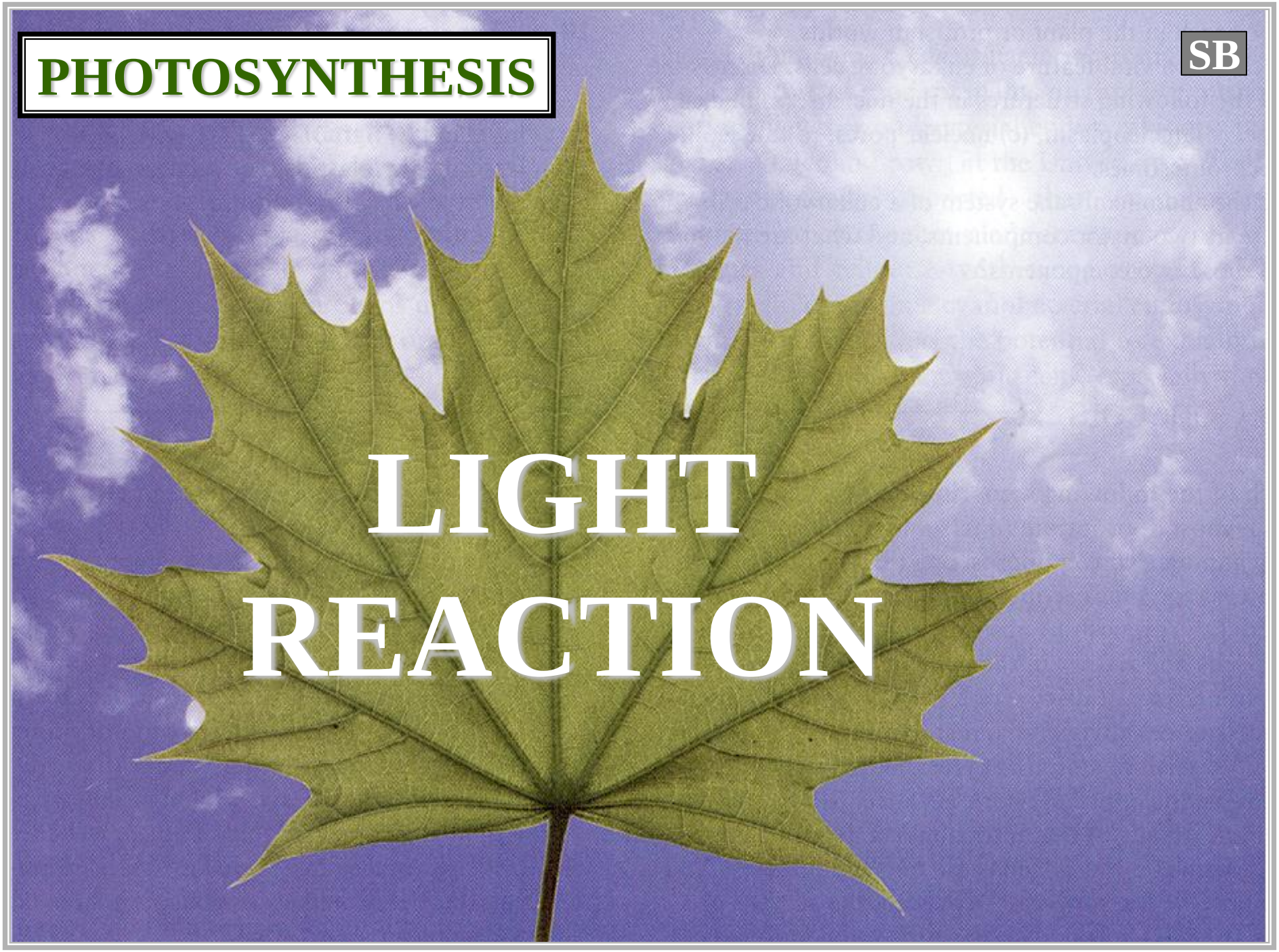
LIGHT REACTION

PHOTOSYNTHESIS

SB



LIGHT REACTION

PHOTOSYNTHESIS

L

LIGHT RXT SERIES BIO-CHEM REACTIONS

PHOTOSYNTHESIS

E

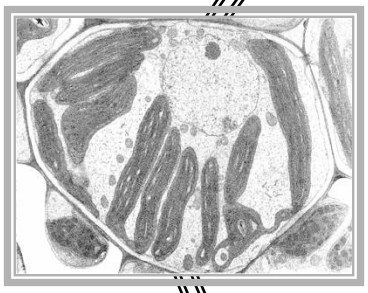
LIGHT RXT
LIGHT DEPENDENT REACTION

PHOTOSYNTHESIS

LIGHT RXT ENERGY CAPTURING REACTION

PHOTOSYNTHESIS

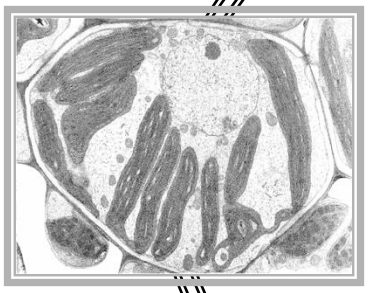
LR



CHLOROPLAST

PHOTOSYNTHESIS

LT



LT RXT

THYLAKOID
GRANUM

CHLOROPLAST

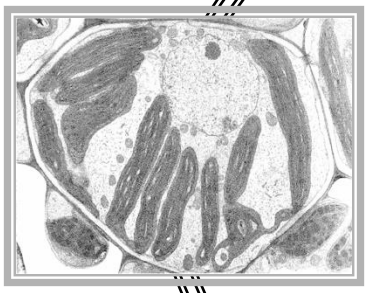
PHOTOSYNTHESIS

?

LIGHT EGY

LT RXT

THYLAKOID
GRANUM



CHLOROPLAST

PHOTOSYNTHESIS

C

WATER

LIGHT EGY

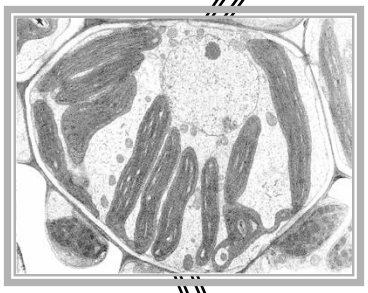
E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

?



CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

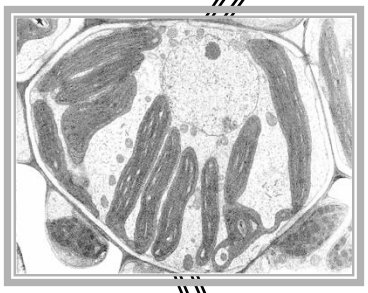
A

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID GRANUM

CHEMICAL ENERGY

P + ADP

CHLOROPLAST

ATMOSPHERE

OXYGEN

CHEMICAL ENERGY INPUT

PHOTOSYNTHESIS

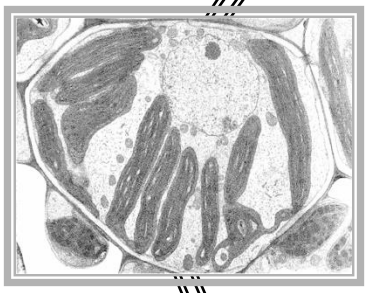
P

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID GRANUM

ATP

P + ADP → ATP

CHLOROPLAST

ATMOSPHERE

OXYGEN

CHEMICAL ENERGY INPUT

PHOTOSYNTHESIS

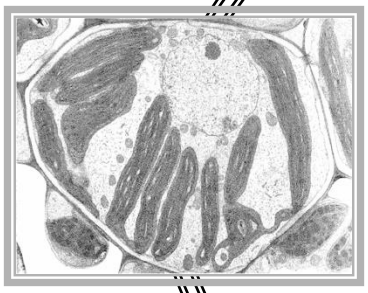
DK

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID GRANUM

ATP

PHOSPHORYLATION

CHLOROPLAST

ATMOSPHERE

OXYGEN

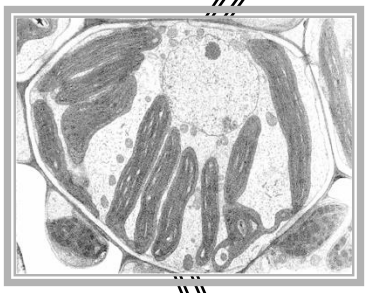
PHOTOSYNTHESIS

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

ATP

DK RXT

STROMA
ENZYMES

PHOSPHORYLATION

CHLOROPLAST

ATMOSPHERE

OXYGEN

DK

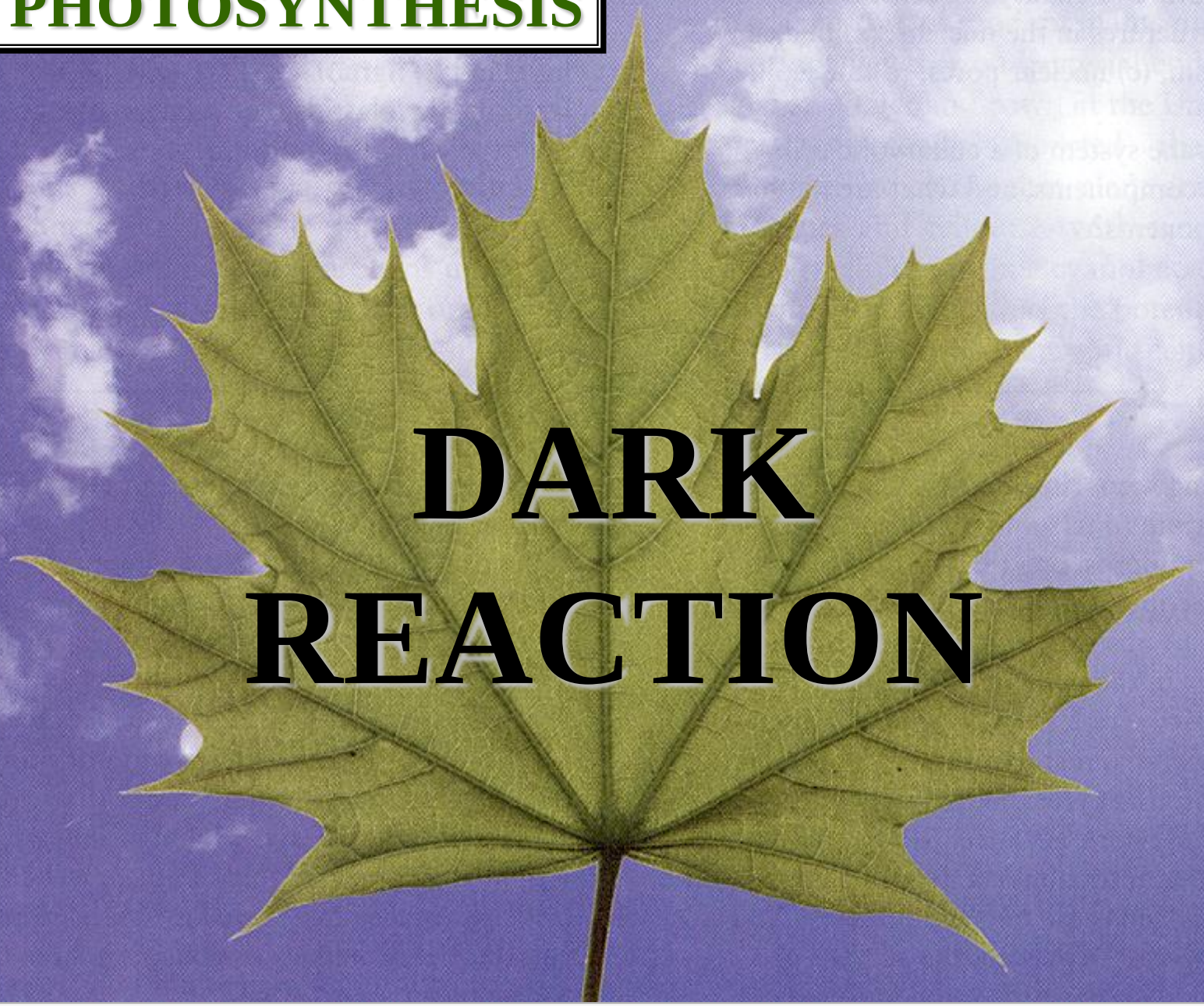
DARK REACTION OVERVIEW

DARK REACTION

PHOTOSYNTHESIS

SB

DARK REACTION



PHOTOSYNTHESIS

L

DARK RXT SERIES BIO-CHEM REACTIONS

PHOTOSYNTHESIS

S

DARK RXT
LIGHT INDEPENDENT REACTION

PHOTOSYNTHESIS

DARK RXT SYNTHESIS REACTION

PHOTOSYNTHESIS

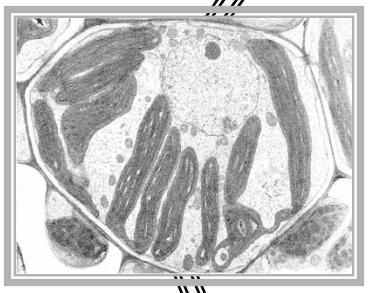
DK

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID GRANUM

ATP

STROMA

CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

?

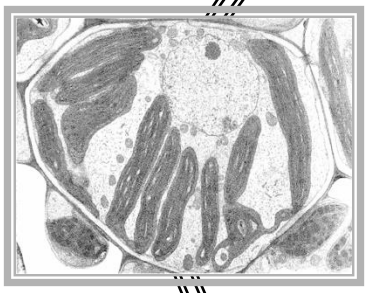
C

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

ATP

DK RXT

STROMA
ENZYMES

CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

C

WATER

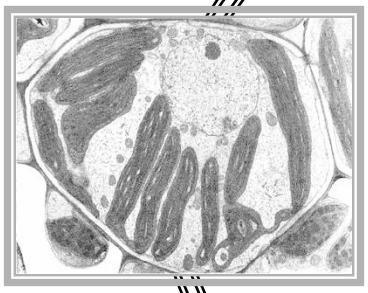
?

LIGHT EGY

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

ATP

DK RXT

STROMA
ENZYMES

CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

?

S

WATER

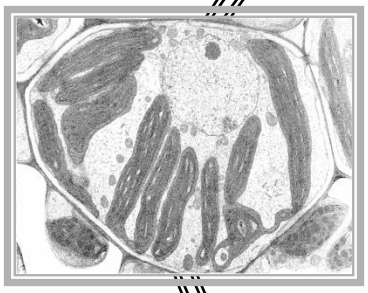
CO2

LIGHT EGY

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

ATP

DK RXT

STROMA
ENZYMES

CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

G

WATER

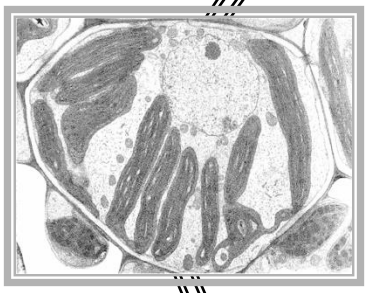
CO2

LIGHT EGY

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

CHEMICAL
ENERGY

DK RXT

STROMA
ENZYMES

SYNTHESIS

CHLOROPLAST

ATMOSPHERE

OXYGEN

?

