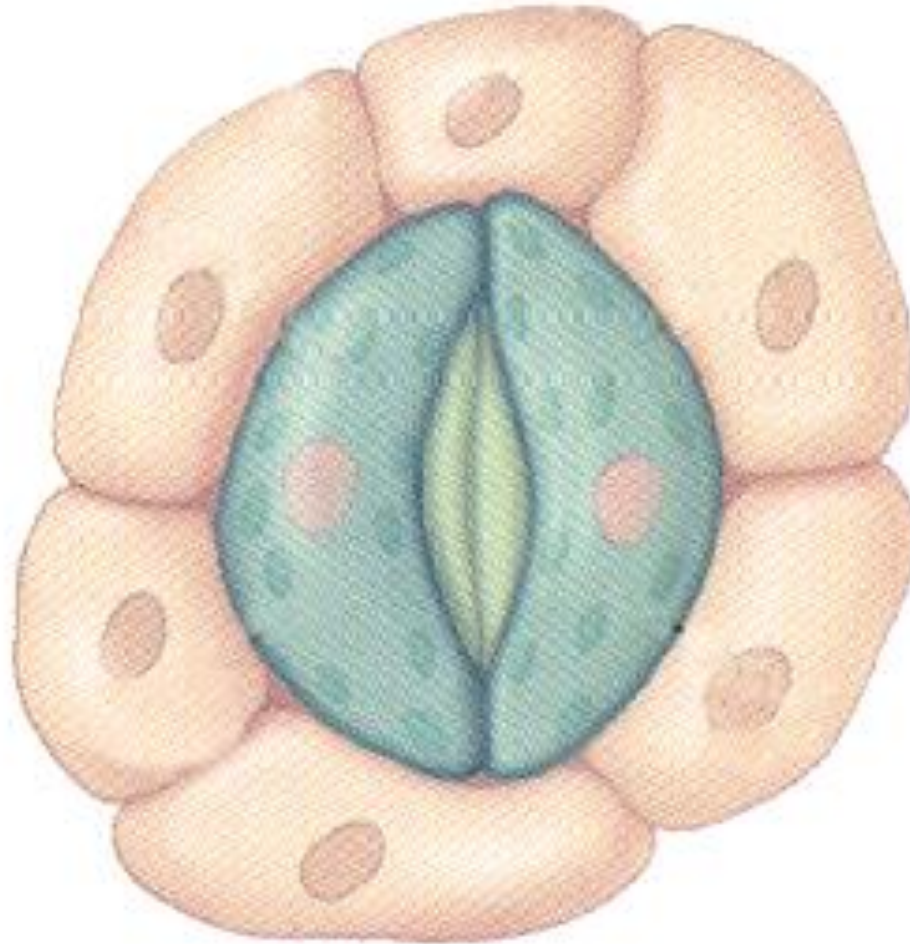


CO₂

CO₂

DIFFUSION

DIFFUSION





ATMOSPHERE

LEAF STOMATE

ATMOSPHERE

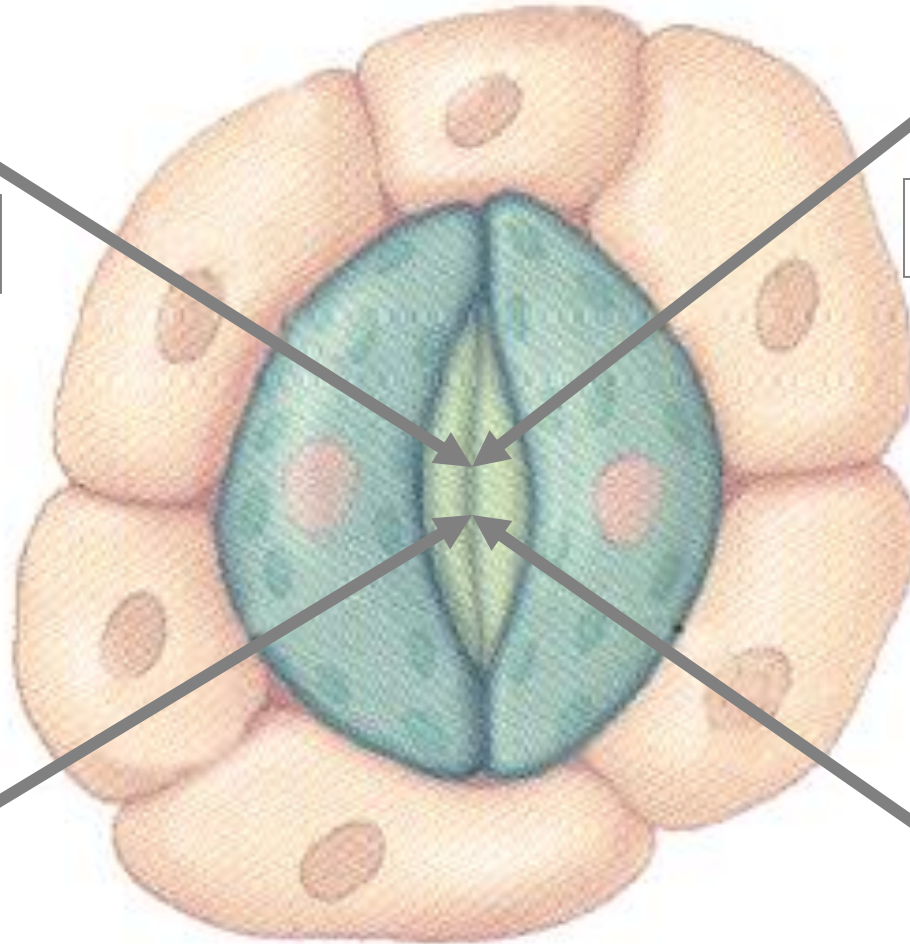
CO₂

DIFFUSION



CO₂

DIFFUSION



CO₂

DIFFUSION



CO₂

DIFFUSION

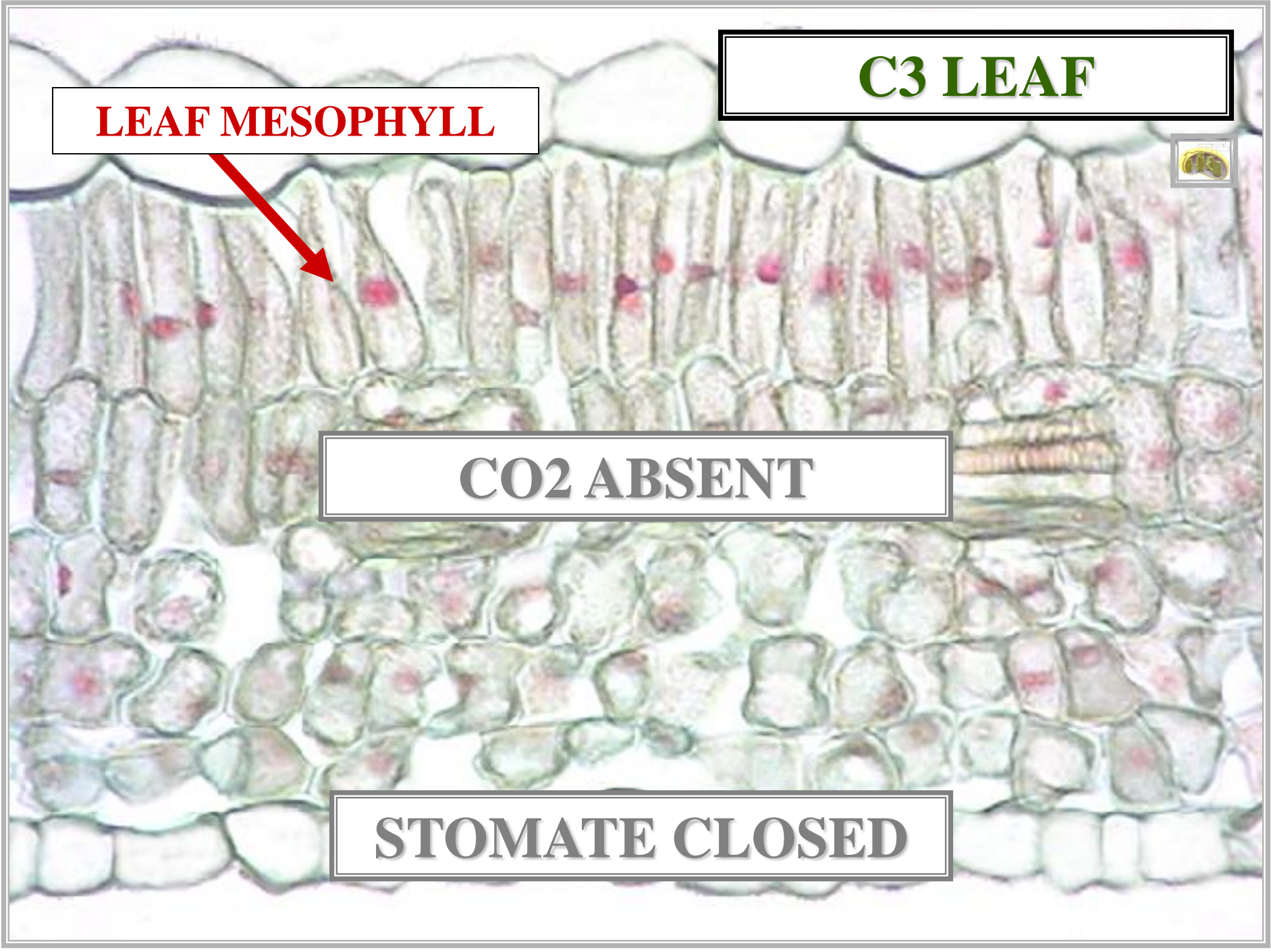
C3 LEAF

LEAF MESOPHYLL



CO₂ ABSENT

STOMATE CLOSED



CHLOROPLAST ULTRASTRUCTURE

CO₂ ABSENT

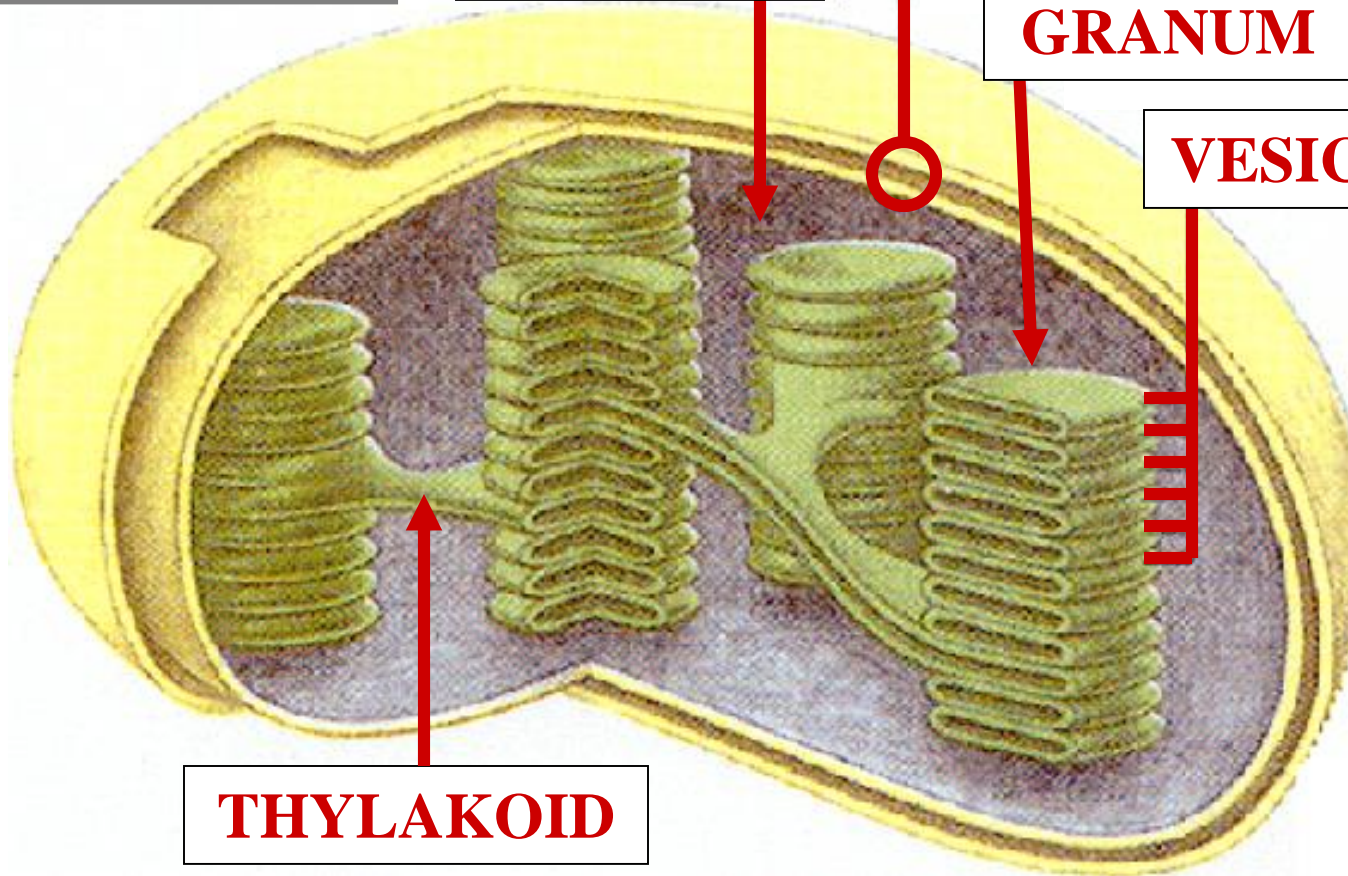
STROMA

DOUBLEMEMBRANE

GRANUM

VESICLES

THYLAKOID



PHOTOSYNTHESIS

0

WATER

LIGHT ENERGY

E-

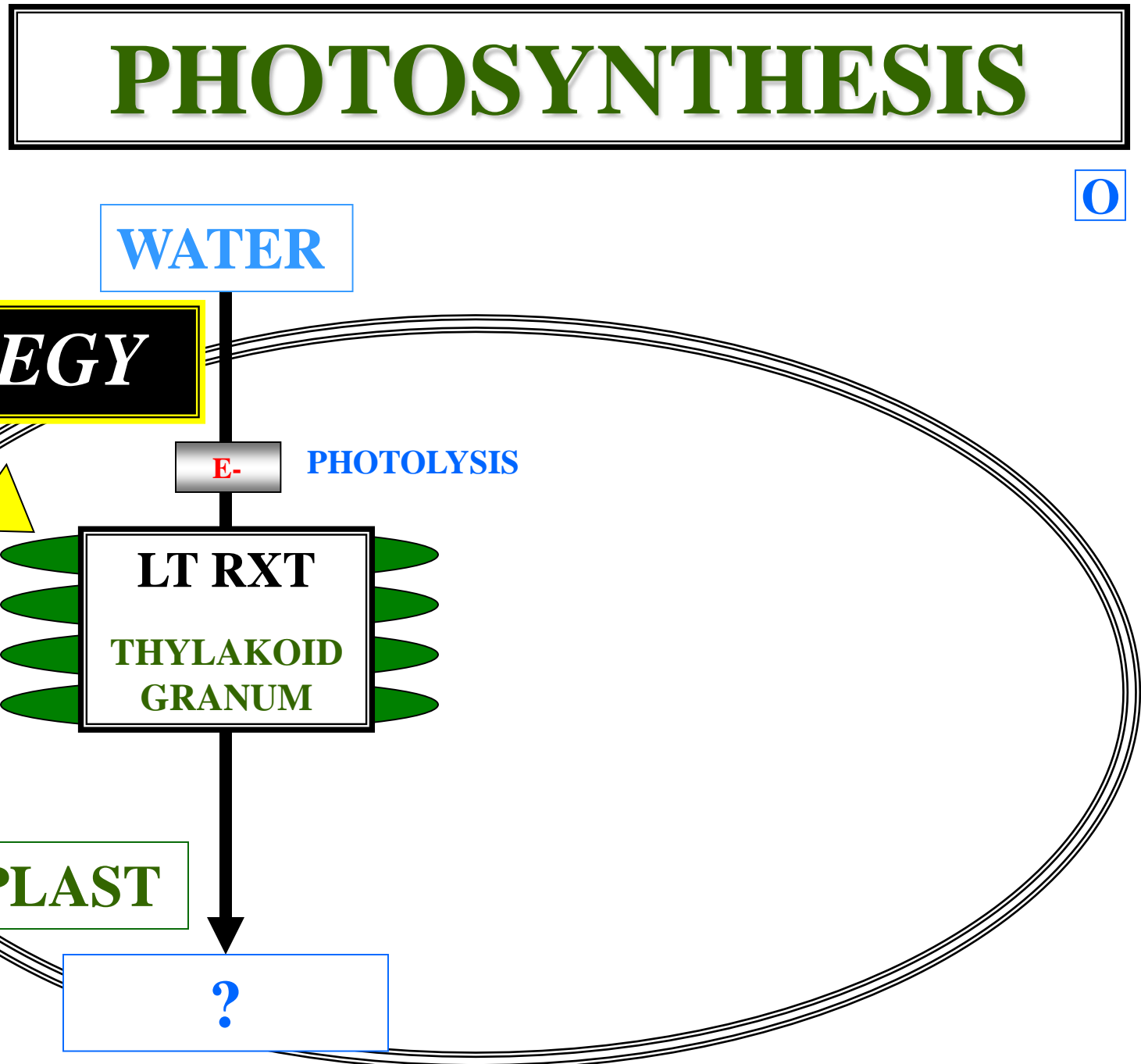
PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

CHLOROPLAST

?



