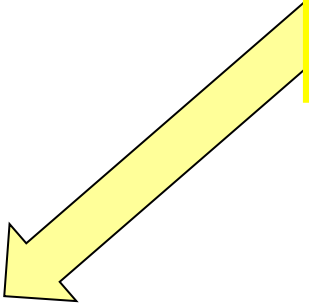




LIGHT ENERGY



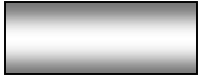
WATER

SPLIT

H⁺

O

ENZYME
COMPLEX
Mn
Manganese
COFACTOR

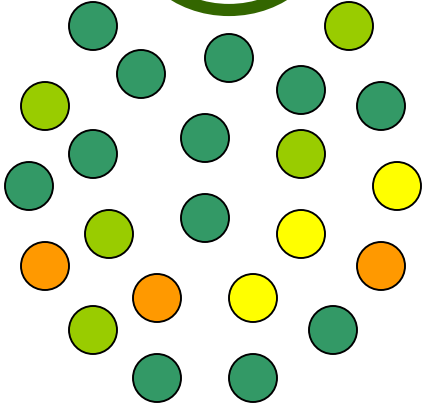


PHOTOLYSIS

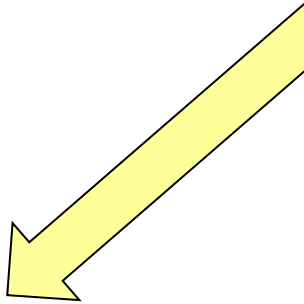
PS-II



P680 OXIDIZED



LIGHT ENERGY



WATER

SPLIT

ENZYME
COMPLEX
Mn
Manganese
COFACTOR

H⁺

O

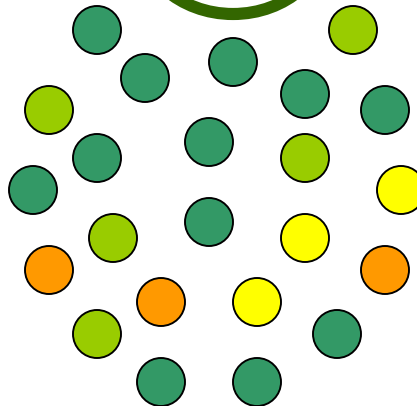
E⁻

PHOTOLYSIS

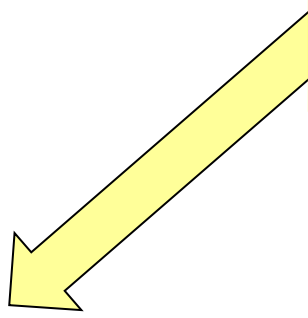
PS-II

CHL-A
P680

P680 OXIDIZED



LIGHT ENERGY



WATER

SPLIT