PHOTOSYNTHESIS

G

WATER

CO2

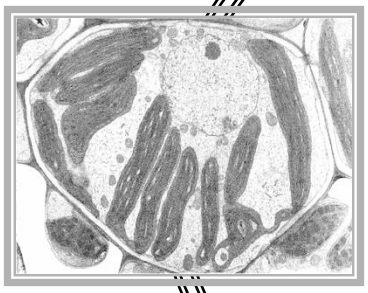
LIGHT EGY

PHOTO

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

CHEMICAL ENERGY

DK RXT

STROMA
ENZYMES

SYNTHESIS

CHEMICAL ENERGY INPUT

CHLOROPLAST

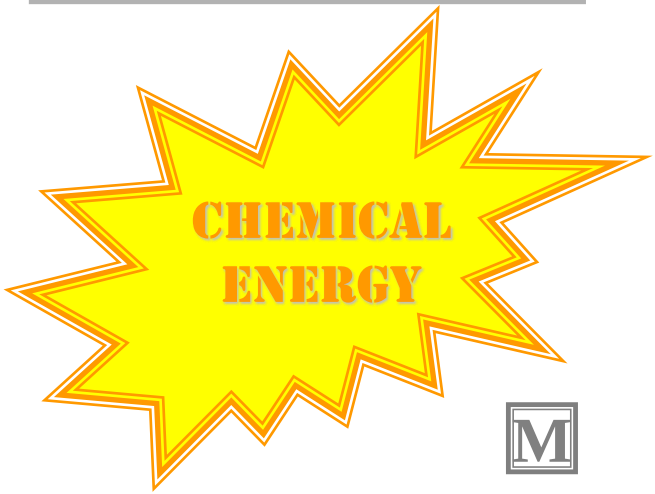
ATMOSPHERE

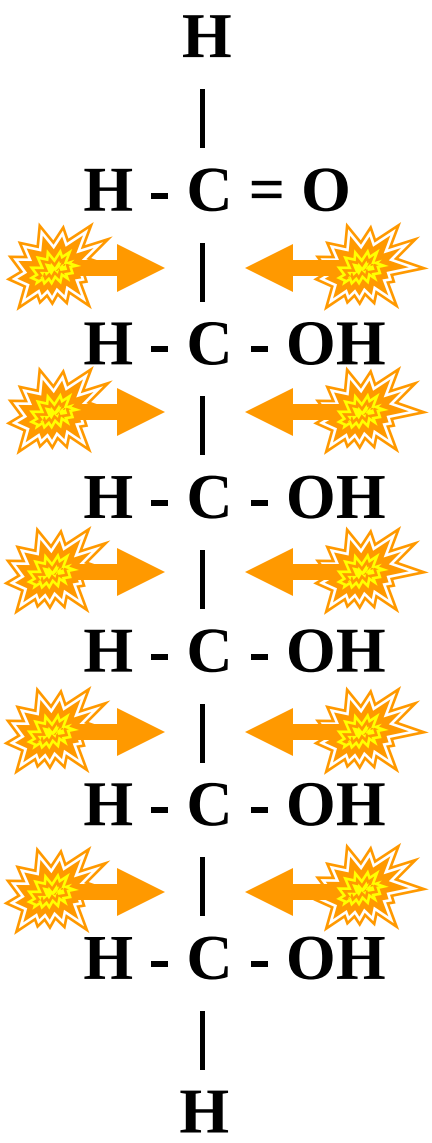
OXYGEN

GLUCOSE

GLUCOSE

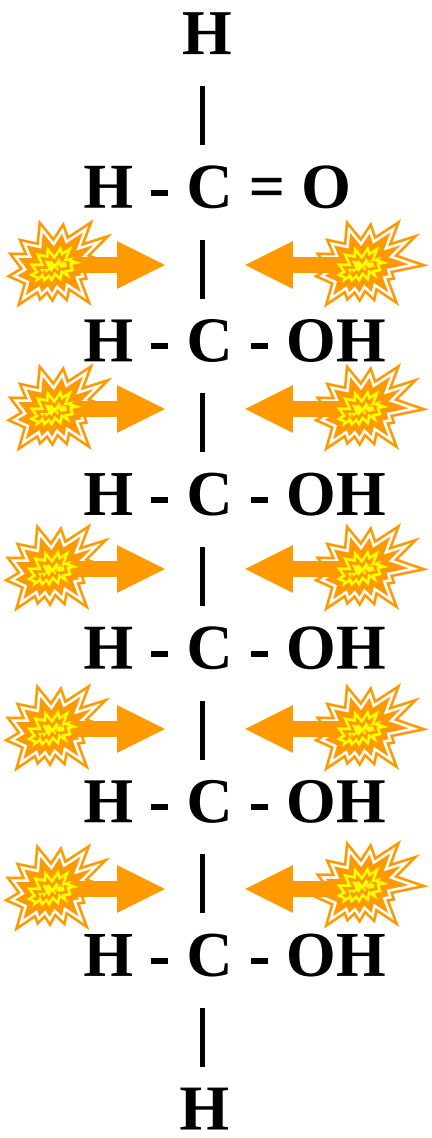

CHEMICAL
ENERGY


CHEMICAL
ENERGY


H
H - C = O
H - C - OH
H - C - OH
H - C - OH
H - C - OH
H - C - OH
H

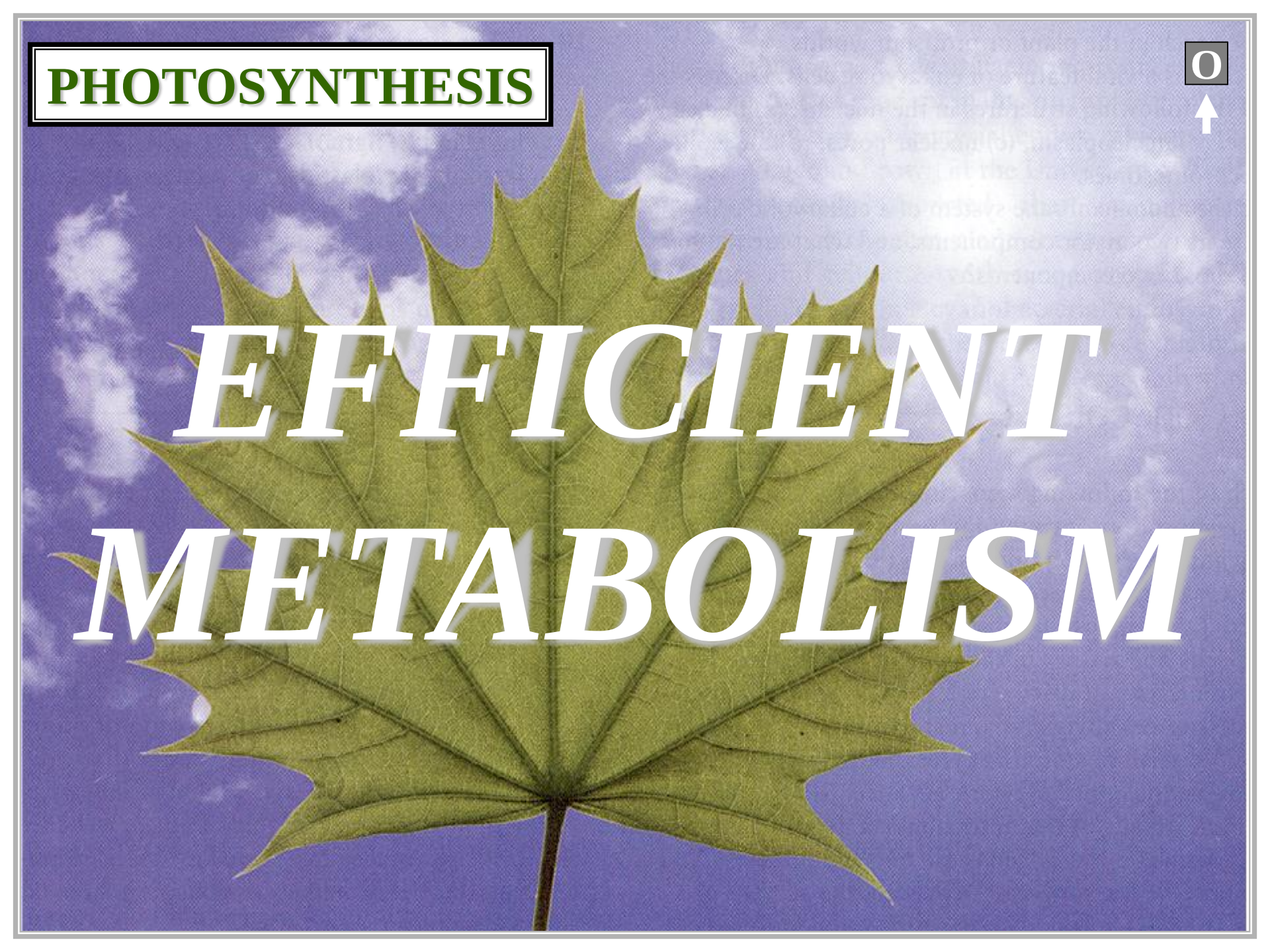
GLUCOSE

ENTERS METABOLISM

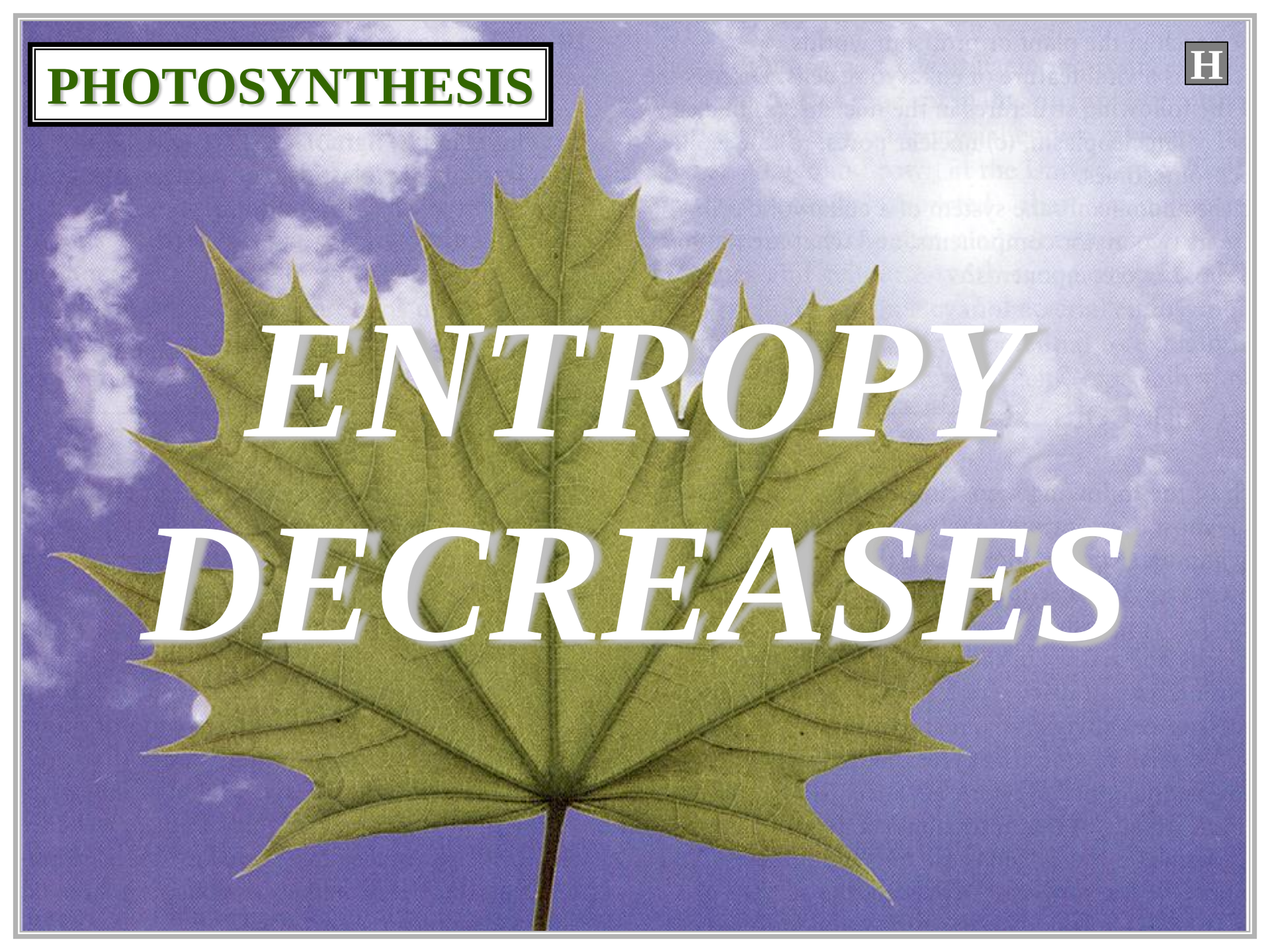


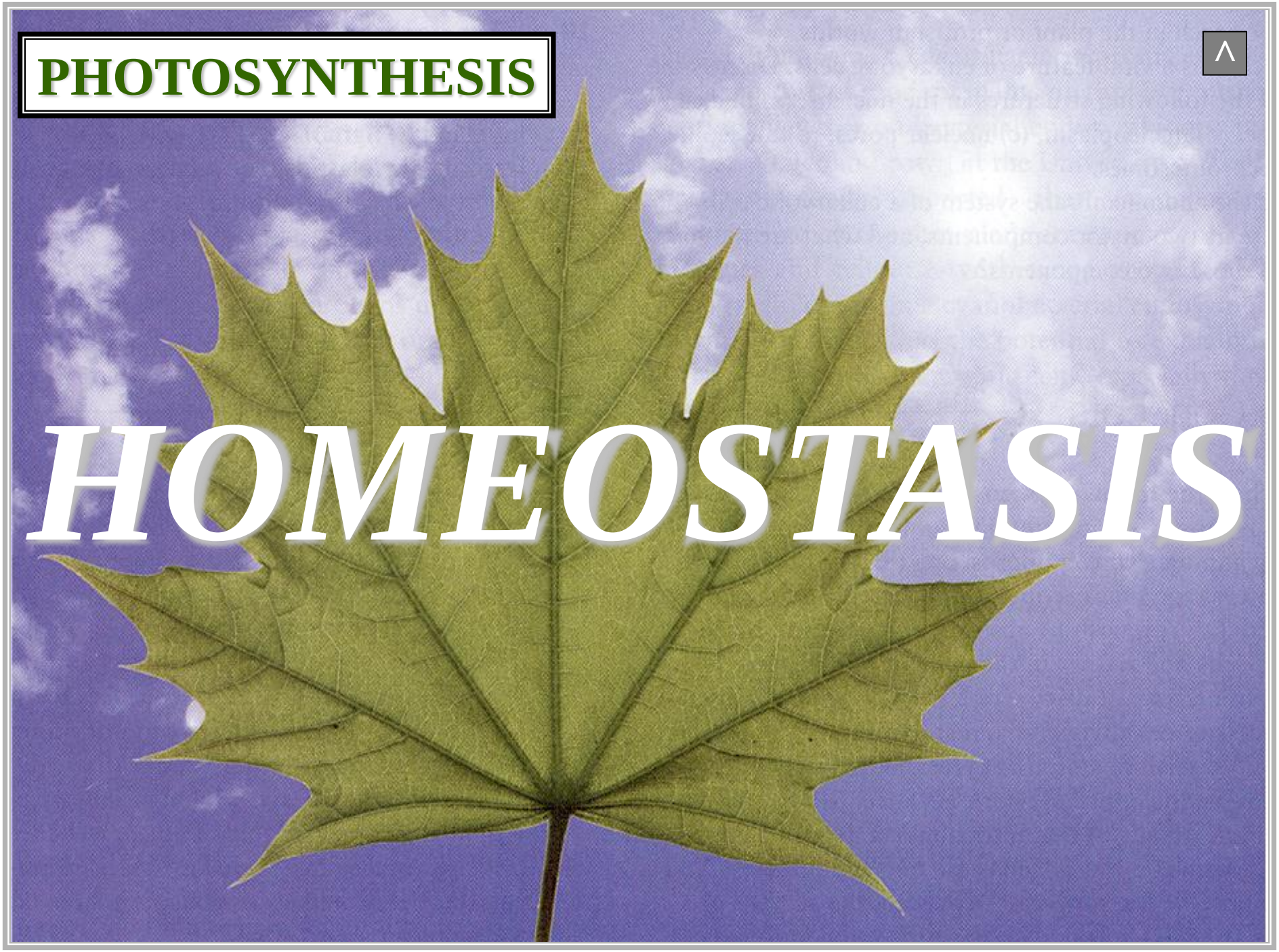
ENTERS METABOLISM

E


PHOTOSYNTHESIS
O
EFFICIENT
METABOLISM

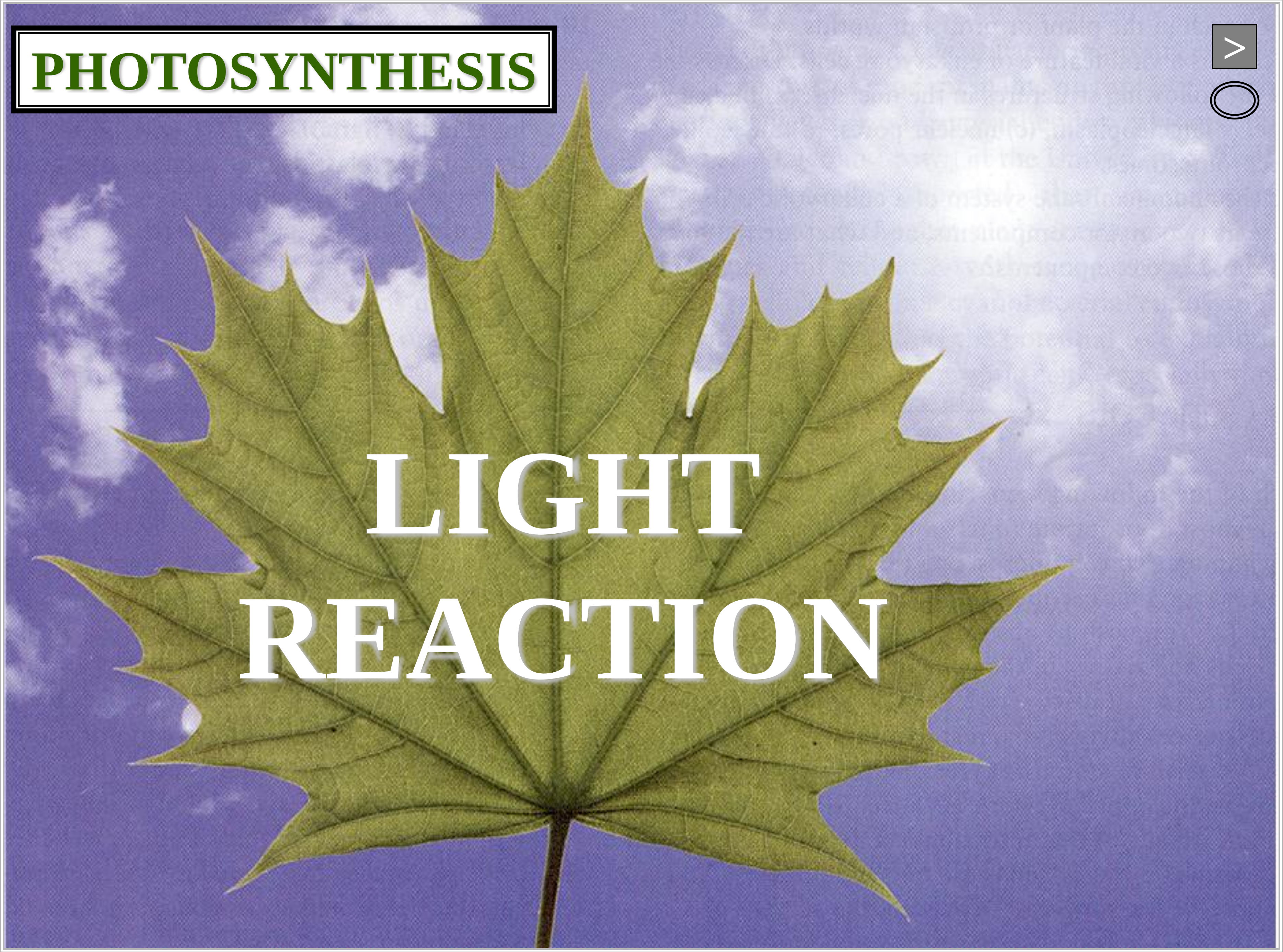

PHOTOSYNTHESIS
E
ORGANIZATION
INCREASES


PHOTOSYNTHESIS
H
ENTROPY
DECREASES


PHOTOSYNTHESIS
HOMEOSTASIS

LIGHT & DARK REACTION OVERVIEW SUMMARY

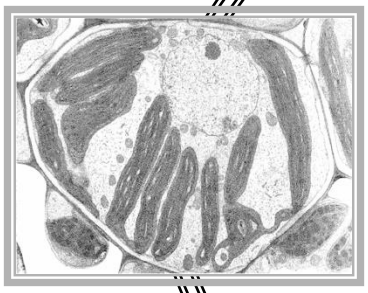
PHOTOSYNTHESIS



LIGHT REACTION

PHOTOSYNTHESIS

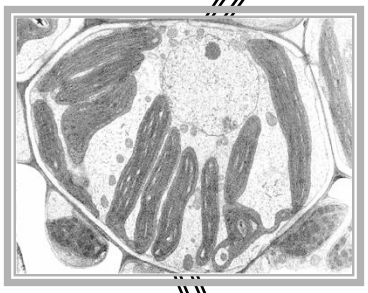
LR



CHLOROPLAST

PHOTOSYNTHESIS

LT



LT RXT

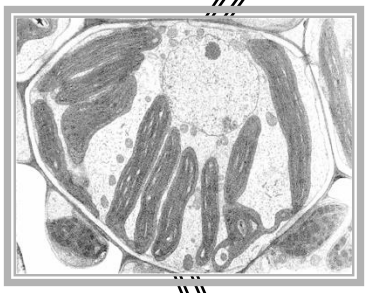
THYLAKOID
GRANUM

CHLOROPLAST

PHOTOSYNTHESIS

C

LIGHT EGY



LT RXT

THYLAKOID
GRANUM

CHLOROPLAST

PHOTOSYNTHESIS

A

WATER

LIGHT EGY

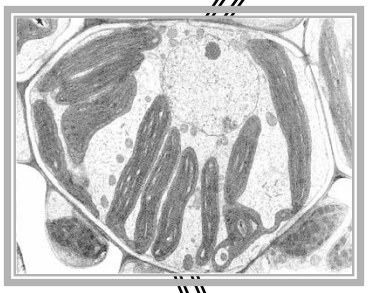
E-

PHOTOLYSIS

LT RXT

THYLAKOID GRANUM

CHEMICAL ENERGY



CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

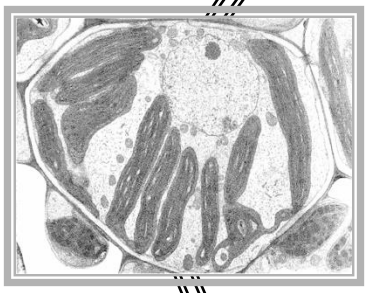
P

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID GRANUM

ATP

P + ADP → ATP

CHLOROPLAST

ATMOSPHERE

OXYGEN

CHEMICAL ENERGY INPUT

PHOTOSYNTHESIS

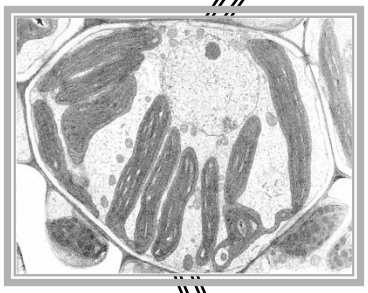
S

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID GRANUM

ATP

PHOSPHORYLATION

CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

A