PHOTOSYNTHESIS

2



WATER

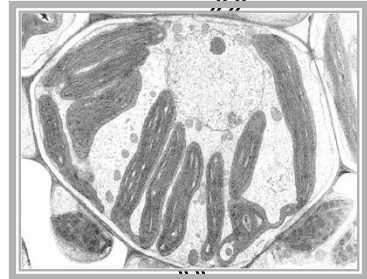
LIGHT ENERGY

E-

PHOTOLYSIS

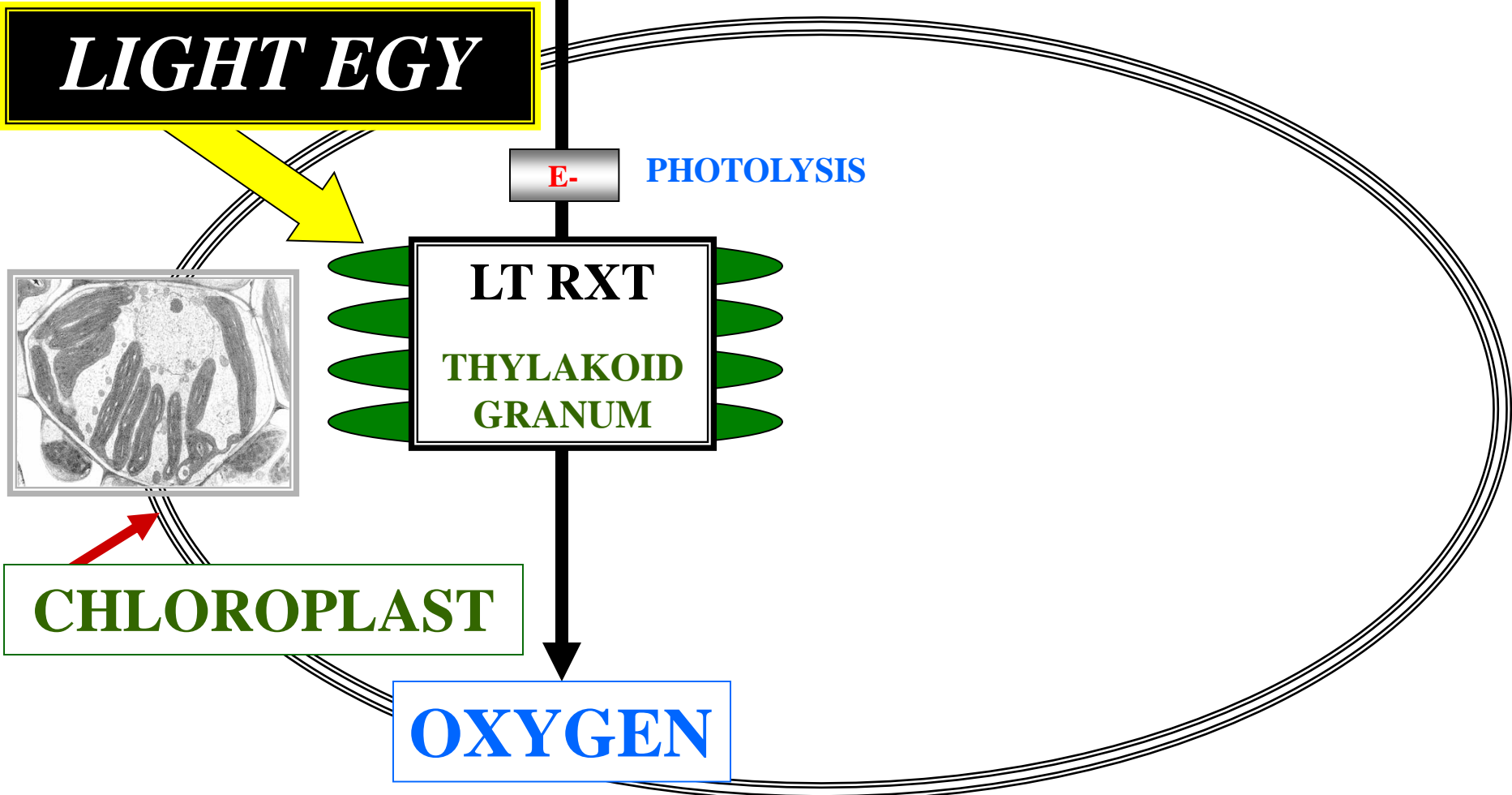
LT RXT

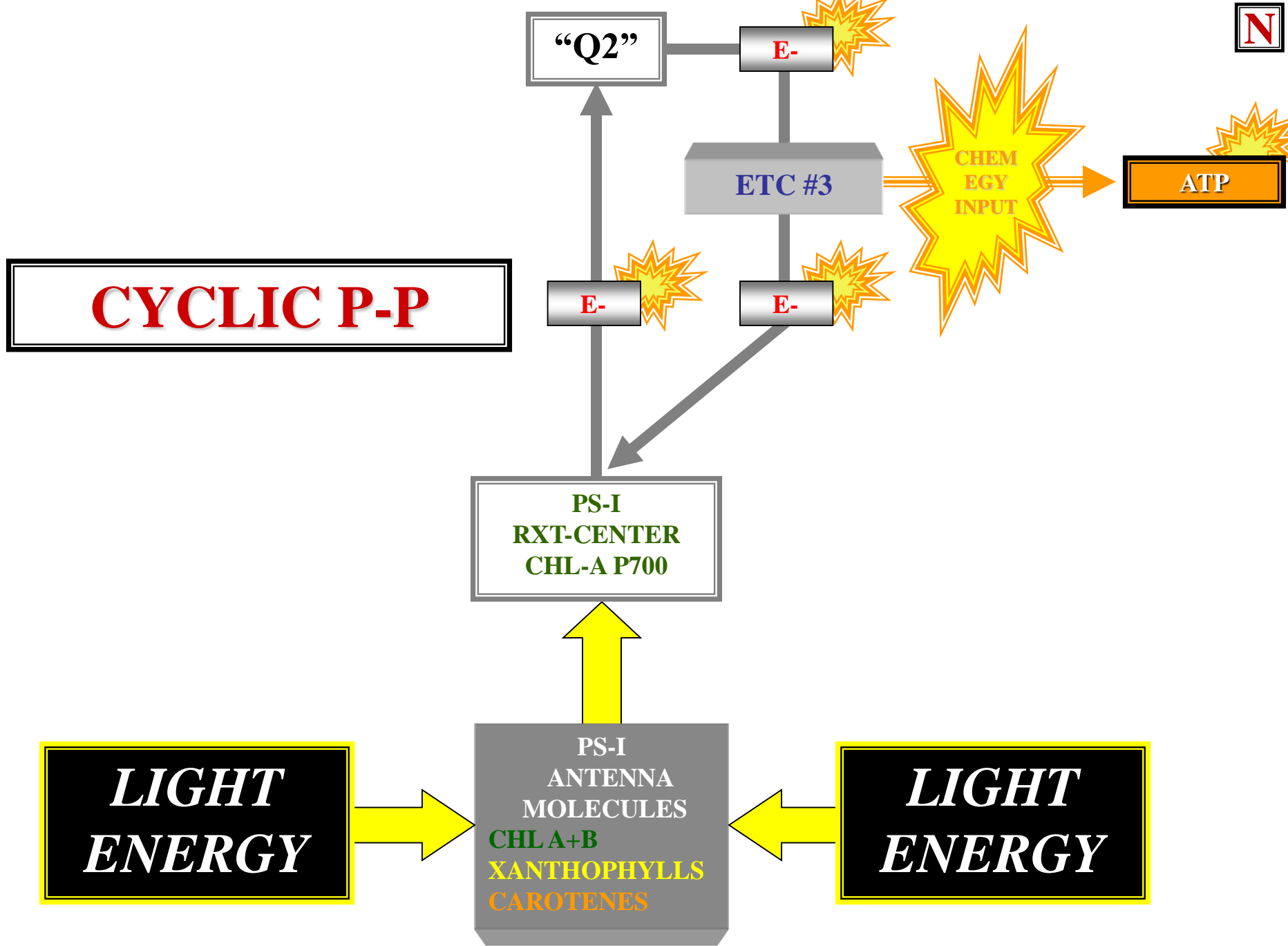
THYLAKOID
GRANUM

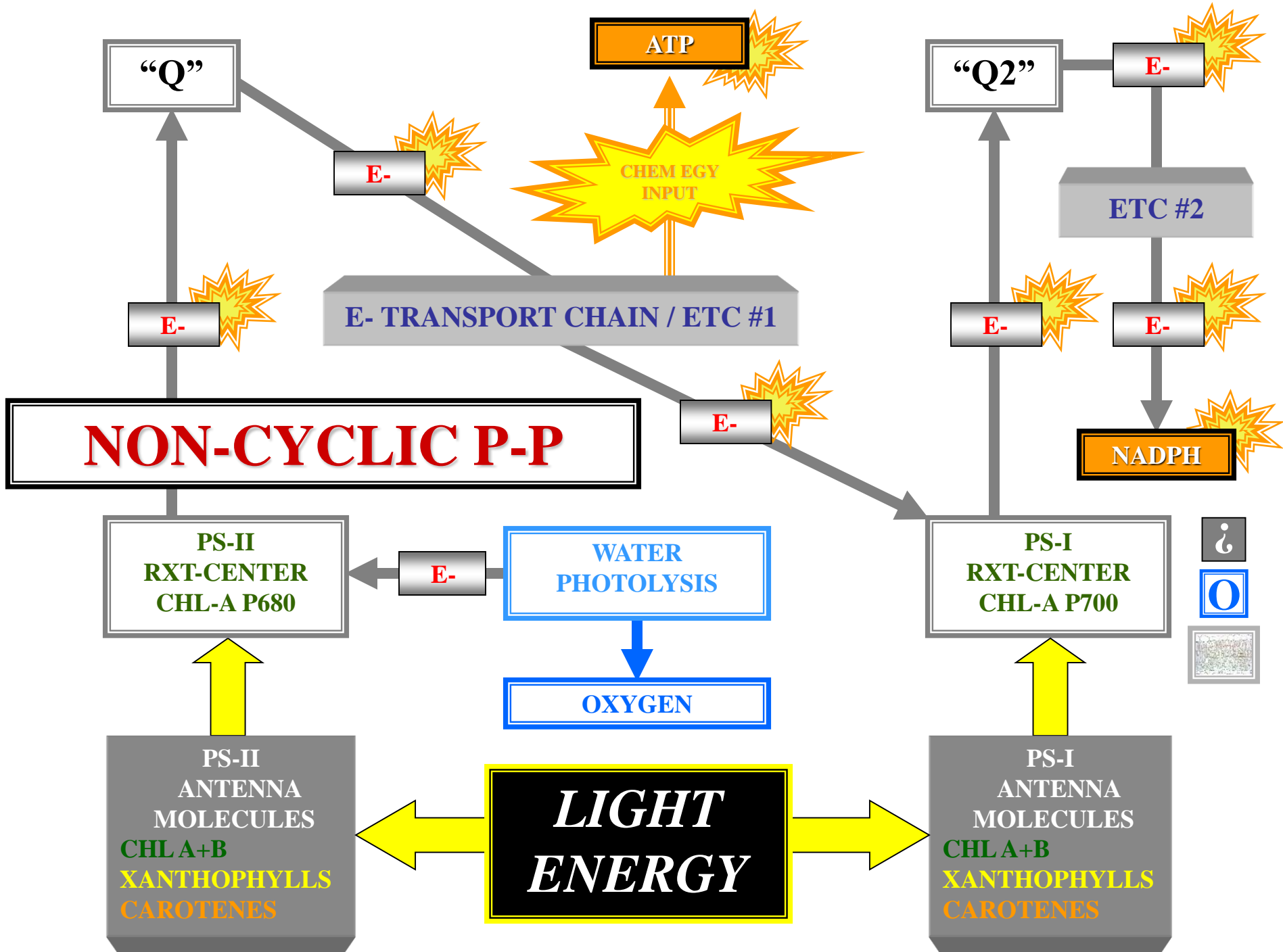


CHLOROPLAST

OXYGEN







C3 LEAF

LEAF MESOPHYLL

HIGH O₂

D

O₂

O₂

O₂

O₂

O₂

O₂

O₂

O₂

O₂

O₂

O₂

O₂

O₂

O₂

O₂

STOMATE CLOSED



C3 LEAF

LEAF MESOPHYLL



O₂

O₂

O₂

O₂

O₂

DIFFUSION

DIFFUSION

DIFFUSION

O₂

O₂

O₂

O₂

O₂

DIFFUSION

DIFFUSION

DIFFUSION

O₂

O₂

O₂

O₂

O₂

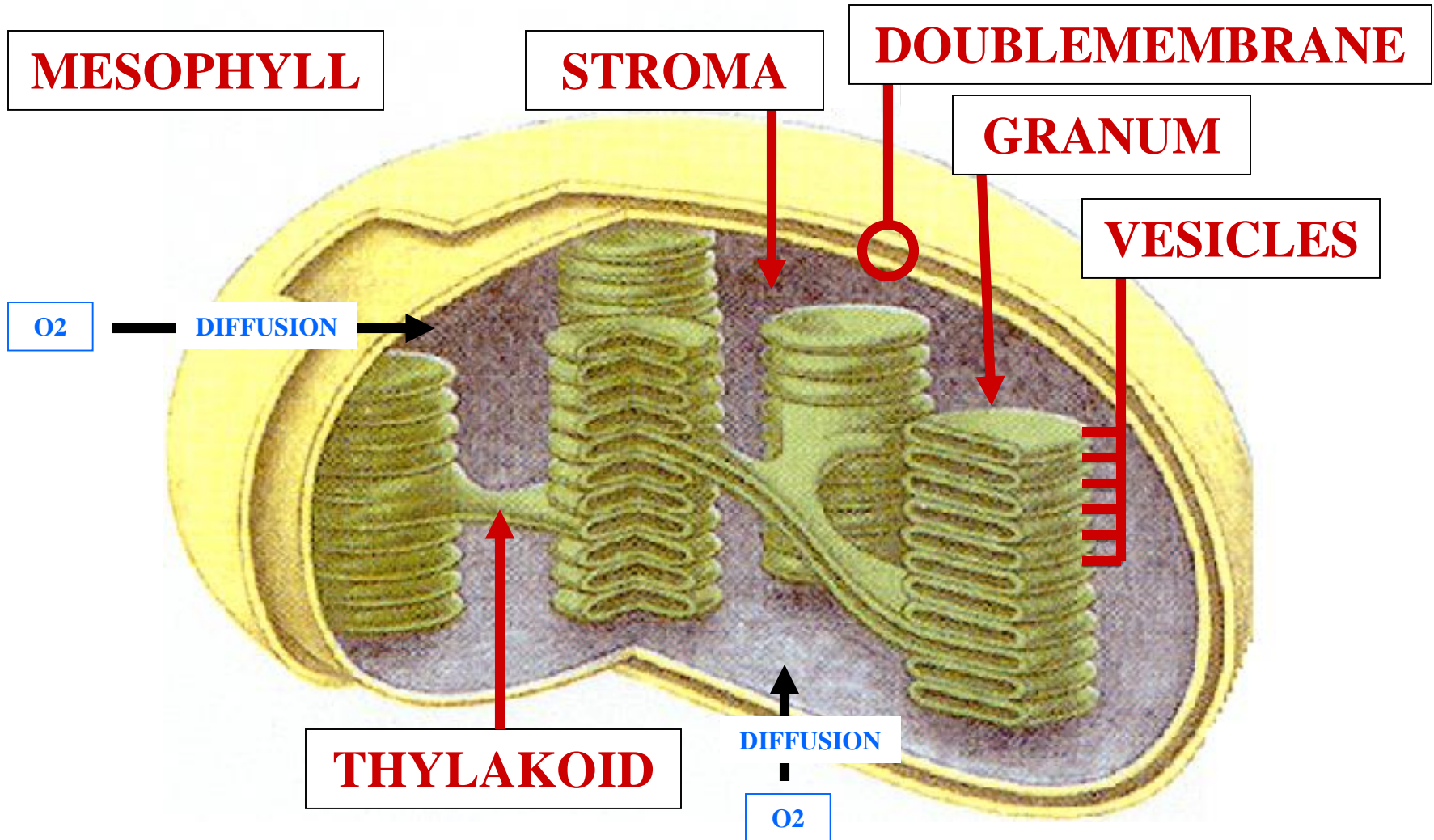
DIFFUSION

DIFFUSION

DIFFUSION



CHLOROPLAST ULTRASTRUCTURE



CHLOROPLAST ULTRASTRUCTURE

HIGH O₂

STROMA

DOUBLEMEMBRANE

GRANUM

VESICLES

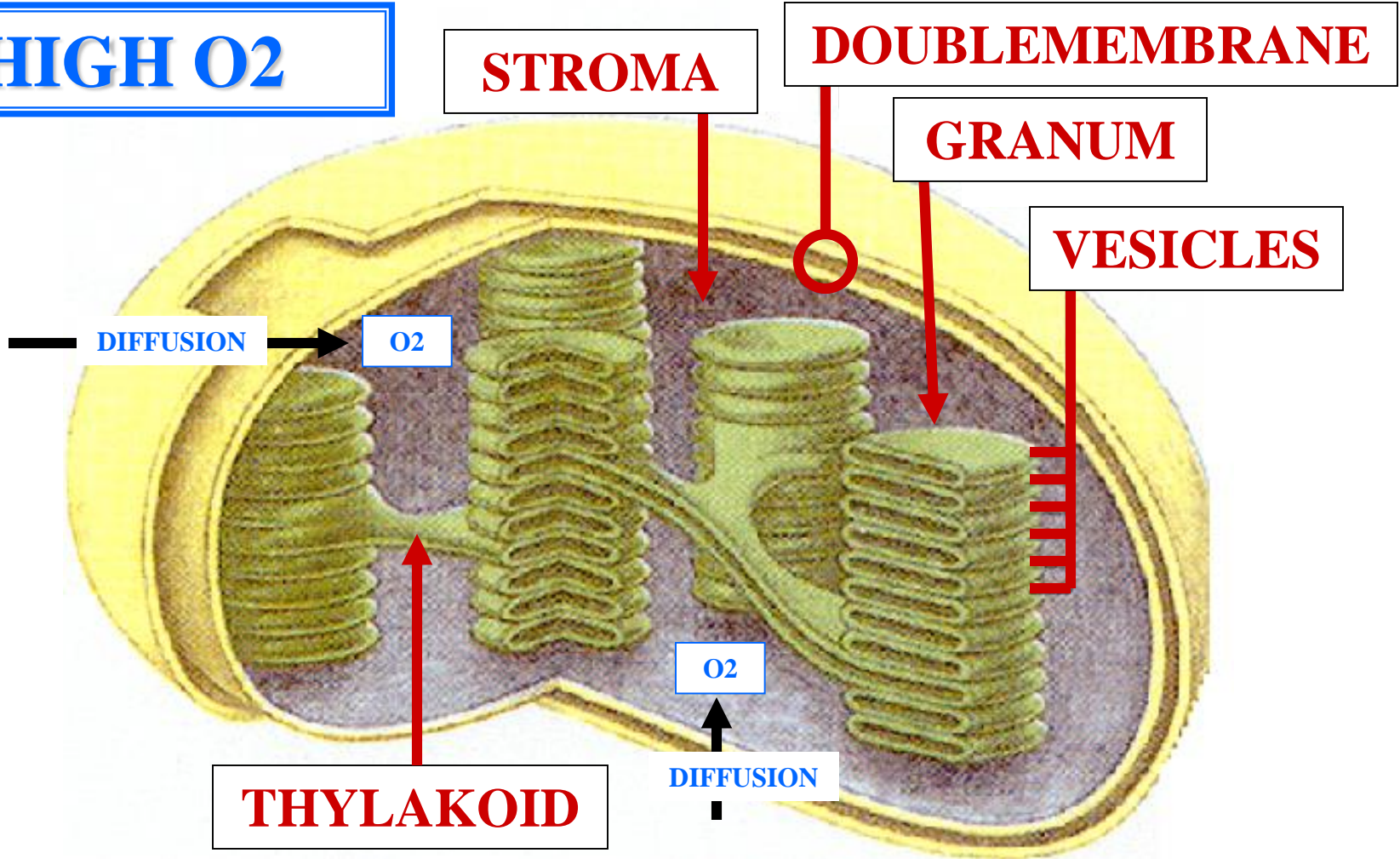
DIFFUSION

O₂

O₂

DIFFUSION

THYLAKOID





O₂
HIGH CONCENTRATION
CHLOROPLAST STROMA

O₂ + RIBULOSE BISPHOSEPHATE / (RUBP)

RIBULOSE BISPHOSEPHATE
ENZYME
(RUBP-ASE)

HIGH O₂



OX



O₂
HIGH CONCENTRATION
CHLOROPLAST STROMA

O₂ + RIBULOSE BISPHOSEPHATE / (RUBP)

RIBULOSE BISPHOSEPHATE
OXYGENASE
(RUBP-OXYGENASE)



P