LIGHT RXT ENERGY CAPTURING REACTION

PHOTOSYNTHESIS

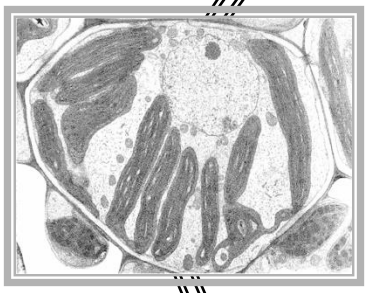
DK

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID GRANUM

ATP

PHOSPHORYLATION

CHLOROPLAST

ATMOSPHERE

OXYGEN

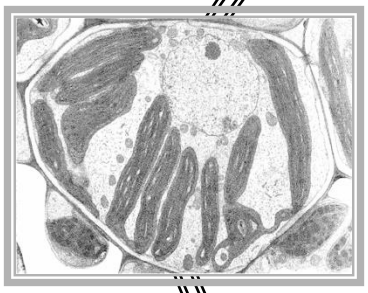
PHOTOSYNTHESIS

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID GRANUM

ATP

DK RXT

PHOSPHORYLATION

CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

DARK REACTION

PHOTOSYNTHESIS

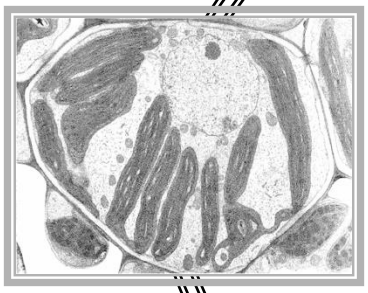
DR

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

ATP

STROMA

CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

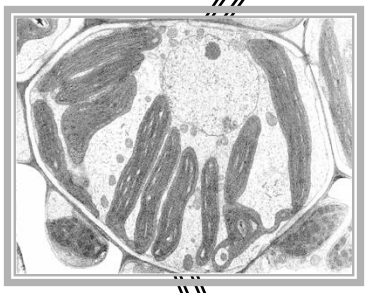
C

WATER

LIGHT EGY

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

ATP

DK RXT

STROMA
ENZYMES

CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

?

S

WATER

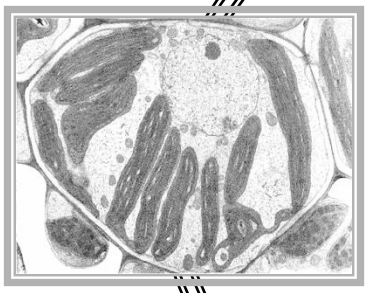
CO2

LIGHT EGY

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

ATP

DK RXT

STROMA
ENZYMES

CHLOROPLAST

ATMOSPHERE

OXYGEN

PHOTOSYNTHESIS

G

WATER

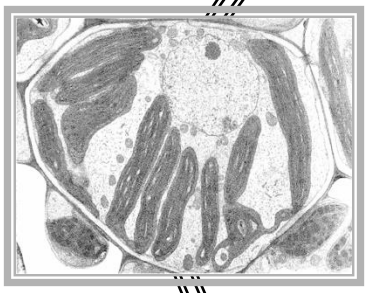
CO2

LIGHT EGY

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

CHEMICAL
ENERGY

DK RXT

STROMA
ENZYMES

SYNTHESIS

CHLOROPLAST

ATMOSPHERE

OXYGEN

?

PHOTOSYNTHESIS

S

WATER

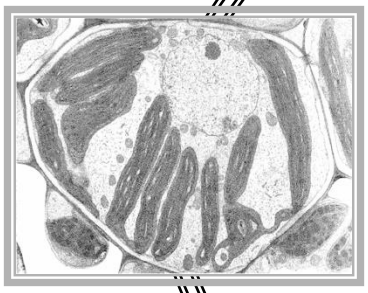
CO2

LIGHT EGY

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

CHEMICAL ENERGY

DK RXT

STROMA
ENZYMES

SYNTHESIS

CHEMICAL ENERGY INPUT

CHLOROPLAST

ATMOSPHERE

OXYGEN

GLUCOSE

PHOTOSYNTHESIS

DARK RXT SYNTHESIS REACTION

PHOTOSYNTHESIS

?

WATER

CO2

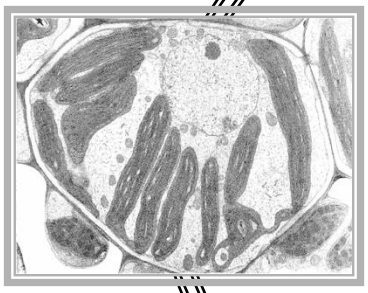
LIGHT EGY

PHOTO

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID GRANUM

CHEMICAL ENERGY

DK RXT

STROMA

ENZYMES

SYNTHESIS

CHEMICAL ENERGY INPUT

CHLOROPLAST

ATMOSPHERE

OXYGEN

GLUCOSE

LIGHT REACTION & DARK REACTION ?

CATABOLIC METABOLISM & ANABOLIC METABOLISM ?

EXERGONIC REACTIONS & ENDERGONIC REACTIONS ?

C

LIGHT REACTION & DARK REACTION ?

LIGHT REACTION & DARK REACTION

!!!COUPLED!!!

PHOTOSYNTHESIS

E

WATER

CO2

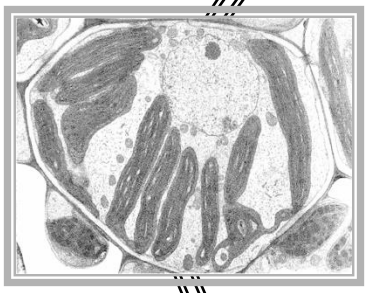
LIGHT EGY

PHOTO

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID GRANUM

CHEMICAL ENERGY

DK RXT

STROMA

ENZYMES

SYNTHESIS

CHEMICAL ENERGY INPUT

CHLOROPLAST

ATMOSPHERE

OXYGEN

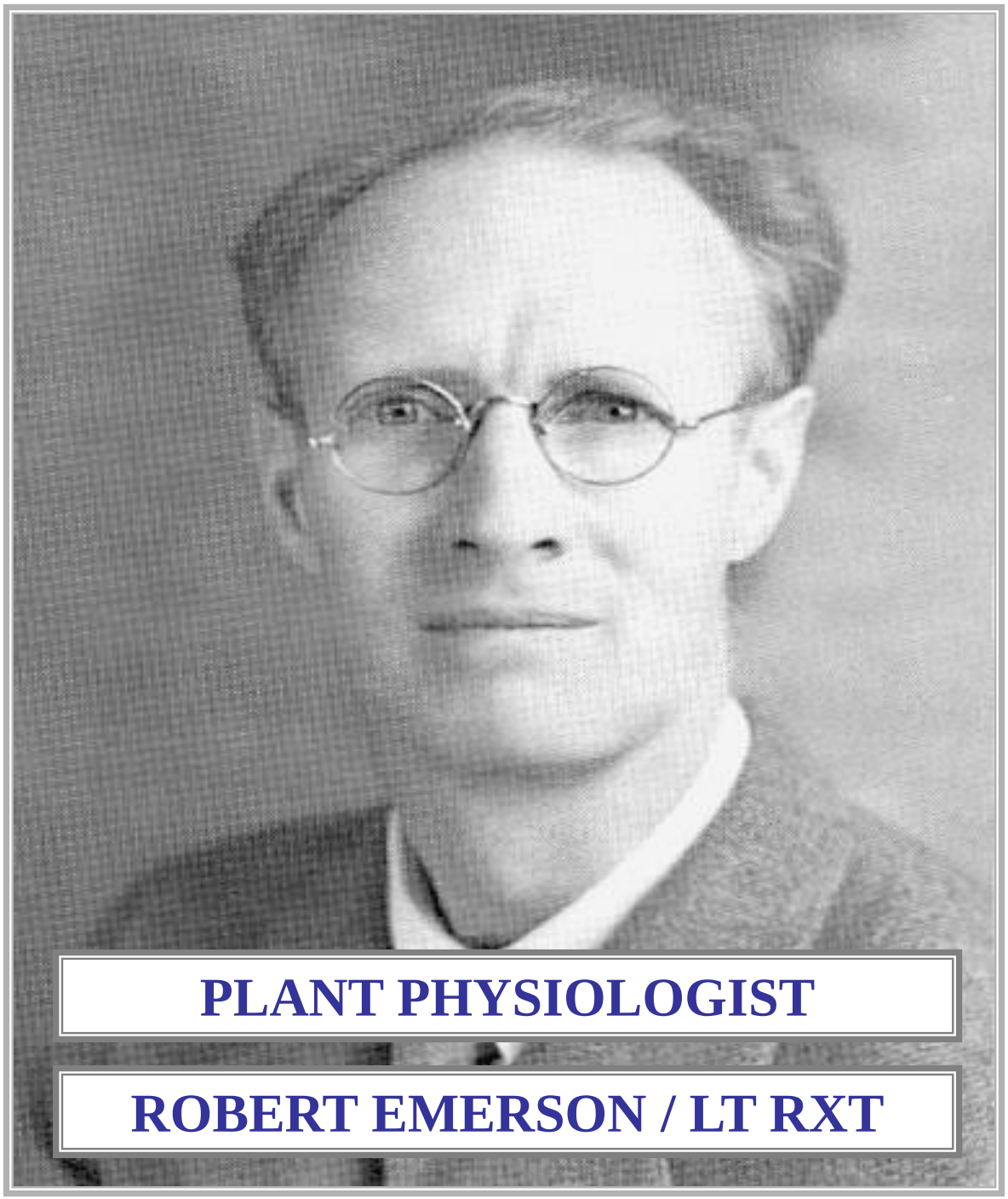
GLUCOSE

CHEMICAL ENERGY

LIGHT REACTION & DARK REACTION

!!!COUPLED!!!

LIGHT REACTION SPECIFICS



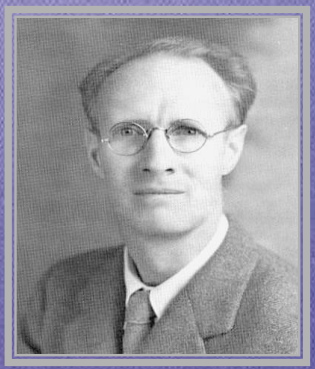
PLANT PHYSIOLOGIST

ROBERT EMERSON / LT RXT

PHOTOSYNTHESIS

L

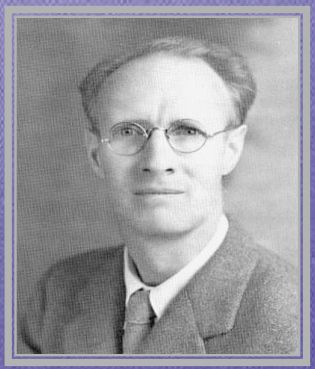
LIGHT REACTION



PHOTOSYNTHESIS

E

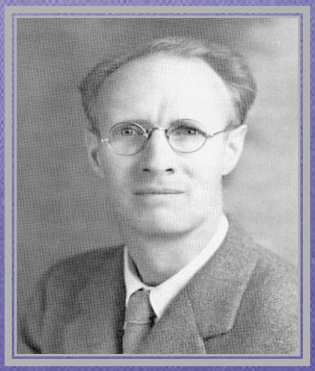
LIGHT RXT
LIGHT DEPENDENT REACTION



PHOTOSYNTHESIS

R

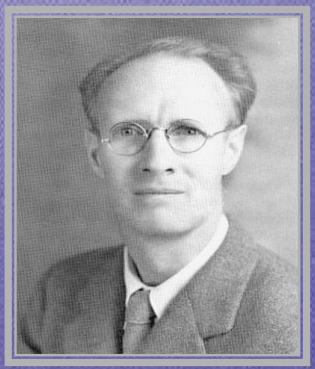
LIGHT RXT ENERGY CAPTURING REACTION



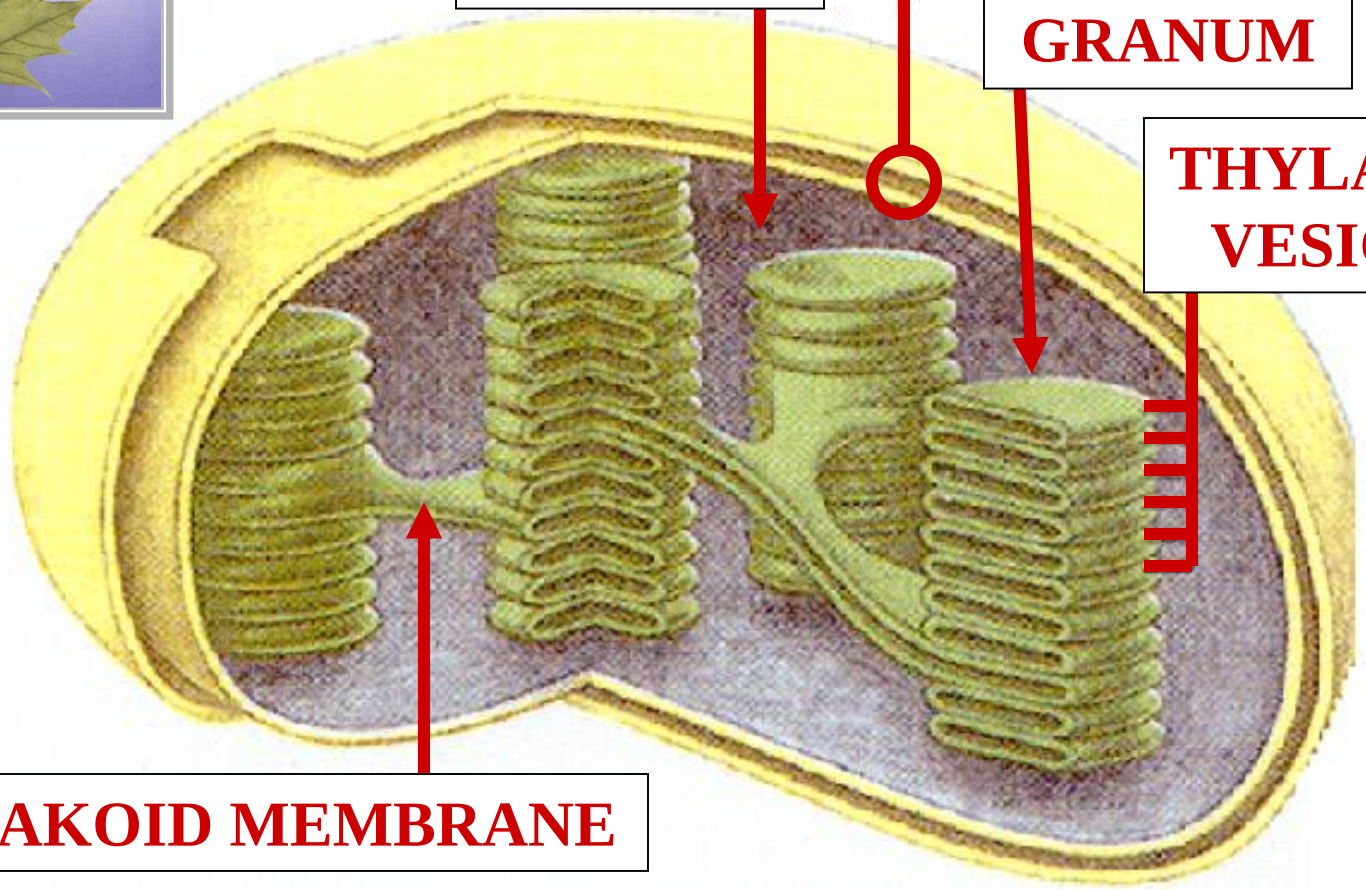
PHOTOSYNTHESIS

?