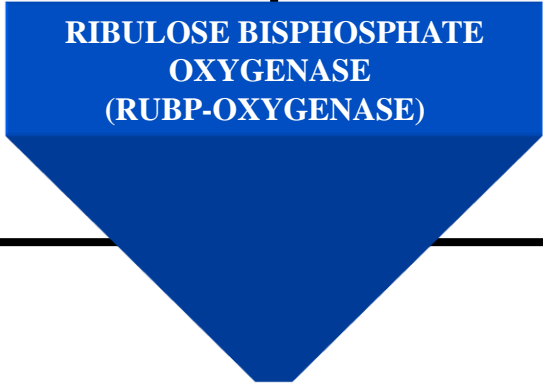
RUBP-ASE: ACTS AS AN OXYGENASE



O₂
HIGH CONCENTRATION
CHLOROPLAST STROMA



O₂ + RIBULOSE BISPHOSEPHATE / (RUBP)



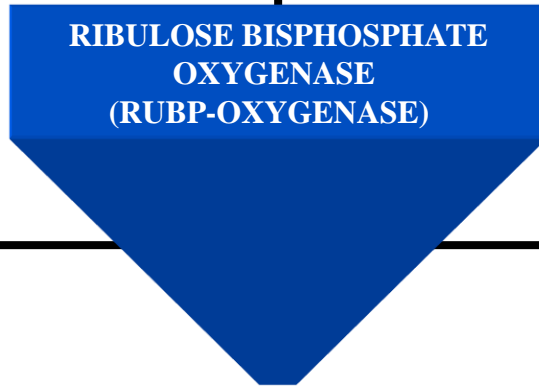
PHOSPHOGLYCERATE / (PGA)

PHOSPHOGLYCOLATE



O₂
HIGH CONCENTRATION
CHLOROPLAST STROMA

O₂ + RIBULOSE BISP(H)OSPHATE / (RUBP)



G

PHOSPHOGLYCERATE / (PGA)

PHOSPHOGLYCOLATE

CALVIN
CYCLE

C₃

CALVIN CYCLE



O₂
HIGH CONCENTRATION
CHLOROPLAST STROMA



O₂ + RIBULOSE BISPHOSPHATE / (RUBP)

RIBULOSE BISPHOSPHATE
OXYGENASE
(RUBP-OXYGENASE)



PHOSPHOGLYCERATE / (PGA)

PHOSPHOGLYCOLATE

CALVIN
CYCLE

GLUCOSE
ENTERS
METABOLISM

C₃

CALVIN CYCLE



O₂
HIGH CONCENTRATION
CHLOROPLAST STROMA



O₂ + RIBULOSE BISPHOSPHATE / (RUBP)

RIBULOSE BISPHOSPHATE
OXYGENASE
(RUBP-OXYGENASE)

PR

PHOSPHOGLYCERATE / (PGA)

PHOSPHOGLYCOLATE

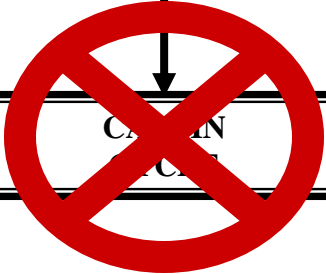
CALVIN
CYCLE

CALVIN
CYCLE

GLUCOSE
ENTERS
METABOLISM

C₃

CALVIN CYCLE





O₂
HIGH CONCENTRATION
CHLOROPLAST STROMA



O₂ + RIBULOSE BISP^HOSPHATE / (RUBP)

RIBULOSE BISP^HOSPHATE
OXYGENASE
(RUBP-OXYGENASE)

>

PHOSPHOGLYCERATE / (PGA)