LIGHT RXT CONSISTS MOSTLY REDOX REACTIONS

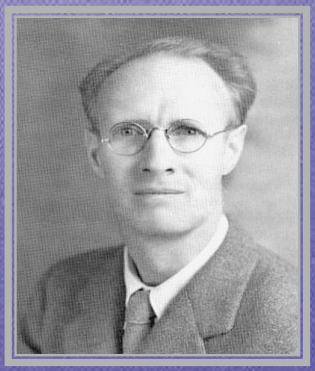


CHLOROPLAST ULTRASTRUCTURE



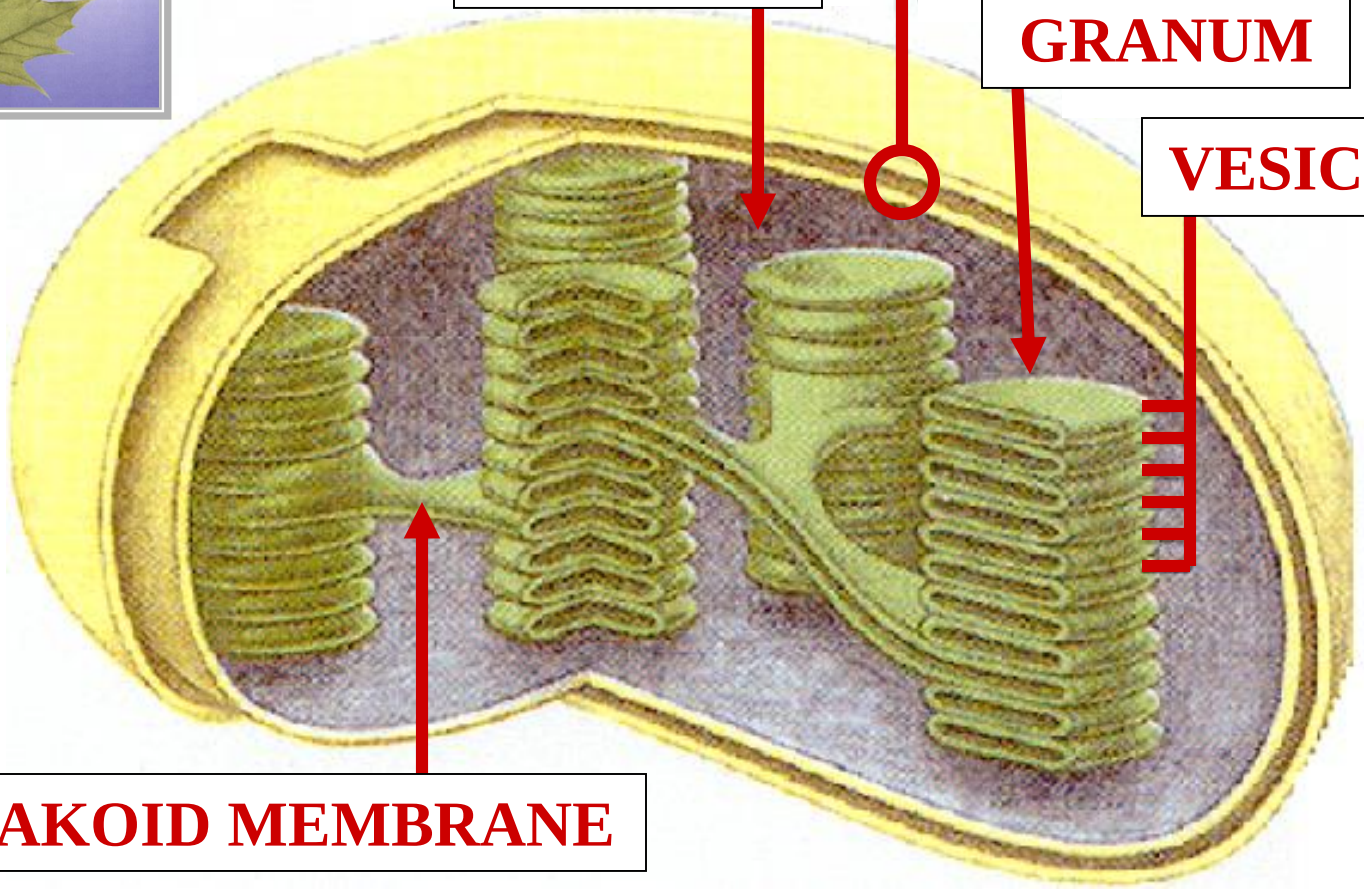
PHOTOSYNTHESIS

LIGHT RXT OCCURS ALONG THYLAKOID

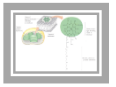


CHLOROPLAST THYLAKOID

CHLOROPLAST ULTRASTRUCTURE



THYLAKOID MEMBRANE



THYLAKOID MEMBRANE

BEARS NUMEROUS PHOTOSYSTEMS

THYLAKOID MEMBRANE

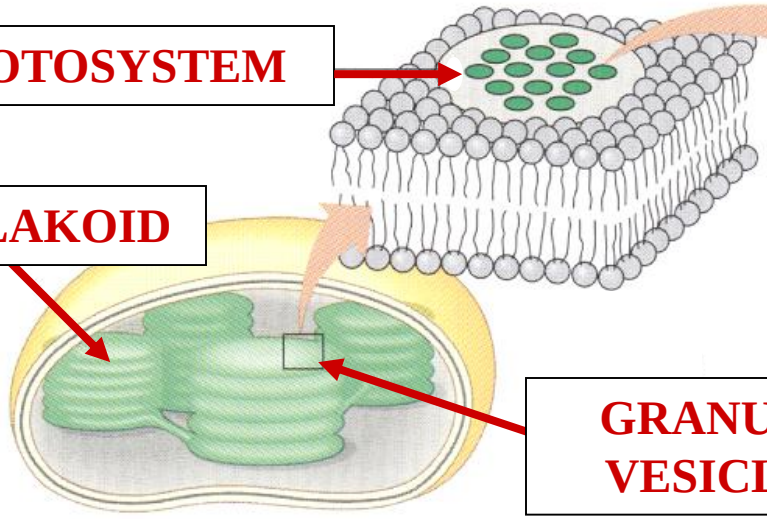
CHLOROPLAST
THYLAKOID GRANUM

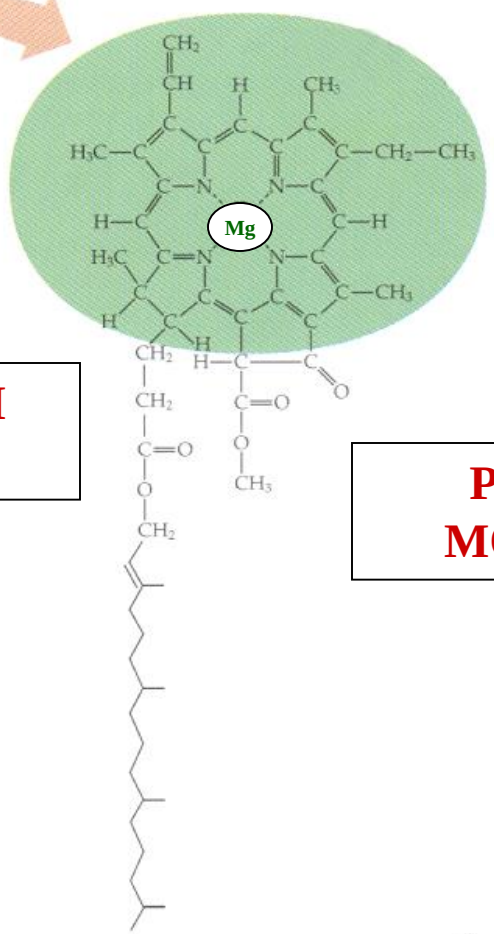
PHOTOSYSTEM

THYLAKOID

GRANUM
VESICLE

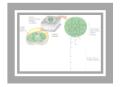
CHLOROPLAST





PIGMENT
MOLECULE

PHOTOSYSTEM



PHOTOSYSTEM

CLUSTER
PIGMENT MOLECULES

PHOTOSYSTEM

P

CHLOROPLAST
THYLAKOID GRANUM

PHOTOSYSTEM

THYLAKOID

GRANUM
VESICLE

CHLOROPLAST

PIGMENT
MOLECULE

PIGMENT

PIGMENT

SUBSTANCE ABSORBS LIGHT & REFLECTS LIGHT

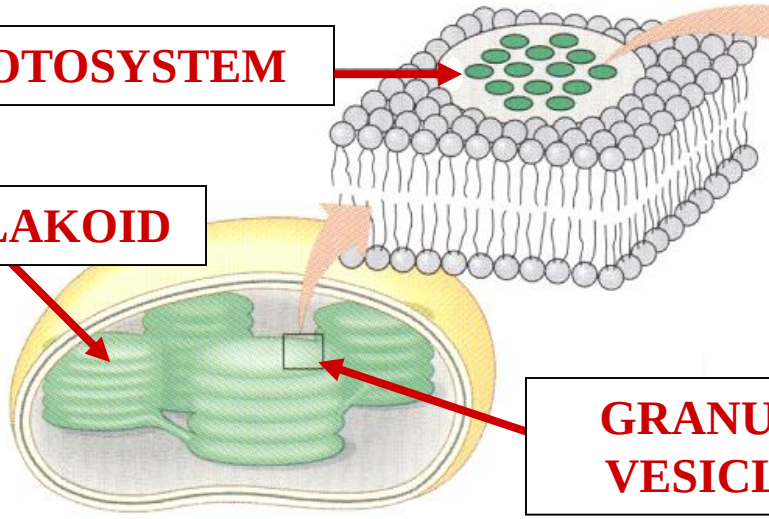
PIGMENT

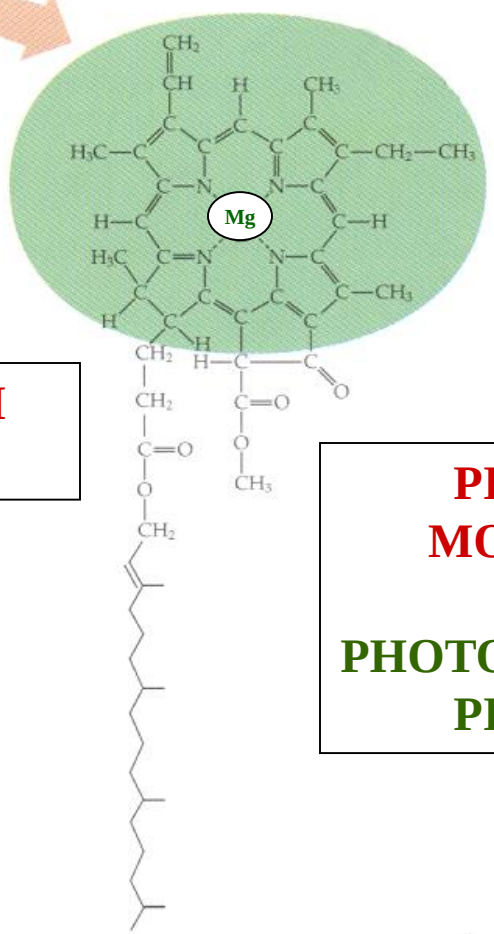
CHLOROPLAST
THYLAKOID GRANUM

PHOTOSYSTEM

THYLAKOID

GRANUM
VESICLE





CHLOROPLAST

PIGMENT MOLECULE
=
PHOTOSYNTHETIC PIGMENT

PHOTOSYNTHETIC PIGMENTS

PHOTOSYNTHETIC PIGMENT TYPES

PHOTOSYNTHETIC PIGMENTS TYPES

CHLOROPHYLLS

PHOTOSYNTHETIC PIGMENTS TYPES

PHOTOSYNTHETIC PIGMENTS

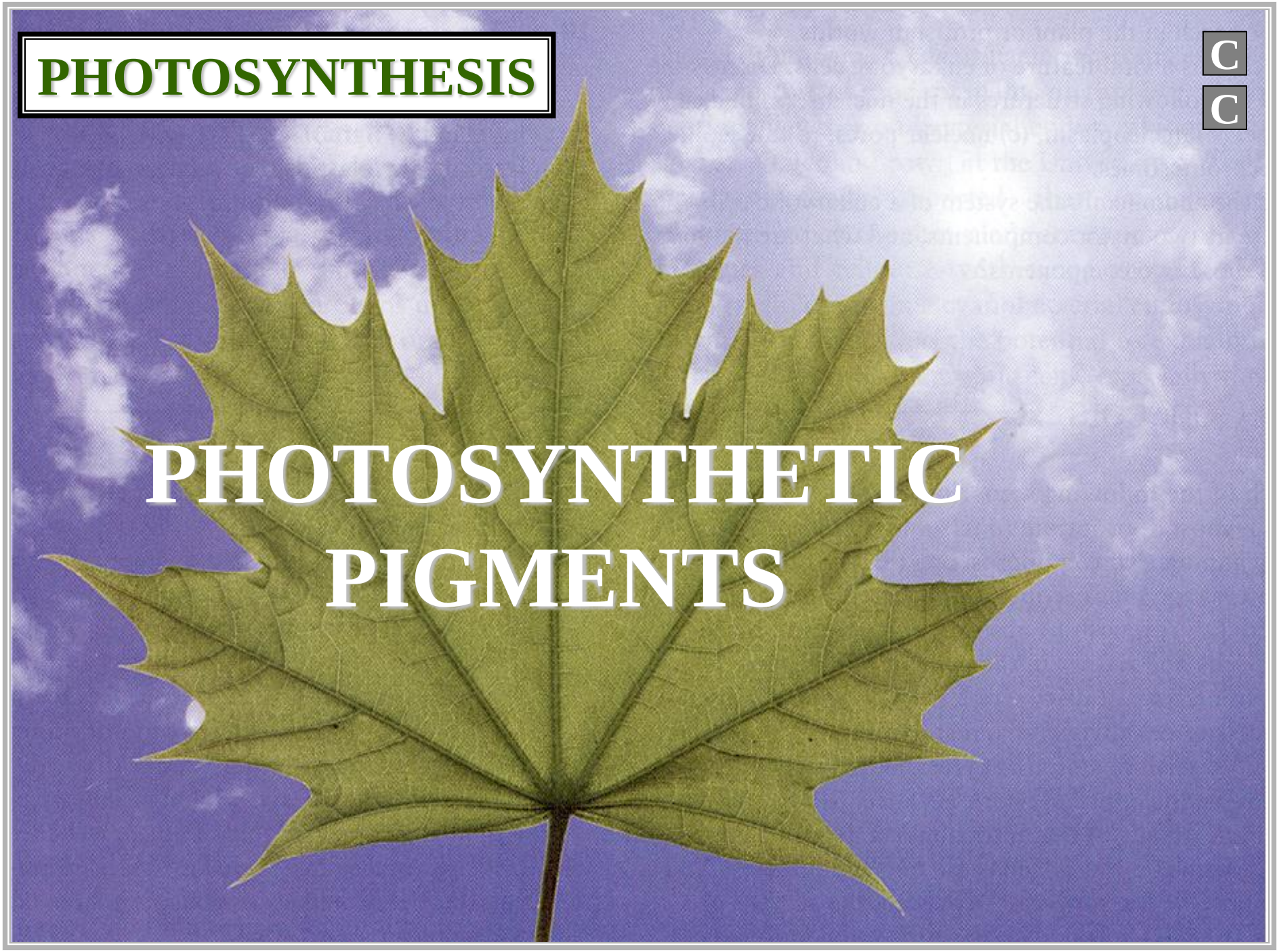
TYPES

CHLOROPHYLLS

CAROTENOIDS

PHOTOSYNTHETIC PIGMENTS

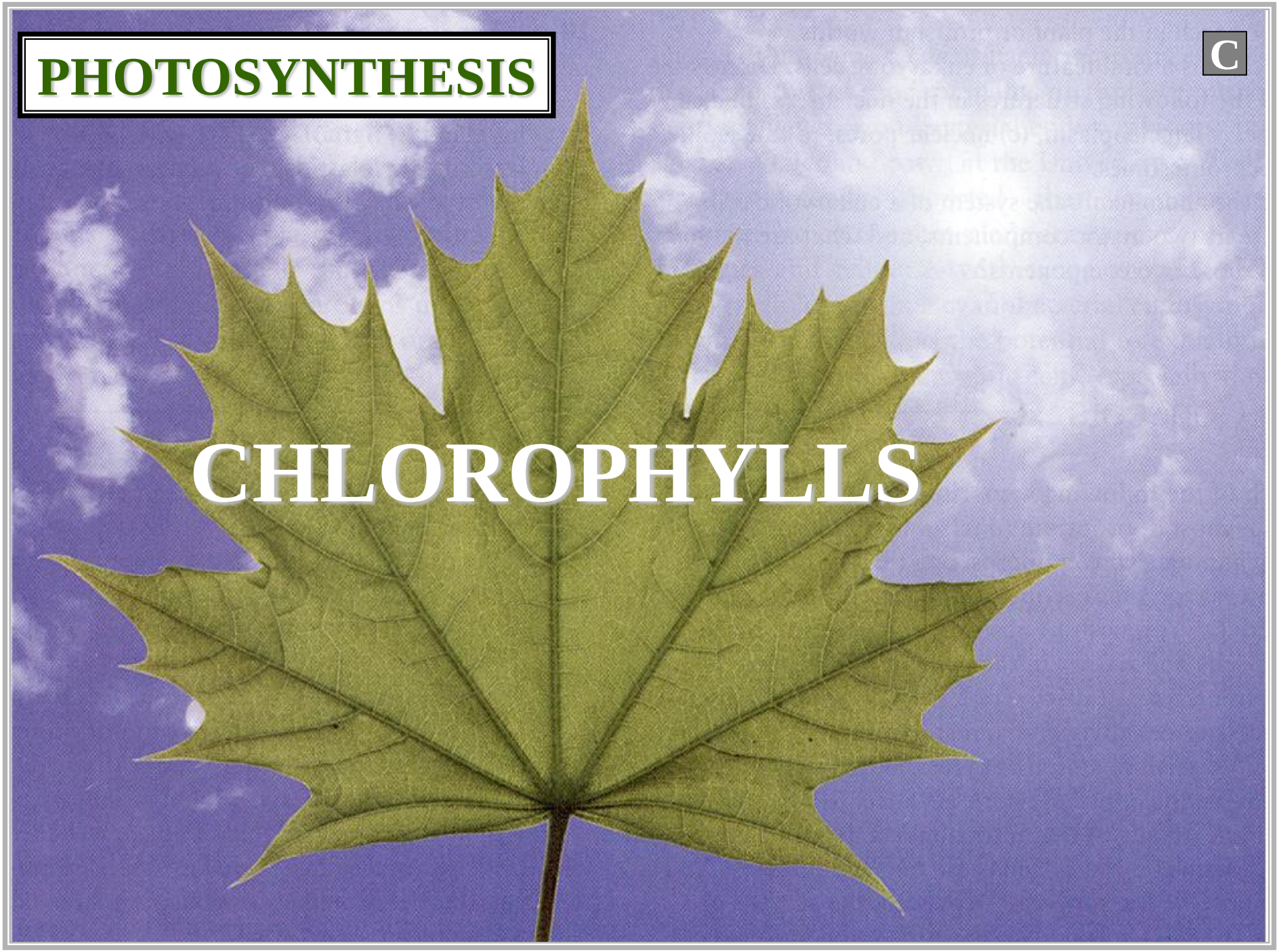
TYPES



PHOTOSYNTHETIC PIGMENTS

PHOTOSYNTHESIS

C



CHLOROPHYLLS

PHOTOSYNTHESIS

CHLOROPHYLLS & CAROTENOIDS

CHLOROPHYLLS

CHLOROPHYLL TYPES

PHOTOSYNTHETIC PIGMENTS CHLOROPHYLLS

CHLOROPHYLL A