PHOSPHOGLYCOLATE

CALVIN
CYCLE

~~**CALVIN**
CYCLE~~

GLUCOSE
ENTERS
METABOLISM

C₃

PHOTO-RESPIRATION

CALVIN CYCLE



RUBP-ASE

OXYGENASE

LOW

PHOTOSYNTHESIS

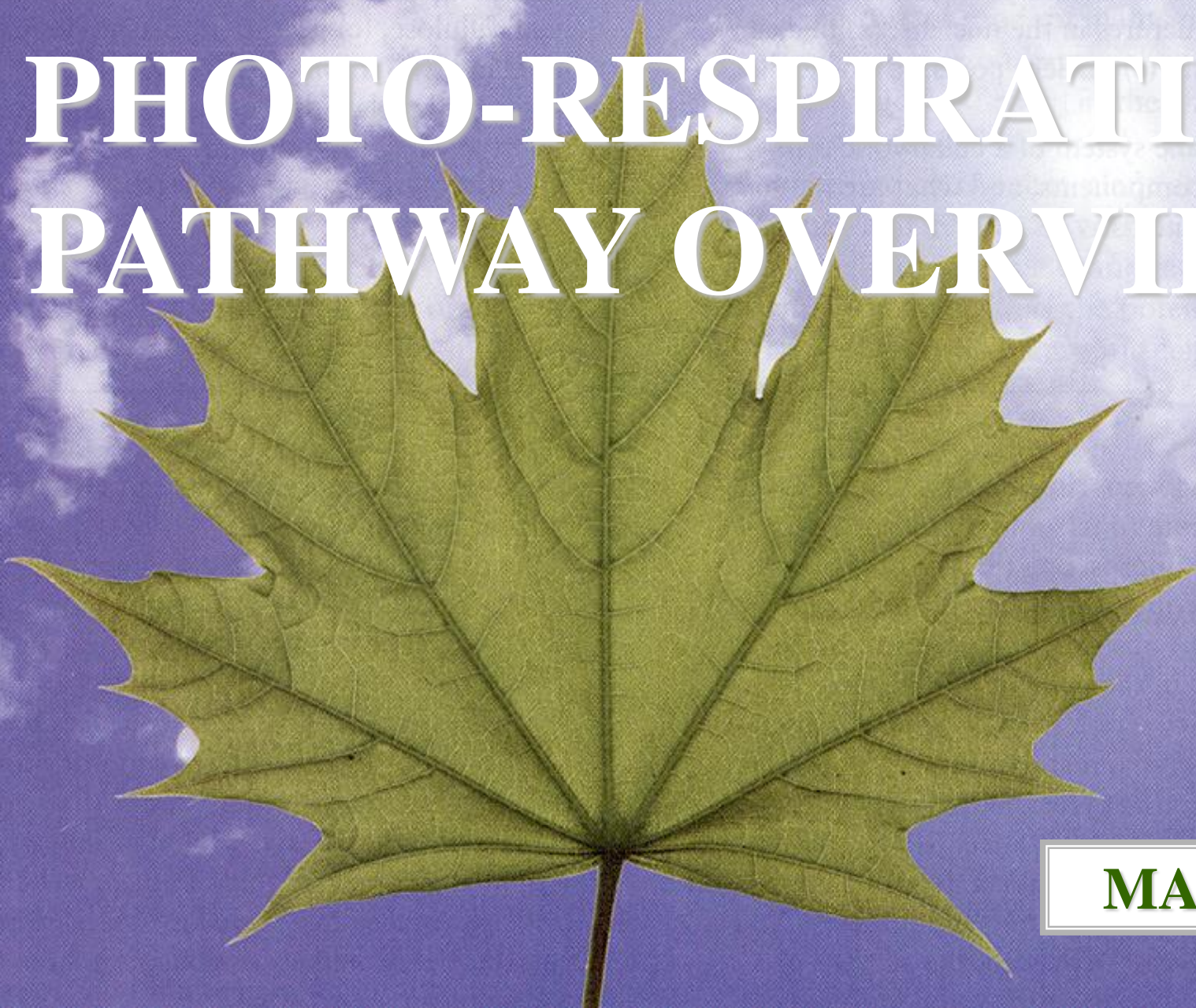
GLUCOSE OUTPUT

MAPLE



PHOTO-RESPIRATION PATHWAY OVERVIEW

PHOTO-RESPIRATION PATHWAY OVERVIEW



MAPLE

PHOTO-RESPIRATION PATHWAY OVERVIEW



LT DEPENDENT

MAPLE

PHOTO-RESPIRATION PATHWAY OVERVIEW



LT DEPENDENT
CONSUMES O₂

MAPLE

PHOTO-RESPIRATION PATHWAY OVERVIEW



LT DEPENDENT
CONSUMES O₂
RELEASES CO₂

MAPLE



PHOTO-RESPIRATION PATHWAY OVERVIEW

LT DEPENDENT

CONSUMES O₂

RELEASES CO₂

PREVALENT: C₃ PLTS - HOT DRY DAY

MAPLE



PHOTO-RESPIRATION PATHWAY OVERVIEW

LT DEPENDENT

CONSUMES O₂

RELEASES CO₂

PREVALENT: C₃ PLTS - HOT DRY DAY

EXPENDS ADDITIONAL ATP/GLUCOSE

MAPLE



PHOTO-RESPIRATION PATHWAY OVERVIEW

LT DEPENDENT

CONSUMES O₂

RELEASES CO₂

PREVALENT: C₃ PLTS - HOT DRY DAY

EXPENDS ADDITIONAL ATP/GLUCOSE

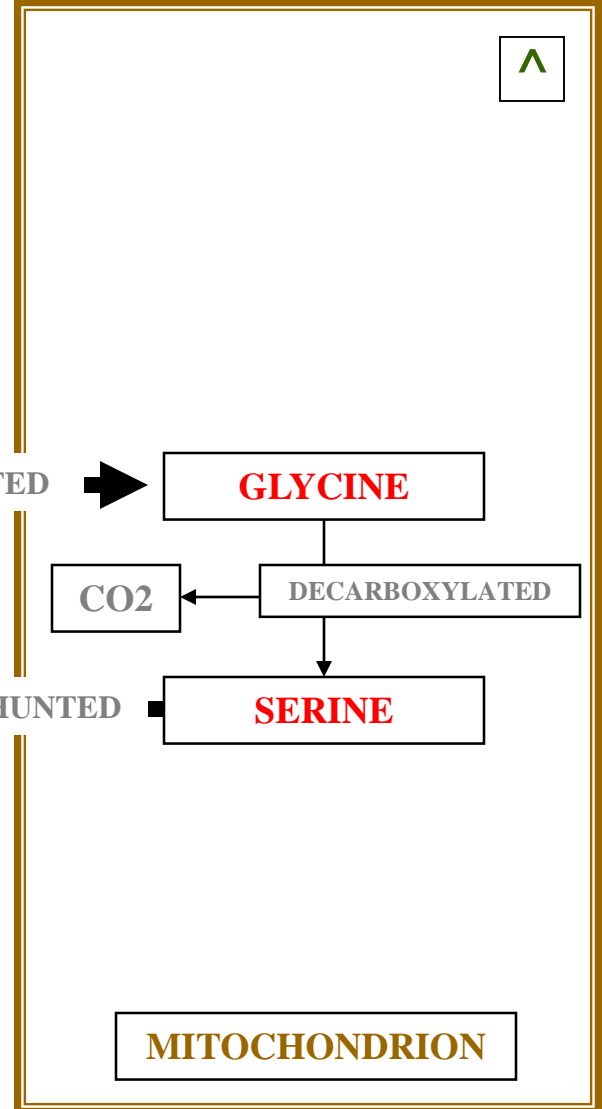
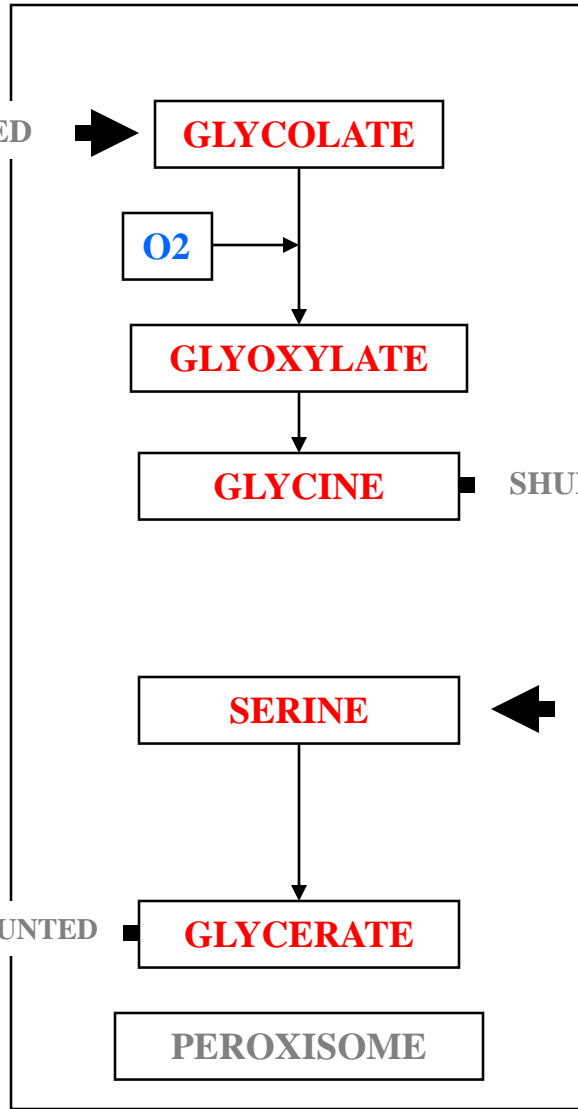
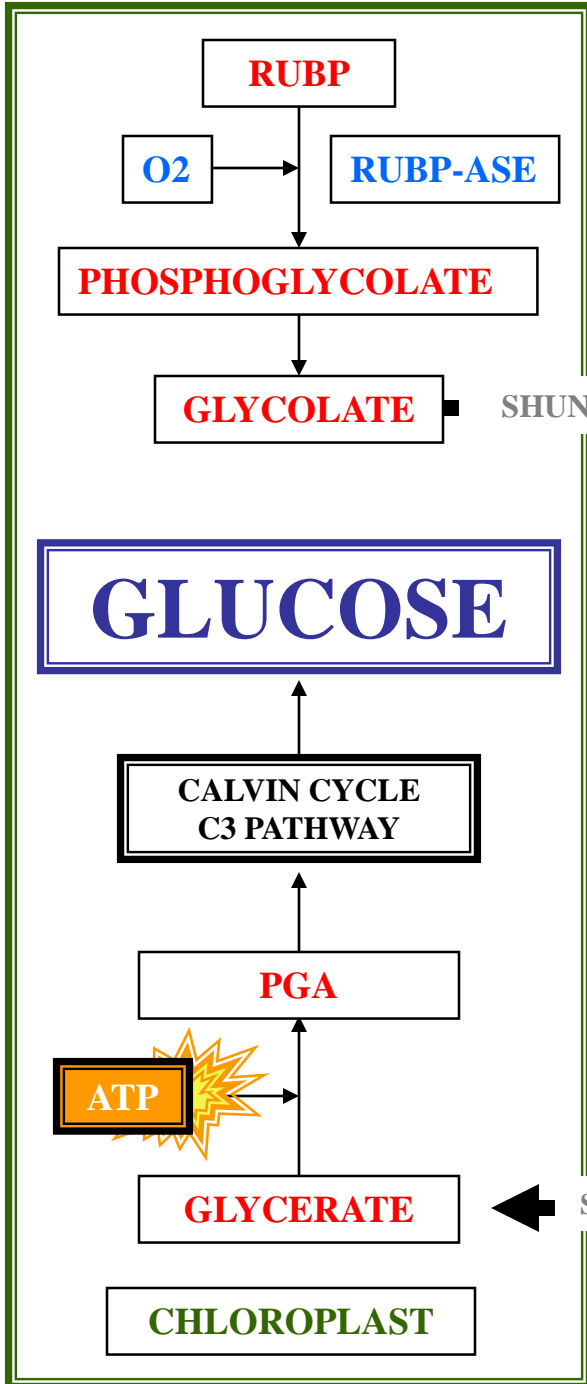
DECREASES PSYN RATE

MAPLE



PHOTO-RESPIRATION PATHWAY SPECIFICS

PHOTO-RESPIRATION PATHWAY SPECIFICS



SHUNTED →

SHUNTED →

SHUNTED ←

← SHUNTED



MESOPHYLL CELL CHLOROPLAST



MESOPHYLL CELL CHLOROPLAST

HIGH O₂

STROMA

DOUBLEMEMBRANE

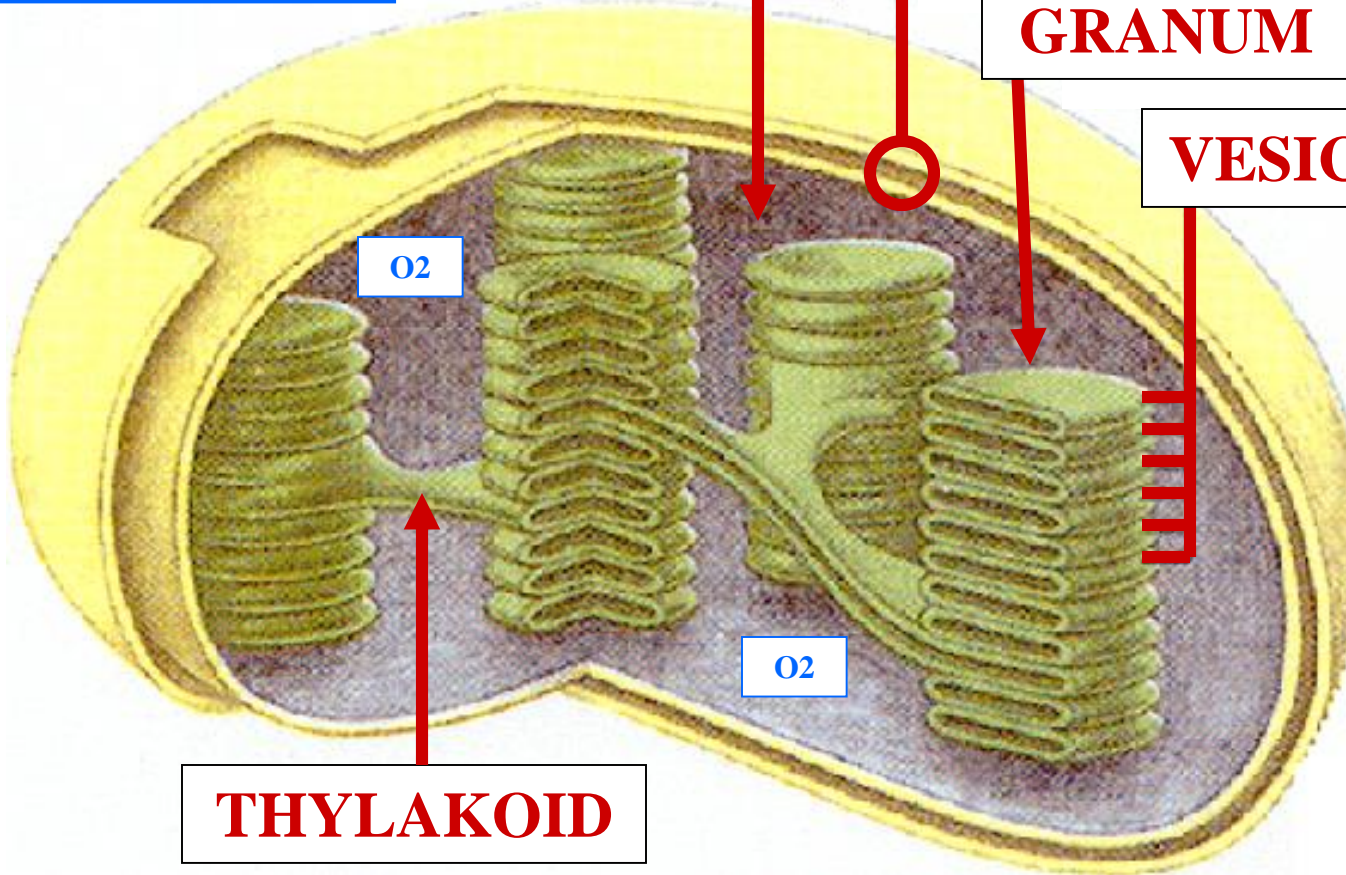
GRANUM

VESICLES

O₂

O₂

THYLAKOID





O₂
HIGH CONCENTRATION
CHLOROPLAST STROMA



O₂ + RIBULOSE BISP HOSPHATE / (RUBP)



EZ



O₂
HIGH CONCENTRATION
CHLOROPLAST STROMA

O₂ + RIBULOSE BISPHTHATE / (RUBP)

RIBULOSE BISPHTHATE
ENZYME
(RUBP-ASE)



OX



O₂
HIGH CONCENTRATION
CHLOROPLAST STROMA



O₂ + RIBULOSE BISPHOSEPHATE / (RUBP)



RIBULOSE BISPHOSEPHATE
OXYGENASE
(RUBP-OXYGENASE)



P



O₂
HIGH CONCENTRATION
CHLOROPLAST STROMA



O₂ + RIBULOSE BISPHOSPHATE / (RUBP)

RIBULOSE BISPHOSPHATE
OXYGENASE
(RUBP-OXYGENASE)

P

PHOSPHOGLYCERATE / (PGA)