PHOTOSYNTHETIC PIGMENTS CHLOROPHYLLS

PHOTOSYNTHETIC PIGMENTS CHLOROPHYLLS

CHLOROPHYLL A

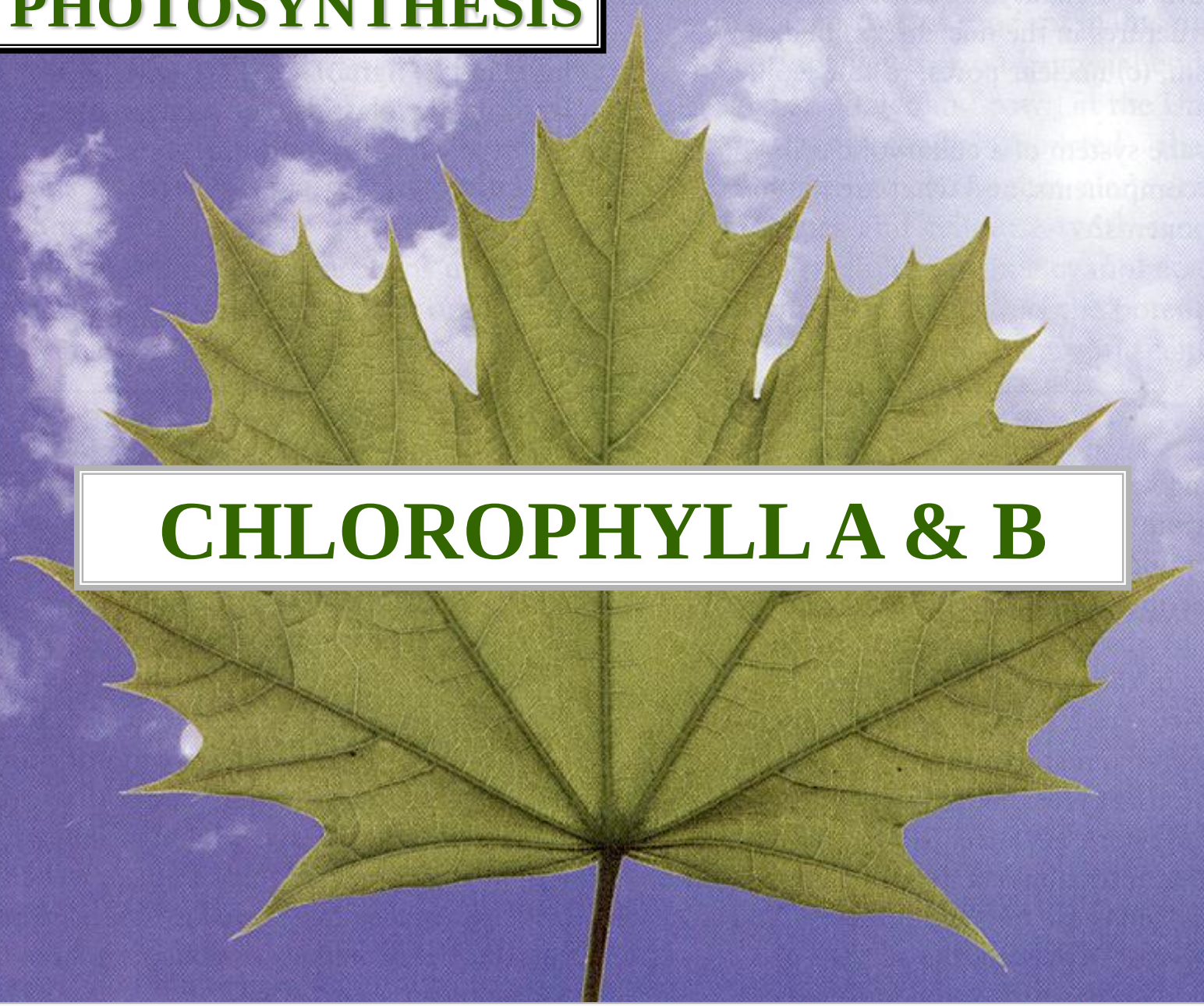
CHLOROPHYLL B

PHOTOSYNTHETIC PIGMENTS CHLOROPHYLLS

PHOTOSYNTHESIS

1

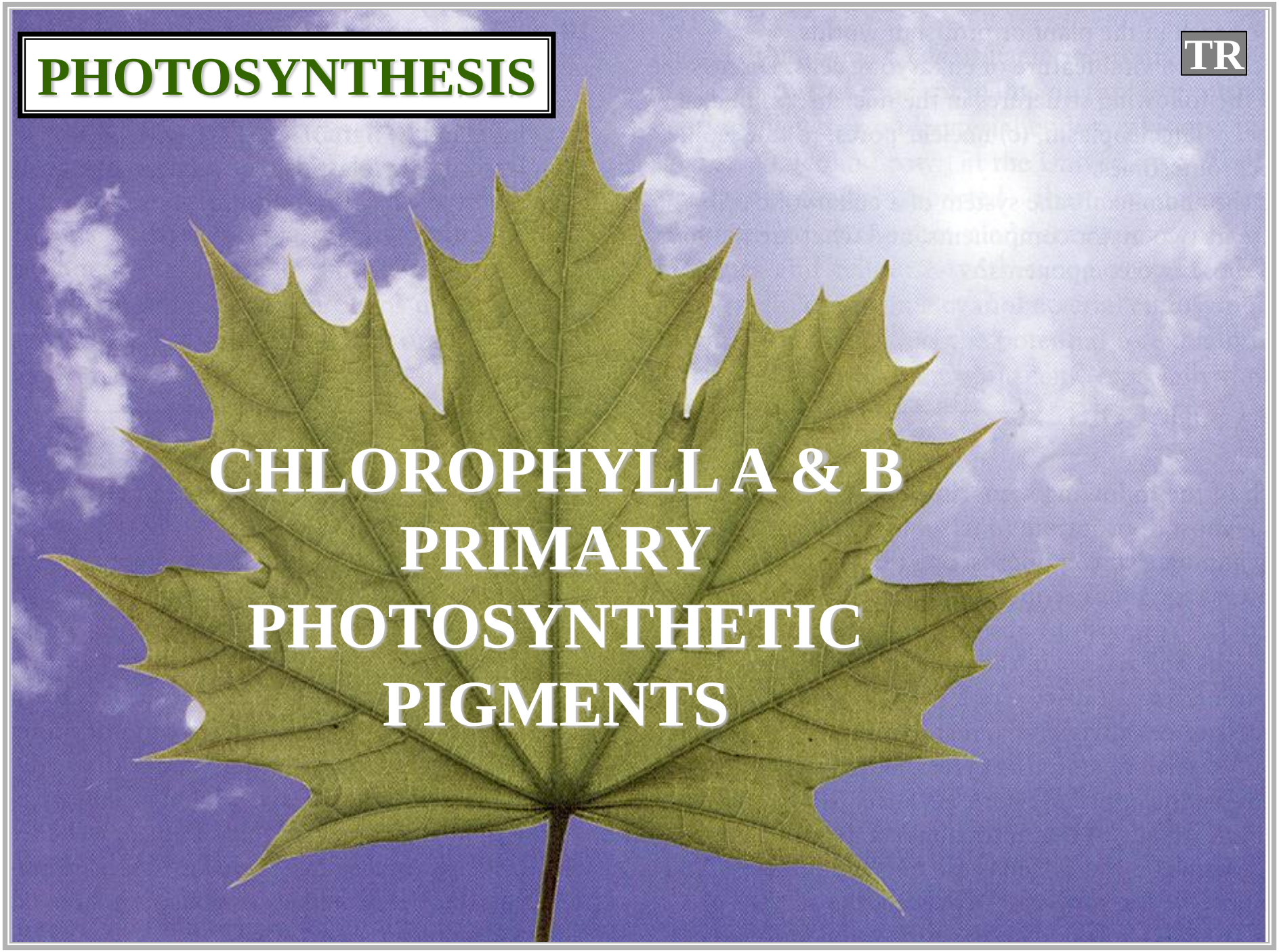
P



CHLOROPHYLL A & B

PHOTOSYNTHESIS

TR



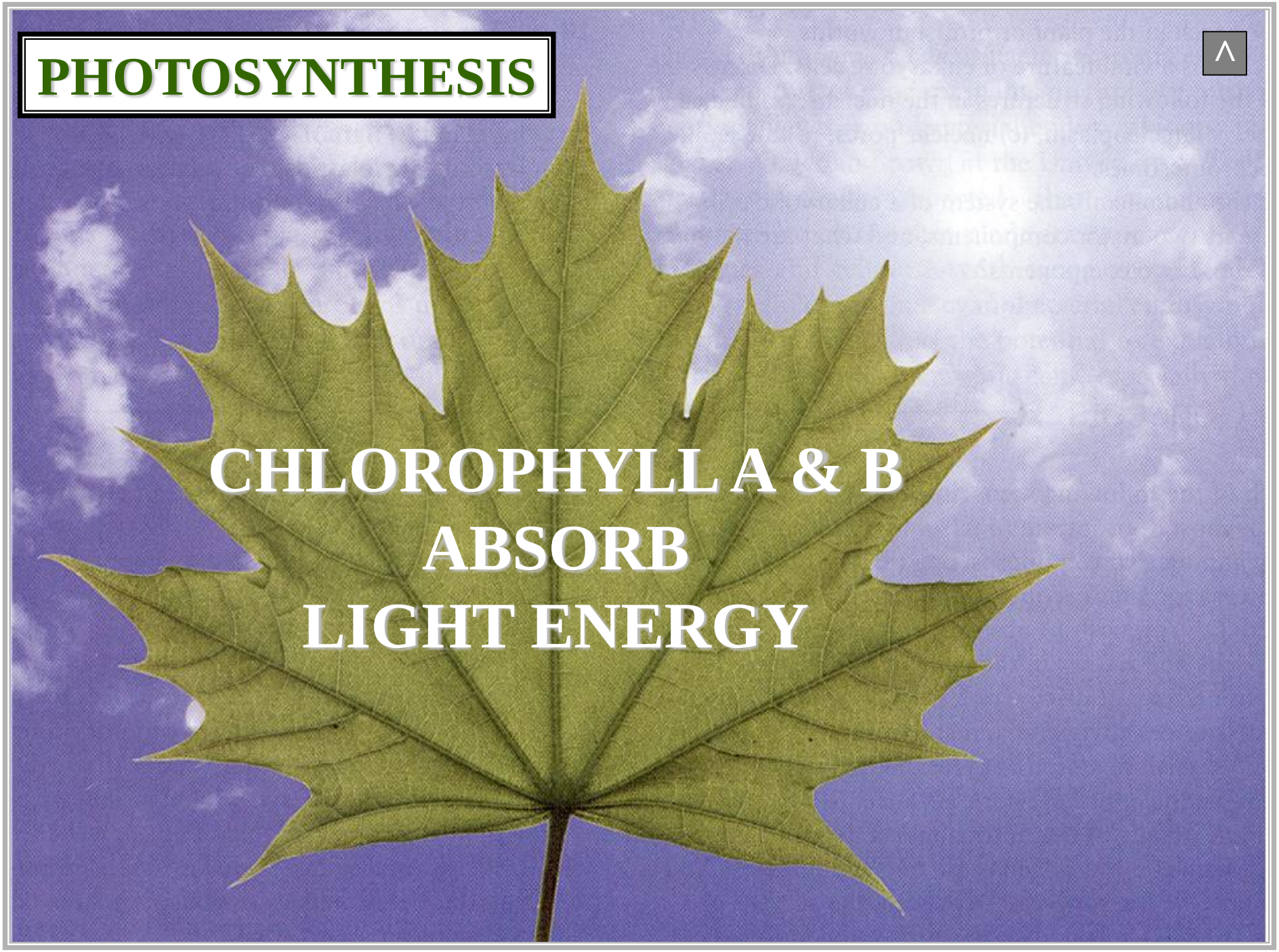
CHLOROPHYLL A & B
PRIMARY
PHOTOSYNTHETIC
PIGMENTS

PHOTOSYNTHESIS

A

ALL TRUE PLANTS
POSSESS
CHLOROPHYLL A & B

PHOTOSYNTHESIS



CHLOROPHYLL A & B
ABSORB
LIGHT ENERGY

CAROTENOIDS

CAROTENOID TYPES

PHOTOSYNTHETIC PIGMENTS CAROTENOIDS

CAROTENES

PHOTOSYNTHETIC PIGMENTS CAROTENOIDS

PHOTOSYNTHETIC PIGMENTS CAROTENOIDS

C

CAROTENES

XANTHOPHYLLS

PHOTOSYNTHETIC PIGMENTS CAROTENOIDS

CAROTENES


X
CAROTENES

XANTHOPHYLLS


2
A
XANTHOPHYLLS