PHOSPHOGLYCOLATE

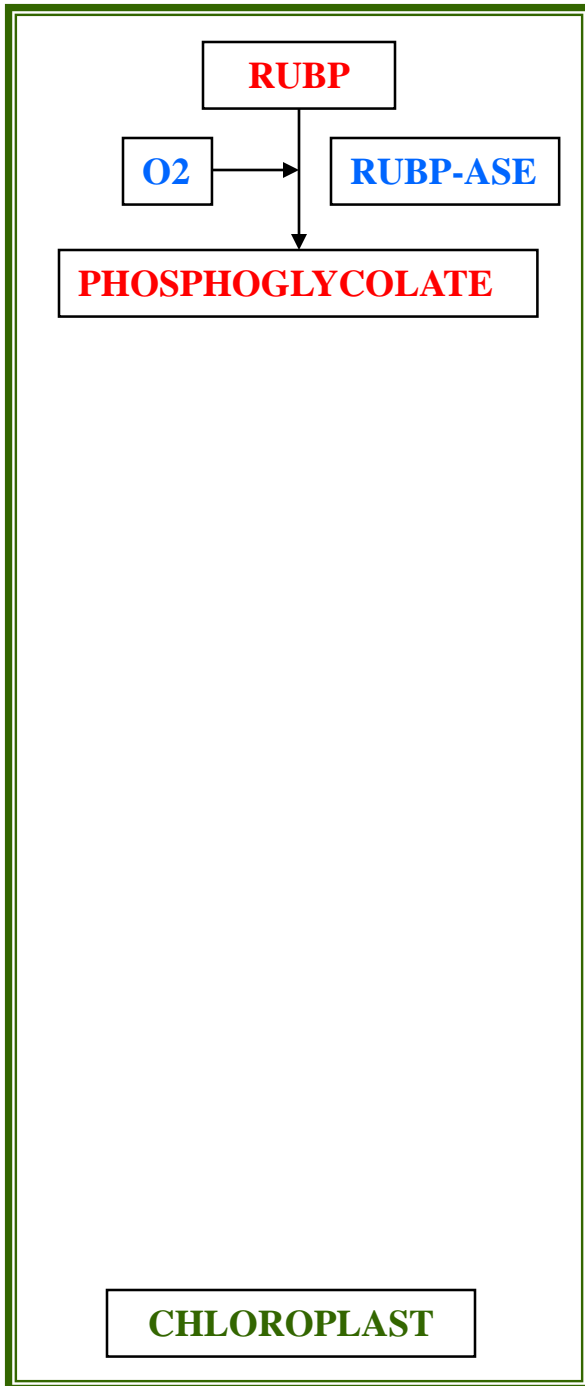
CALVIN
CYCLE

~~**CALVIN**
CYCLE~~

GLUCOSE
ENTERS
METABOLISM

PHOTORESPIRATION

PHOTO-RESPIRATION PATHWAY SPECIFICS



PHOTOSYNTHESIS

2



WATER

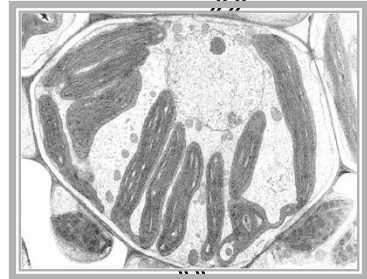
LIGHT ENERGY

E-

PHOTOLYSIS

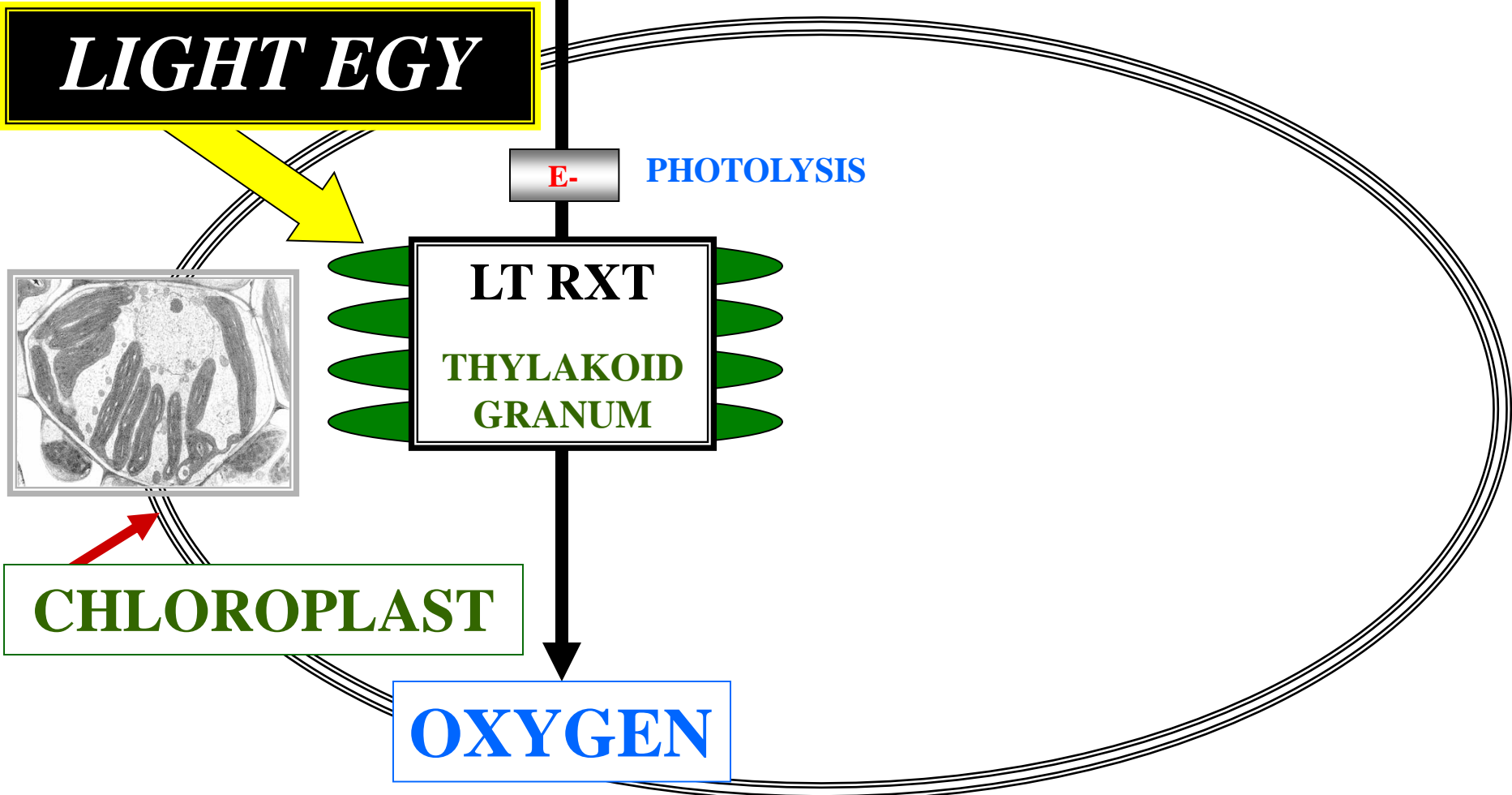
LT RXT

THYLAKOID
GRANUM



CHLOROPLAST

OXYGEN



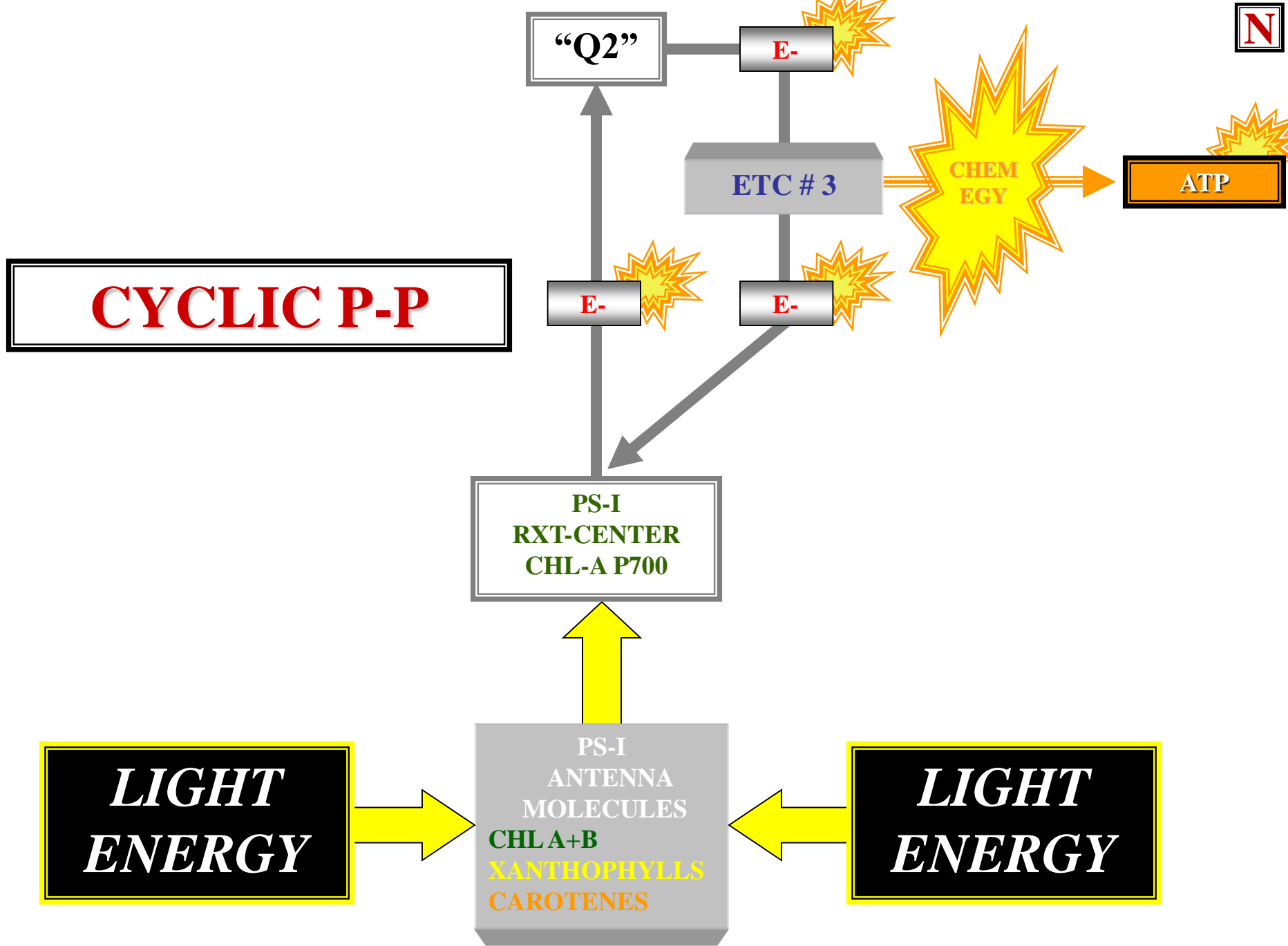


PHOTO-RESPIRATION PATHWAY SPECIFICS G

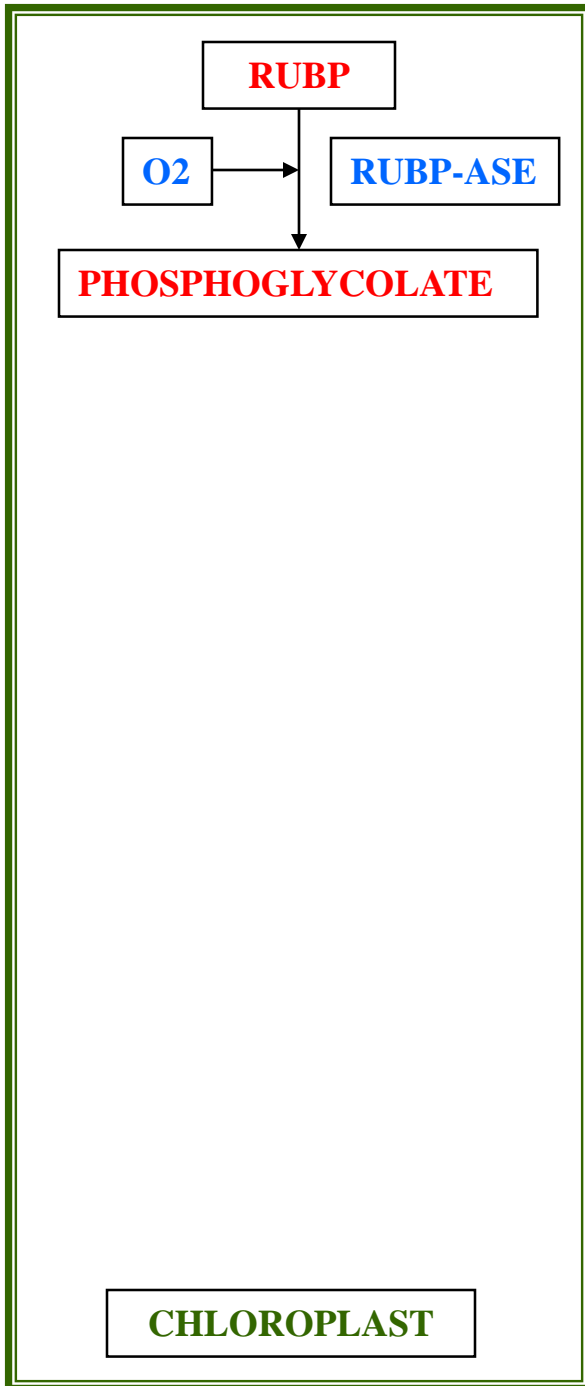


PHOTO-RESPIRATION PATHWAY SPECIFICS →

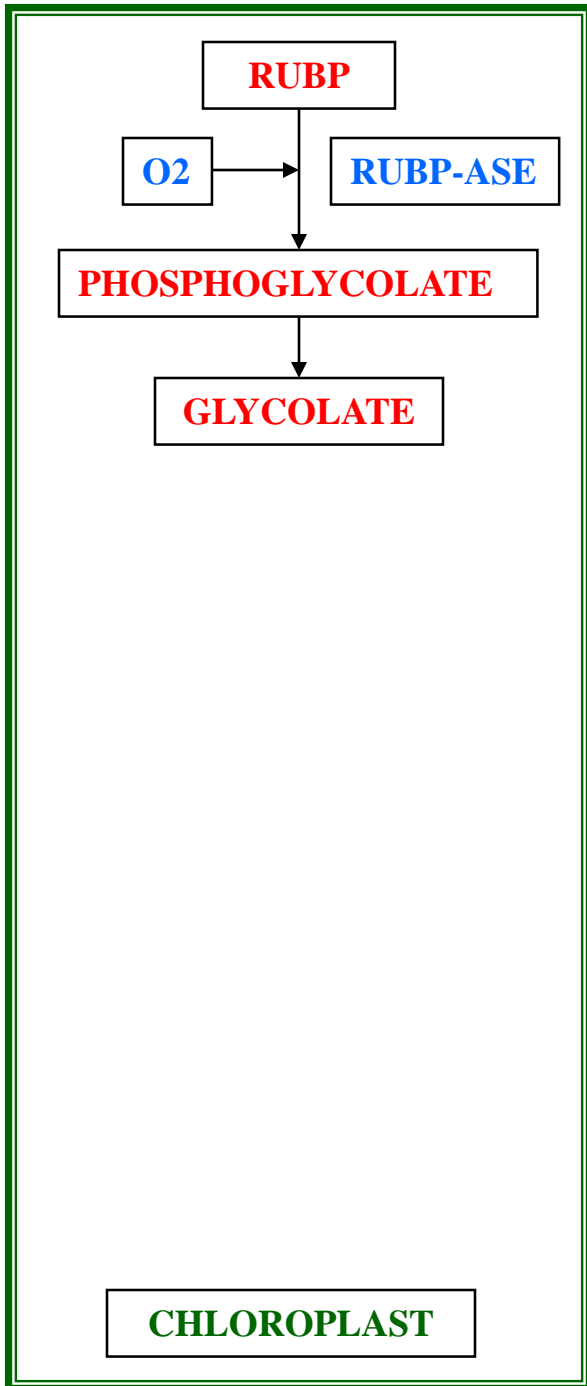
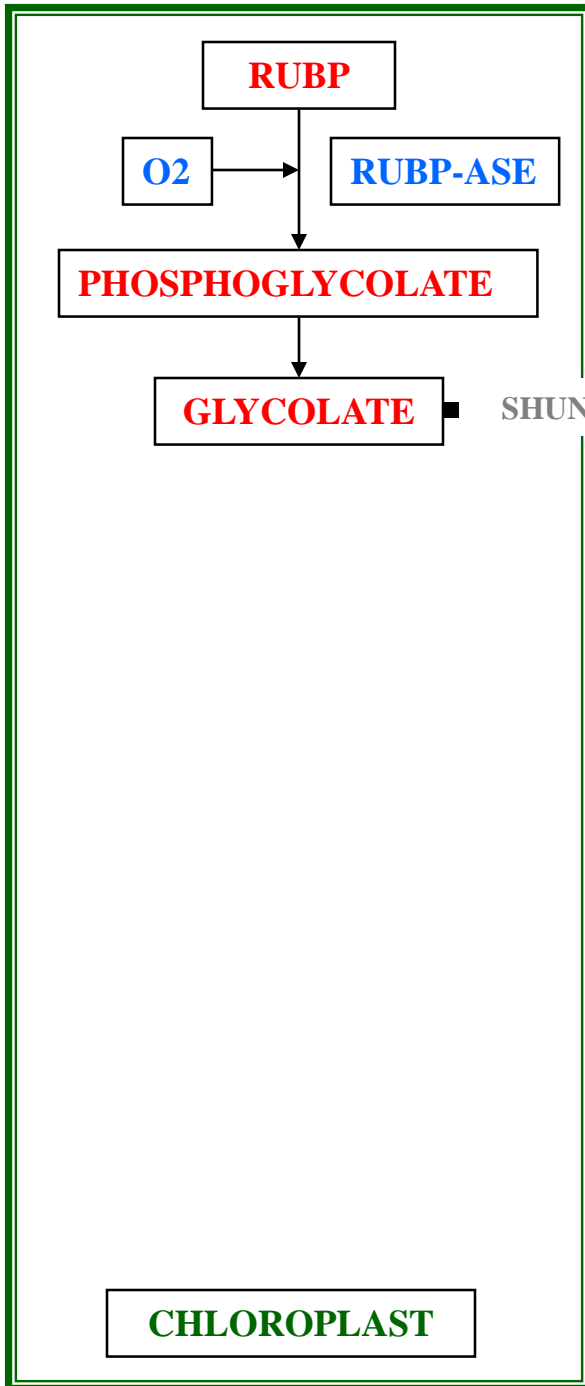
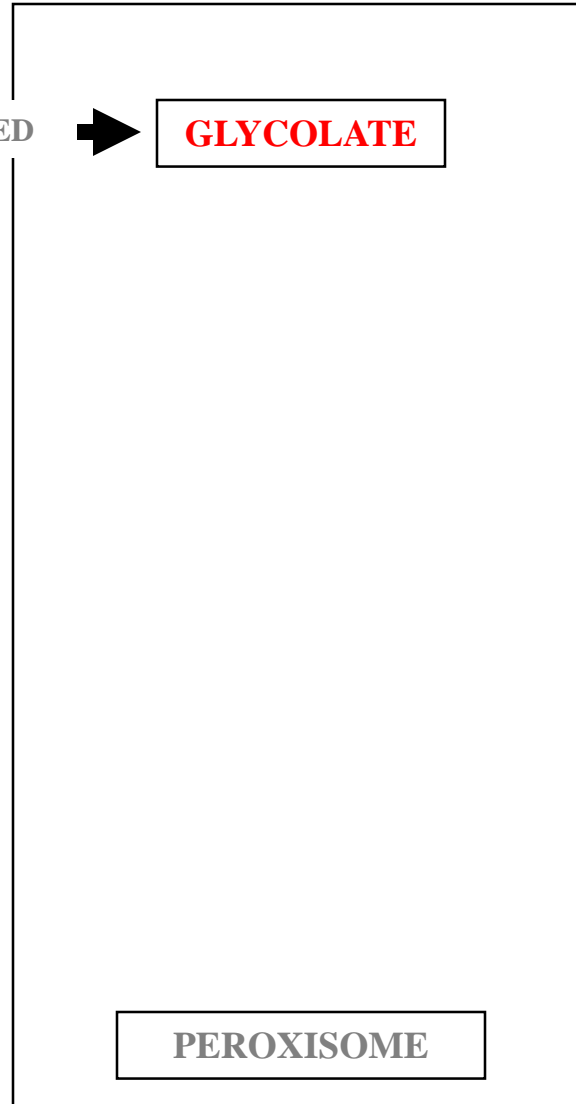


PHOTO-RESPIRATION PATHWAY SPECIFICS



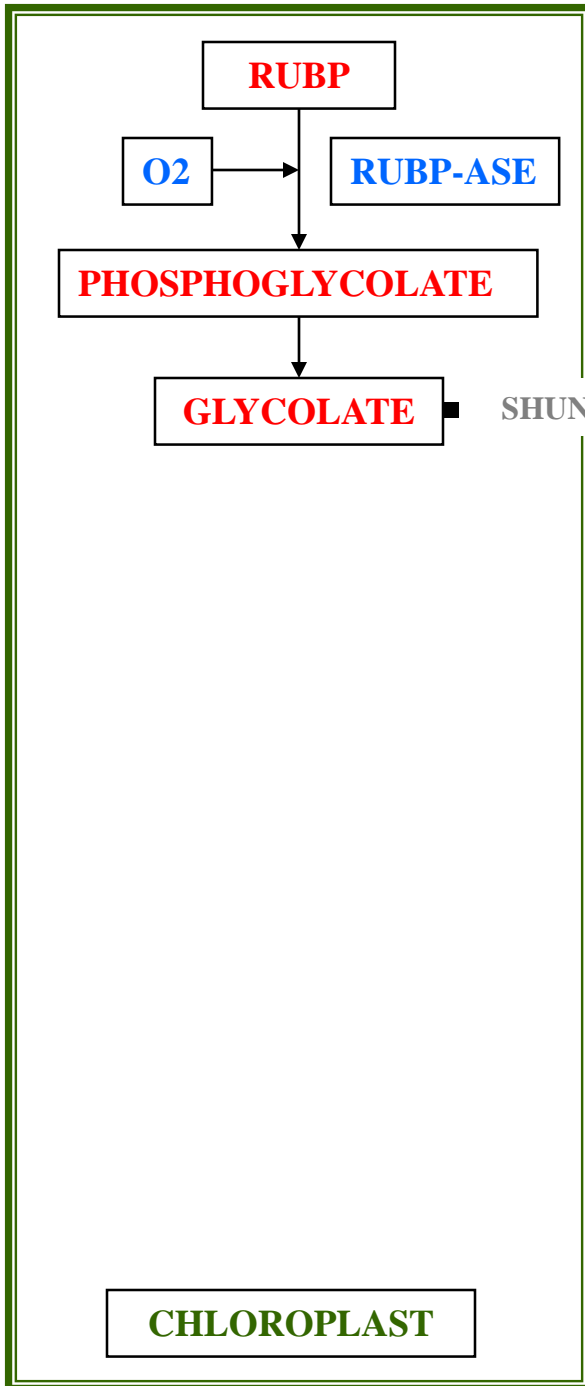
SHUNTED





MESOPHYLL CELL PEROXISOME

PHOTO-RESPIRATION PATHWAY SPECIFICS G



SHUNTED

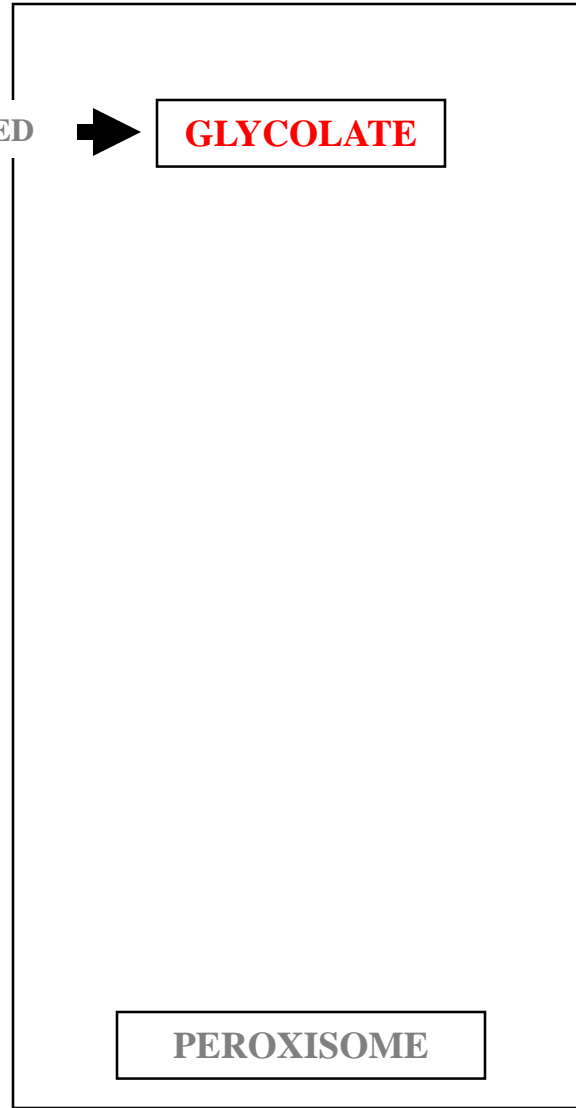
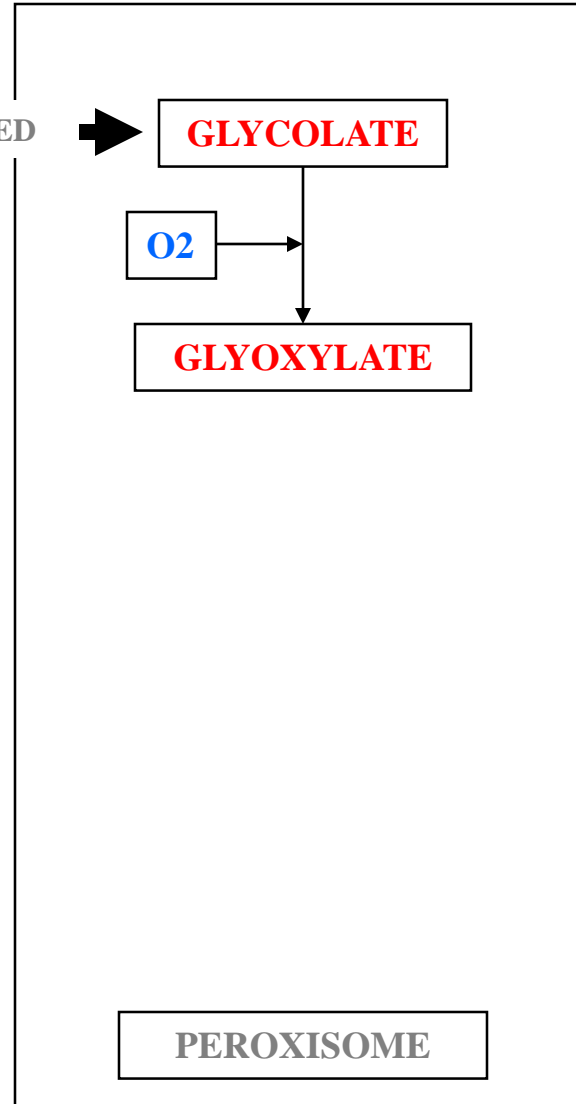


PHOTO-RESPIRATION PATHWAY SPECIFICS



PHOTOSYNTHESIS

N

WATER

LIGHT ENERGY

E-

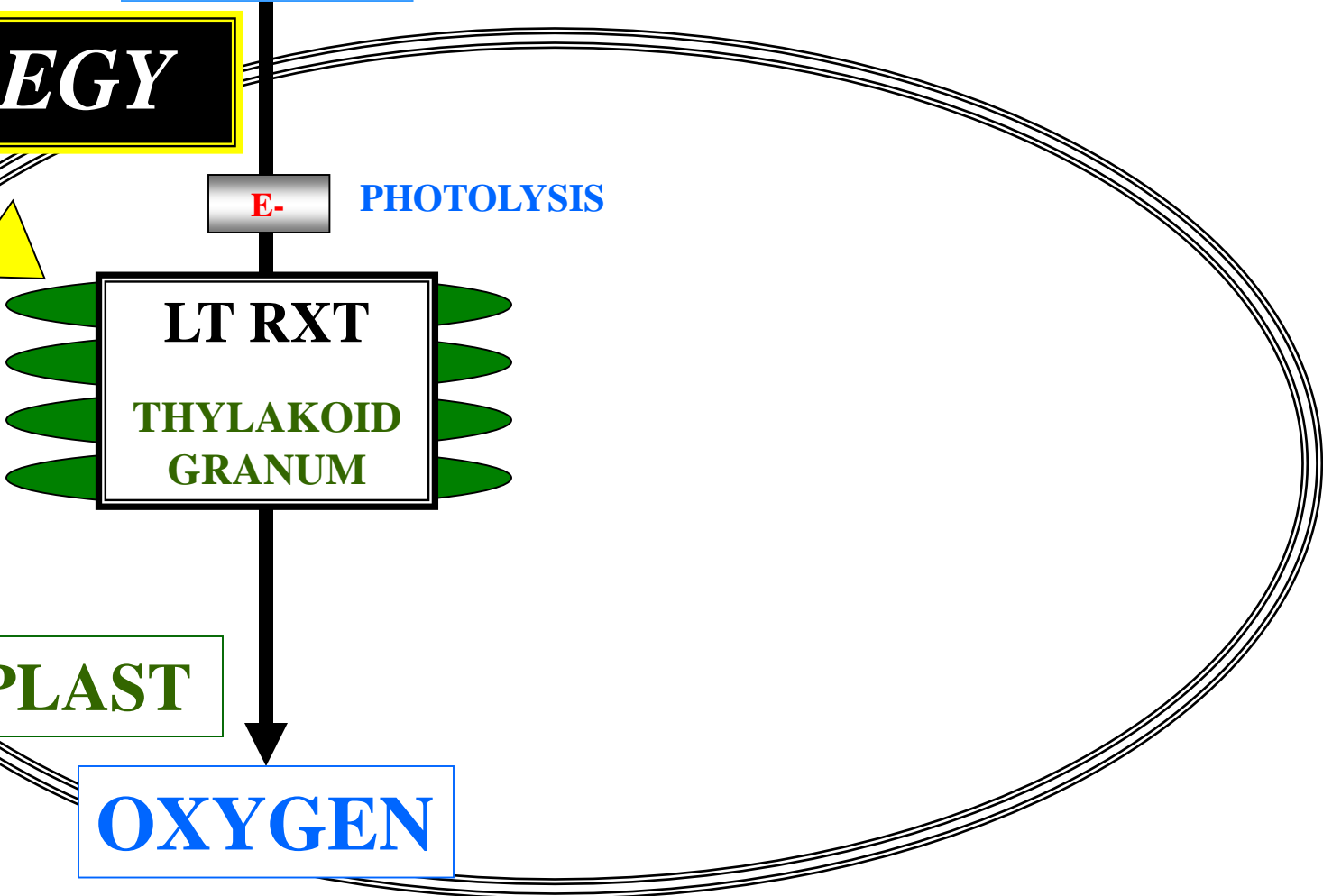
PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

CHLOROPLAST

OXYGEN



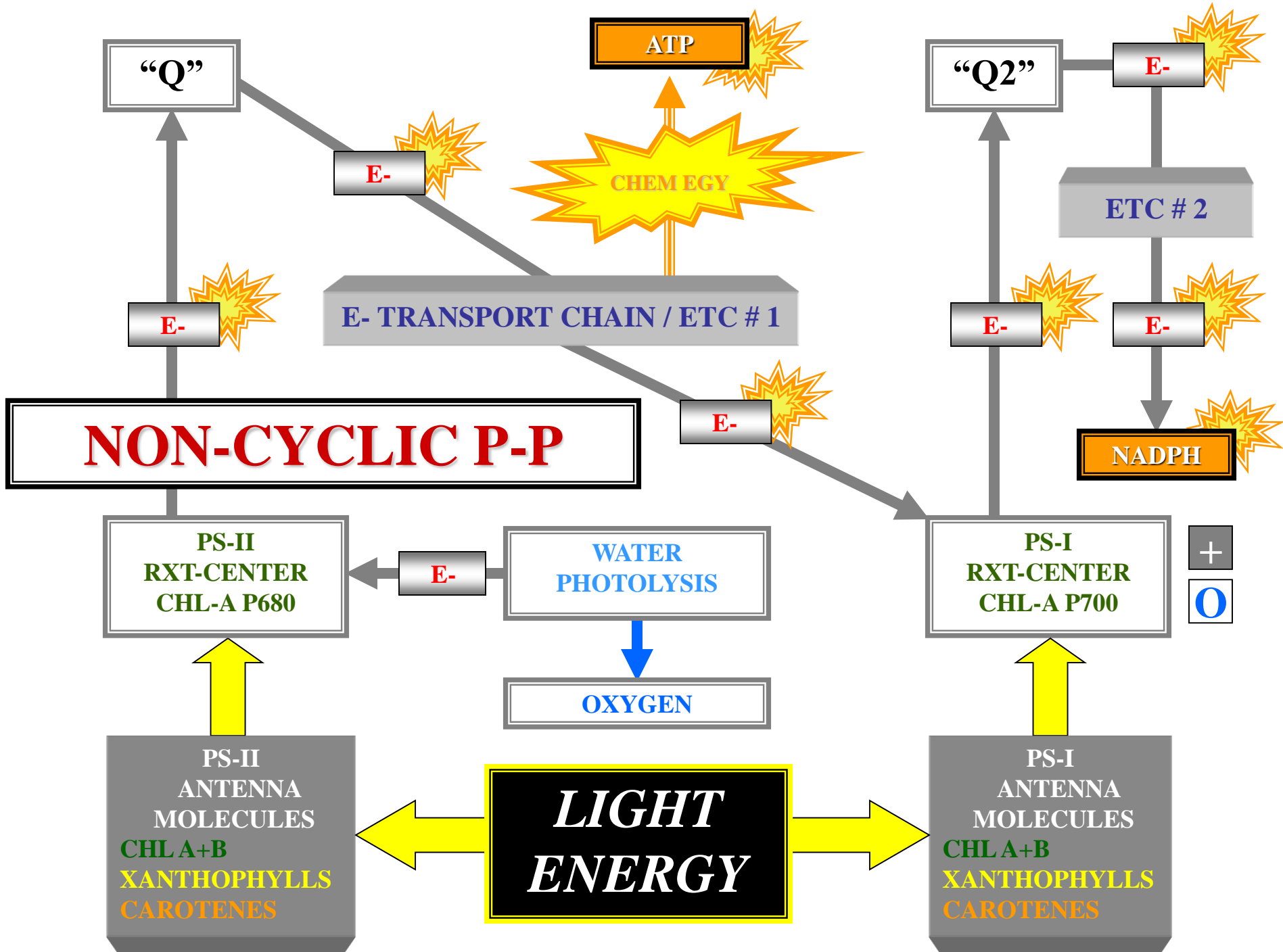


PHOTO-RESPIRATION PATHWAY SPECIFICS G



SHUNTED

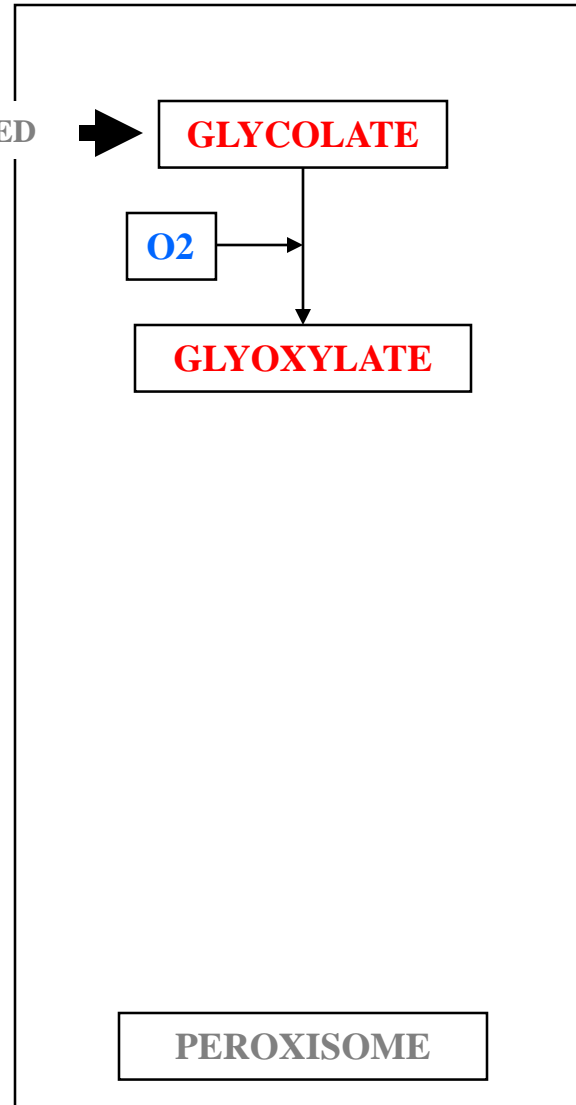
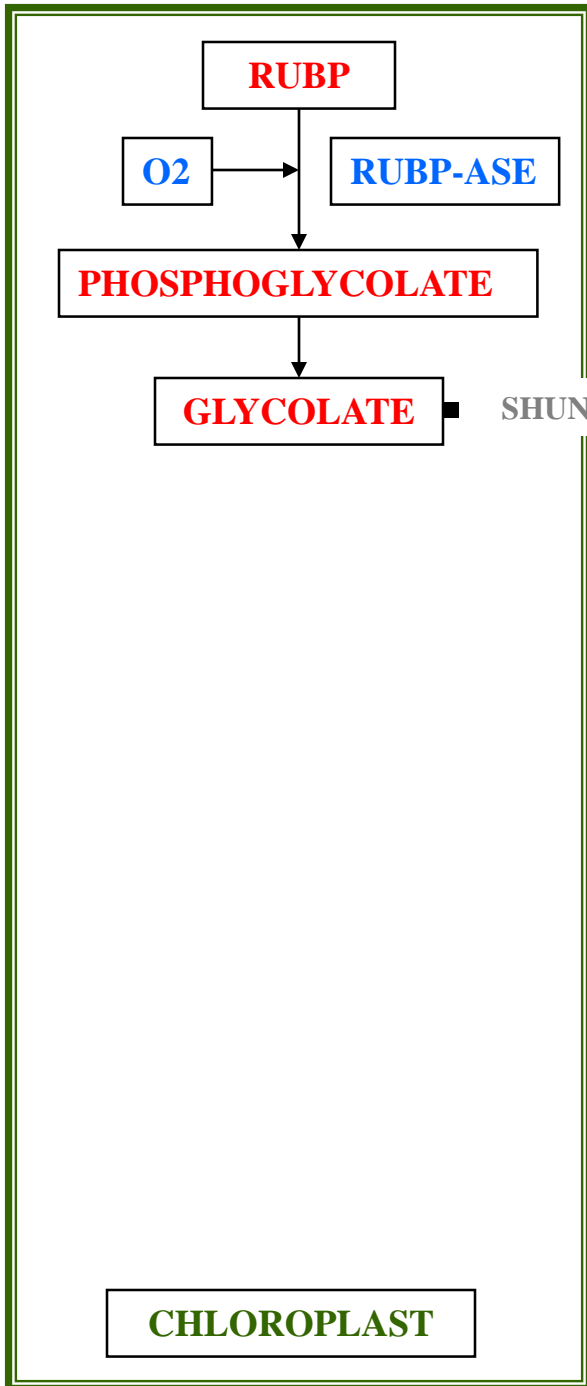


PHOTO-RESPIRATION PATHWAY SPECIFICS →



SHUNTED →

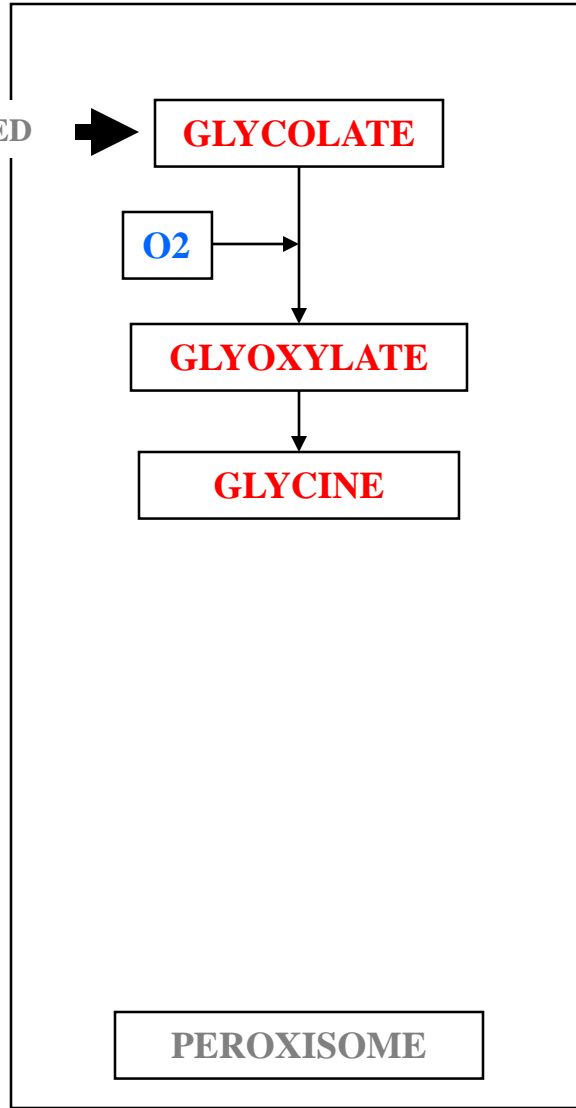
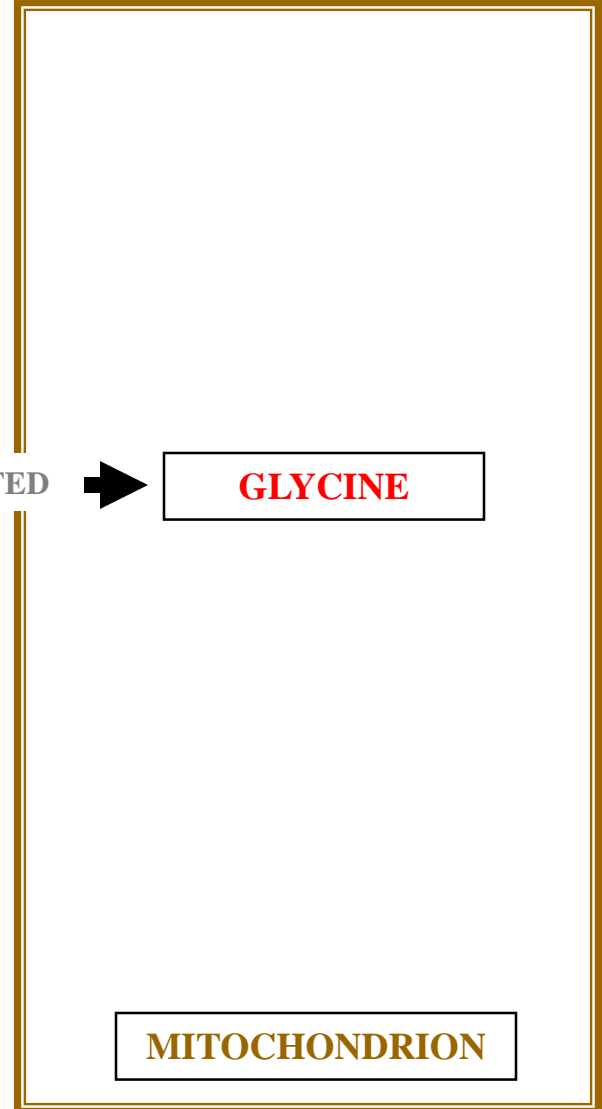
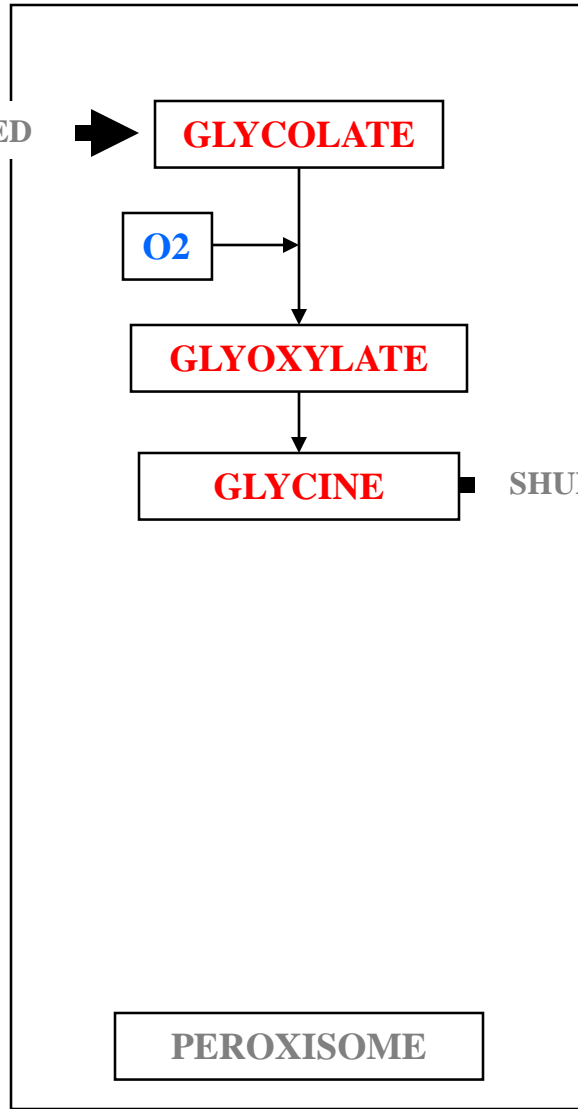
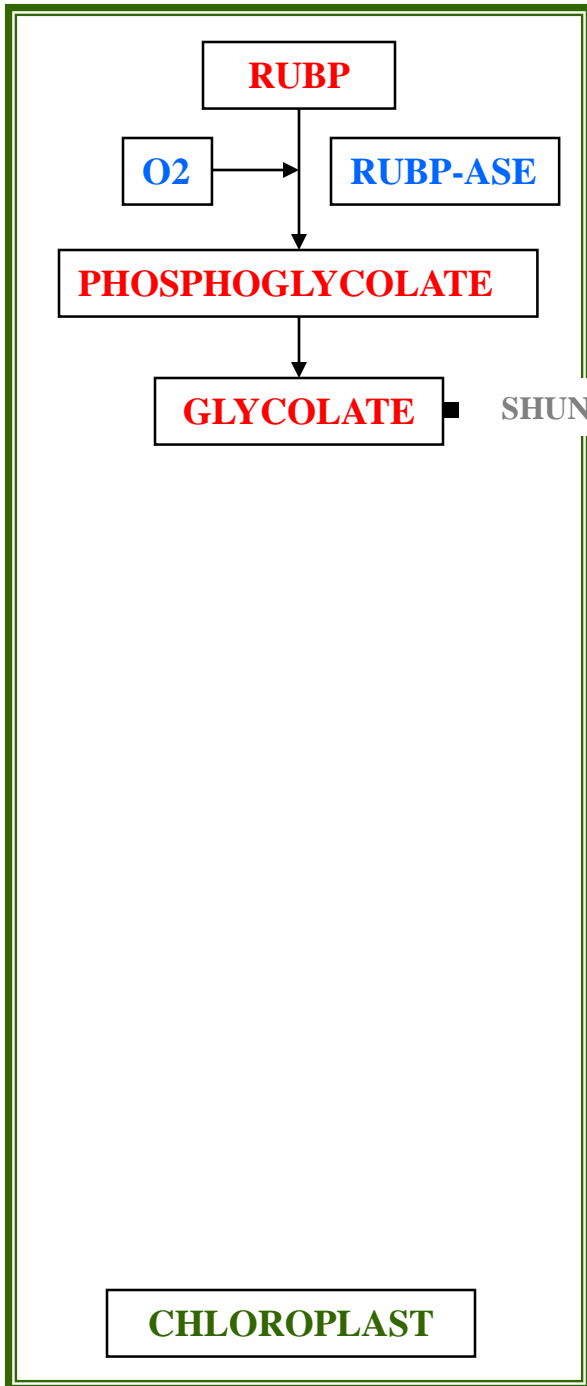


PHOTO-RESPIRATION PATHWAY SPECIFICS



SHUNTED →

SHUNTED →



MESOPHYLL CELL MITOCHONDRION

PHOTO-RESPIRATION PATHWAY SPECIFICS

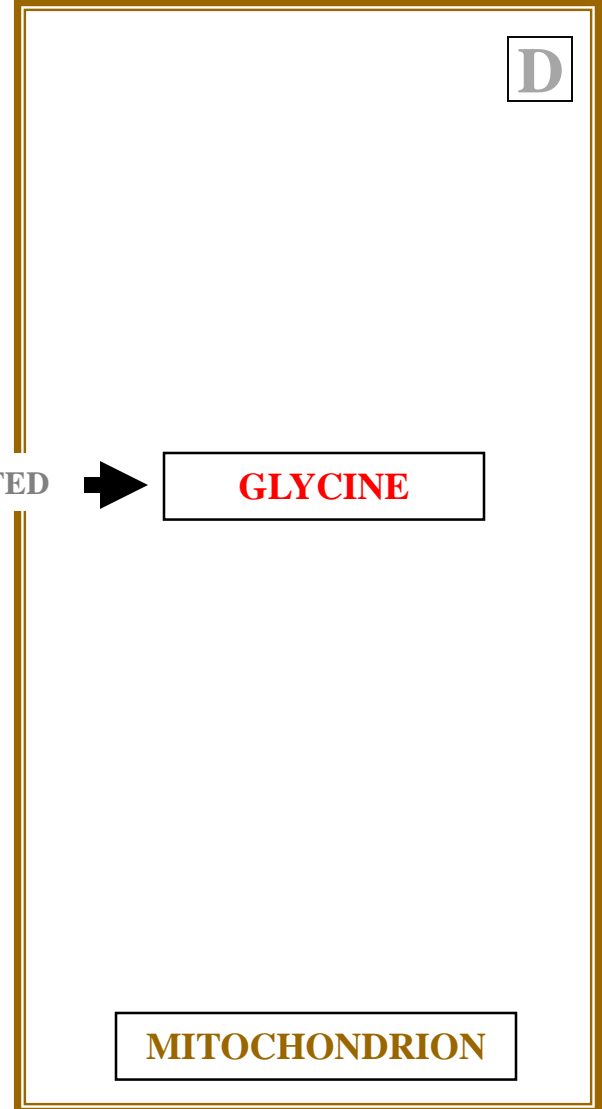
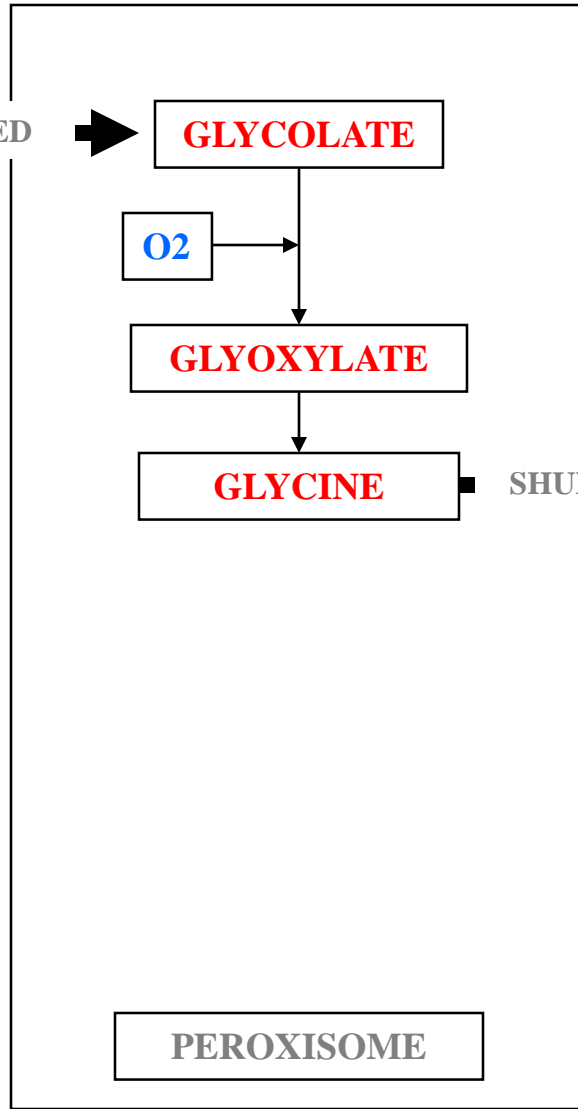
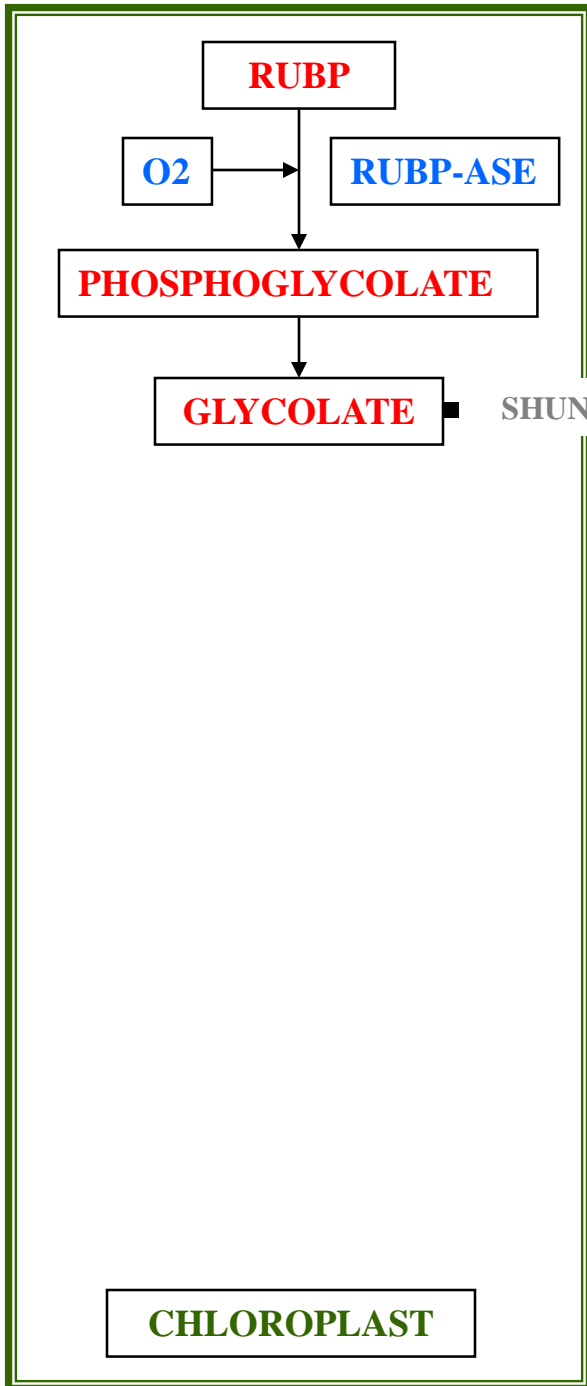


PHOTO-RESPIRATION PATHWAY SPECIFICS

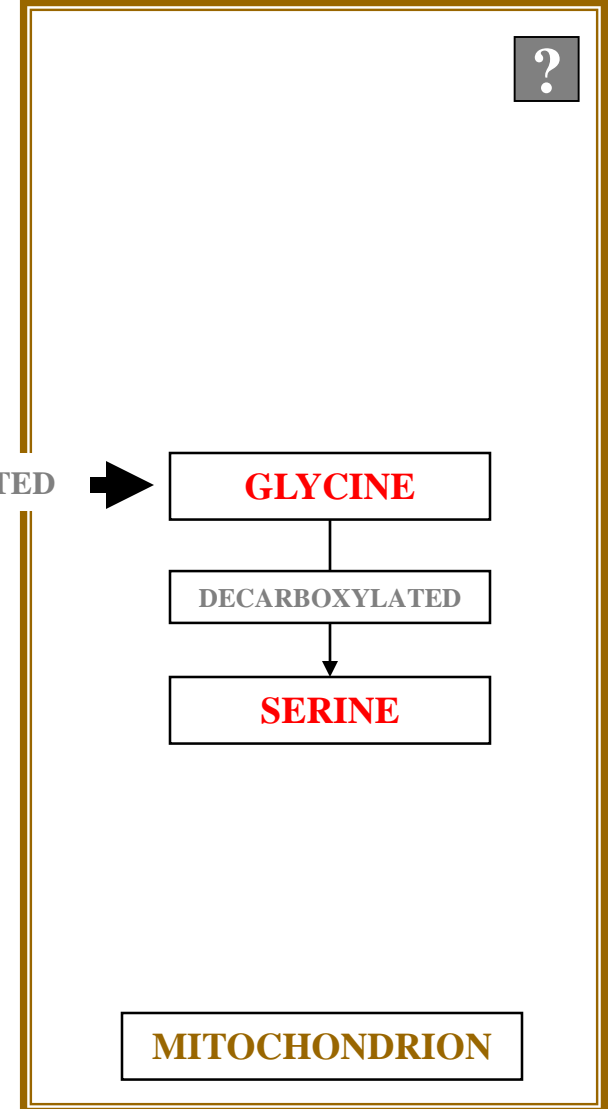
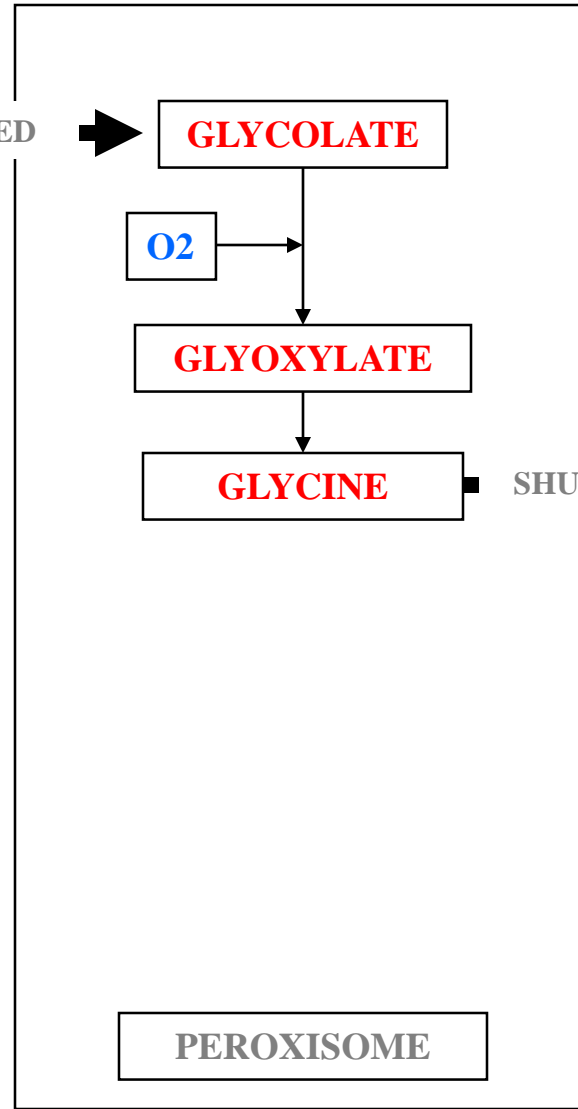
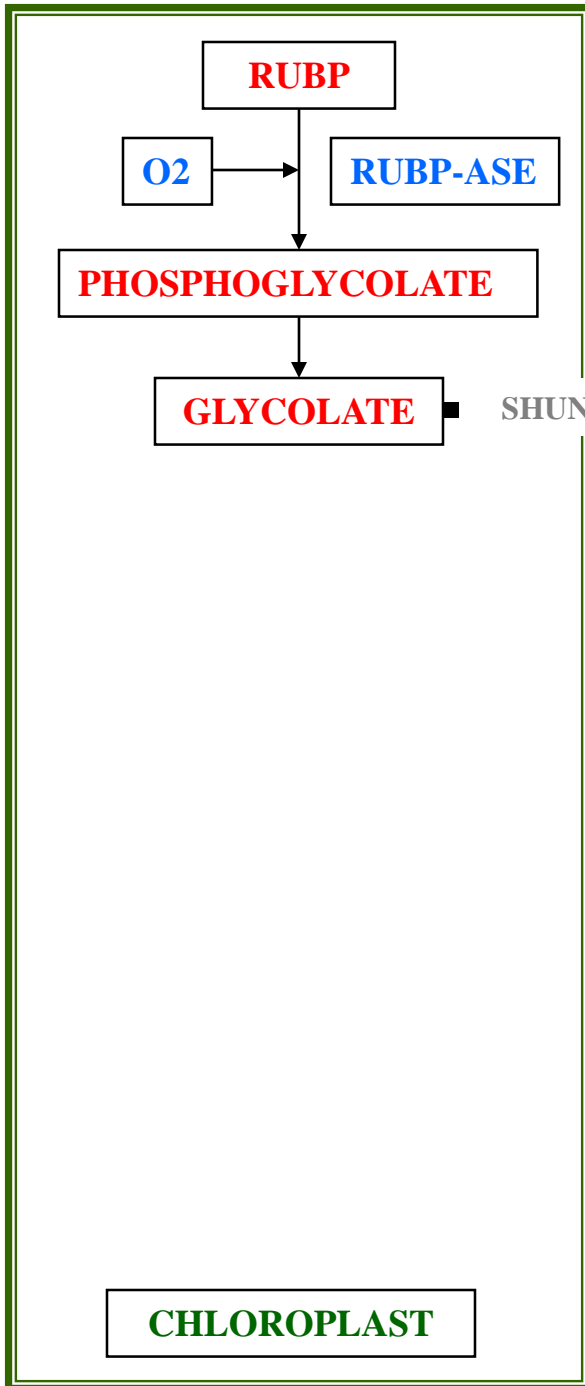


PHOTO-RESPIRATION PATHWAY SPECIFICS

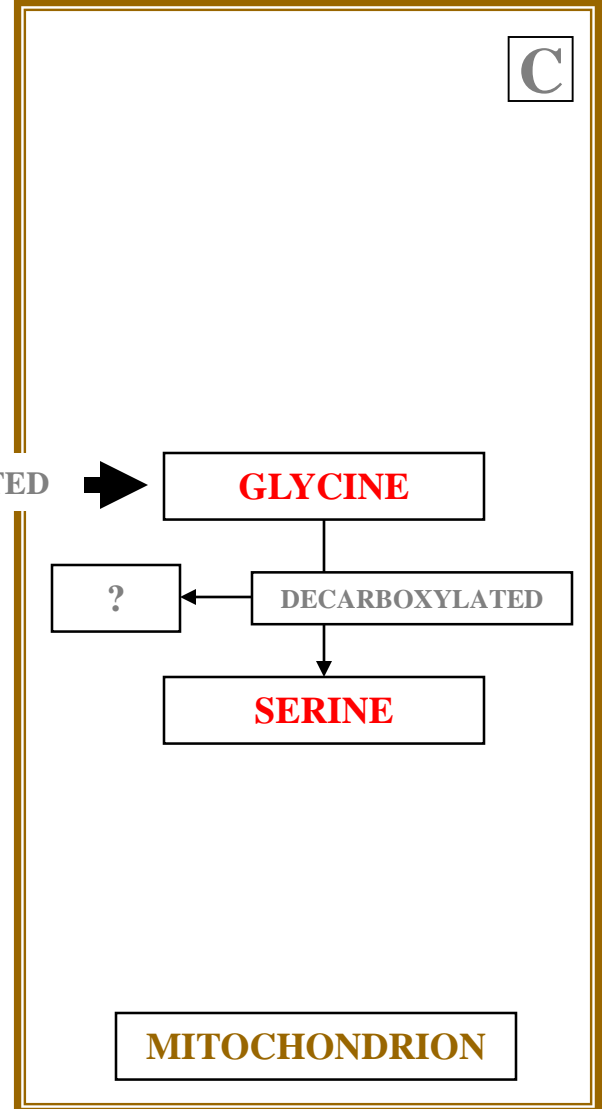
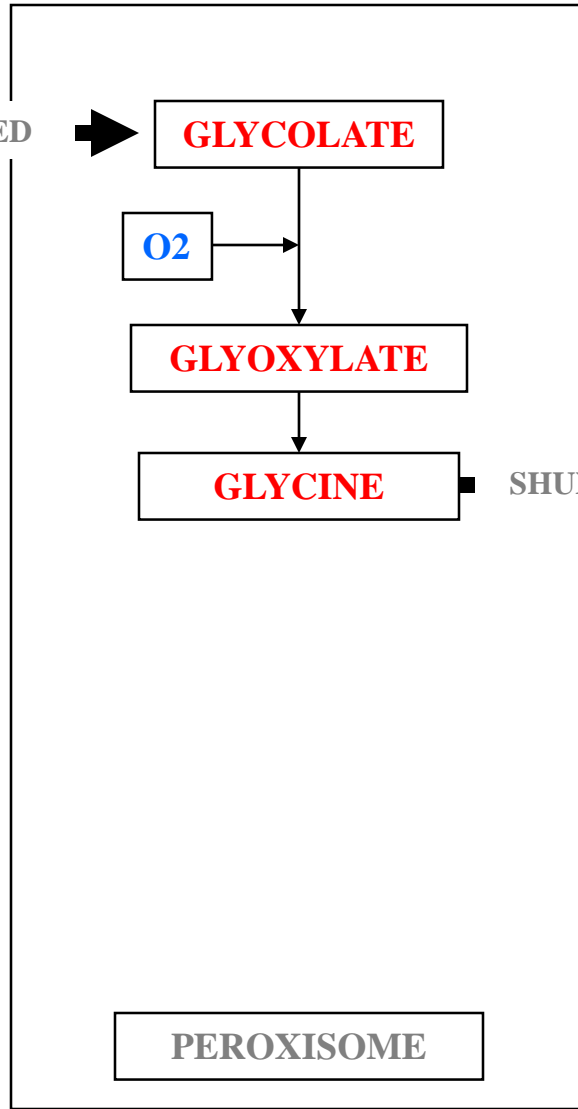
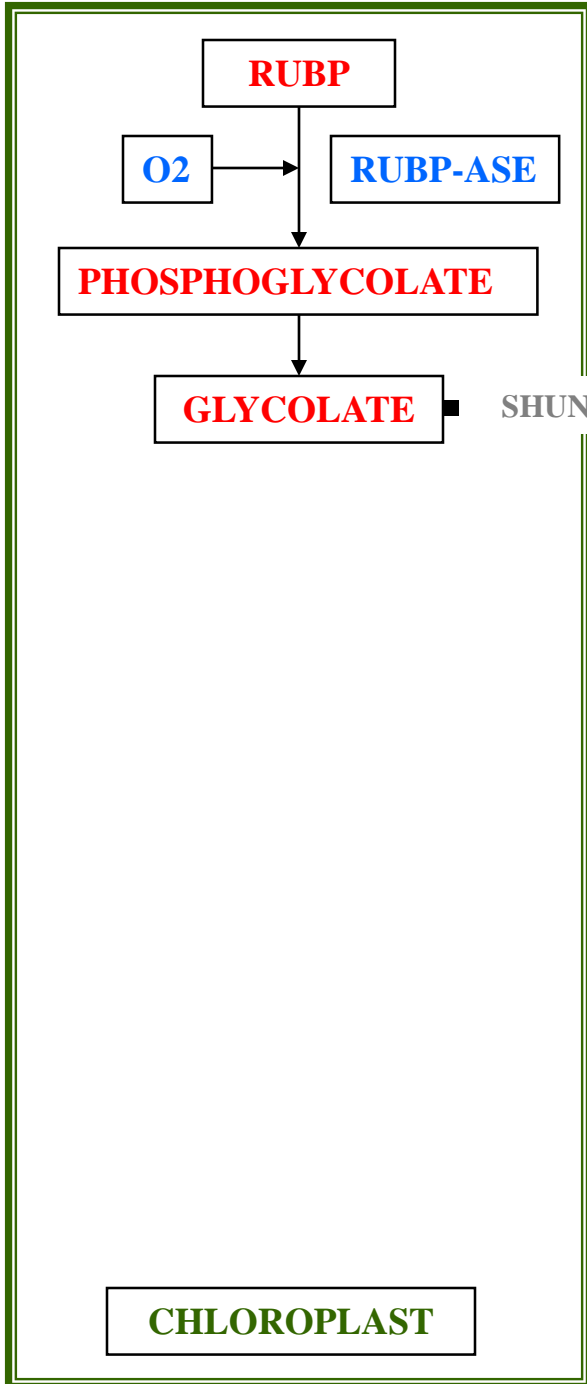


PHOTO-RESPIRATION PATHWAY SPECIFICS