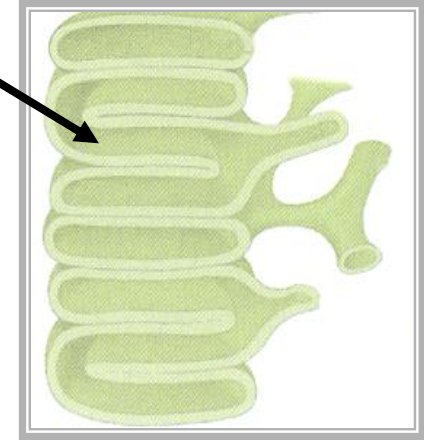
ENZYME
COMPLEX
Mn
Manganese
COFACTOR

H+

O

E-

THYLAKOID SPACE

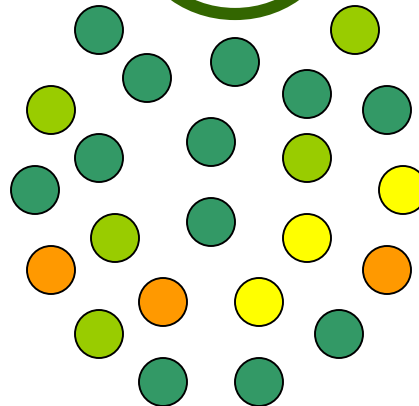


PHOTOLYSIS

PS-II

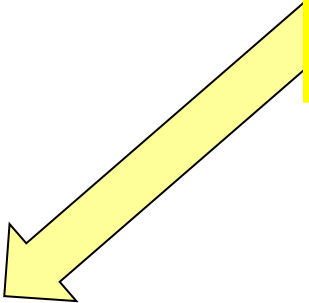
CHL-A
P680

P680 OXIDIZED





LIGHT ENERGY



WATER

SPLIT

ENZYME
COMPLEX
Mn
Manganese
COFACTOR

H+



THYLAKOID SPACE

O



ATMOSPHERE

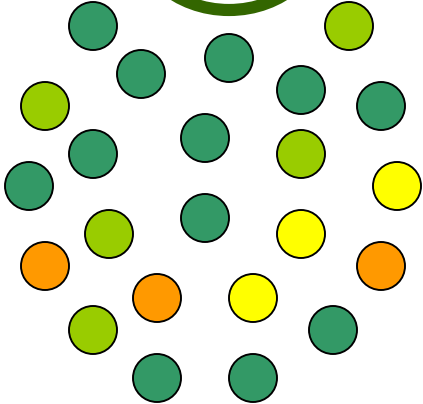
E-

PHOTOLYSIS

PS-II

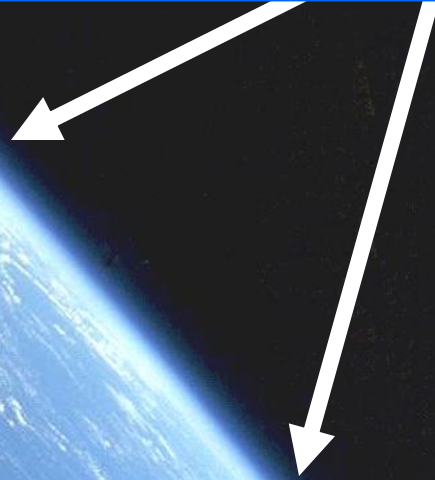
CHL-A
P680

P680 OXIDIZED

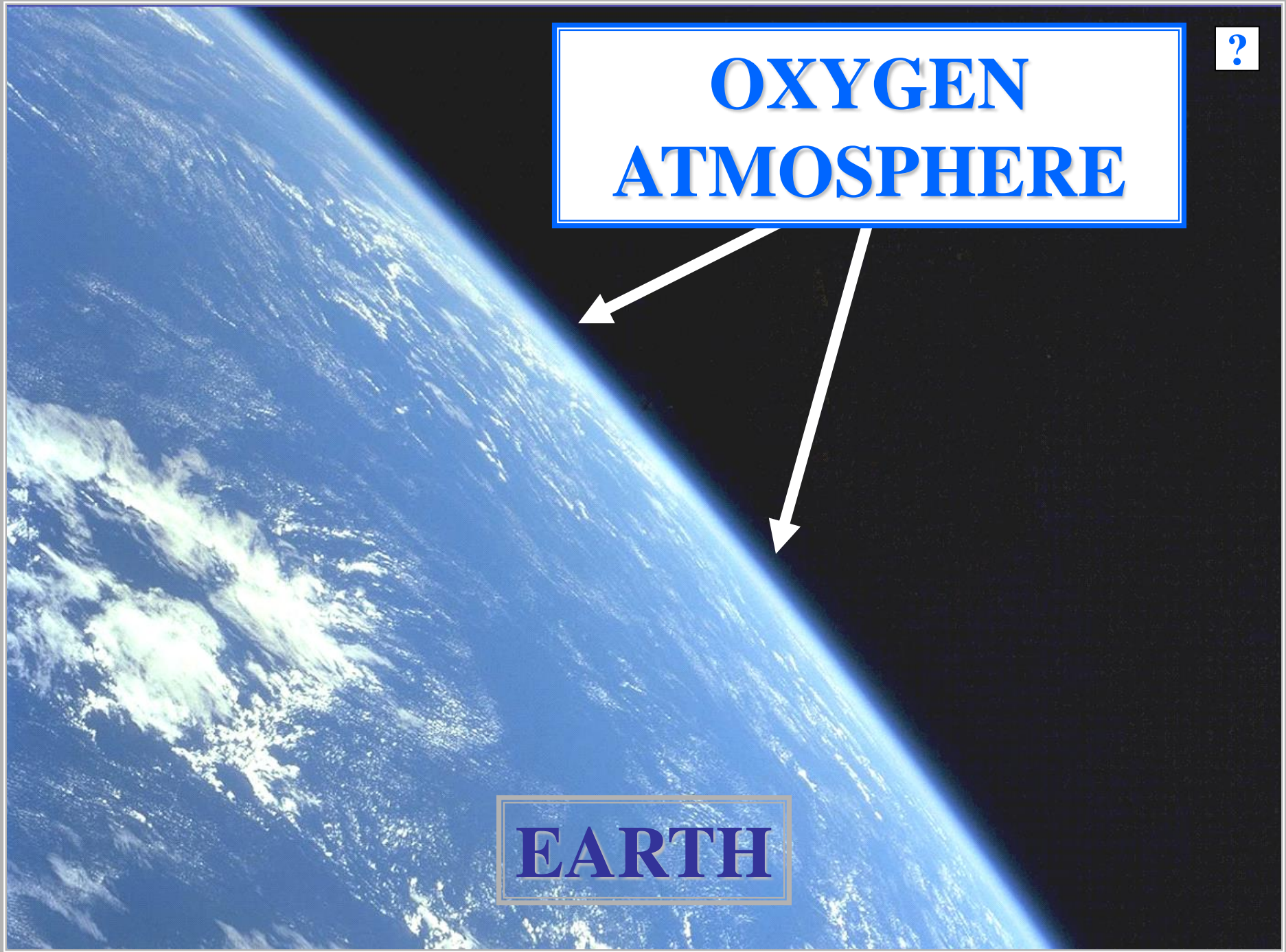




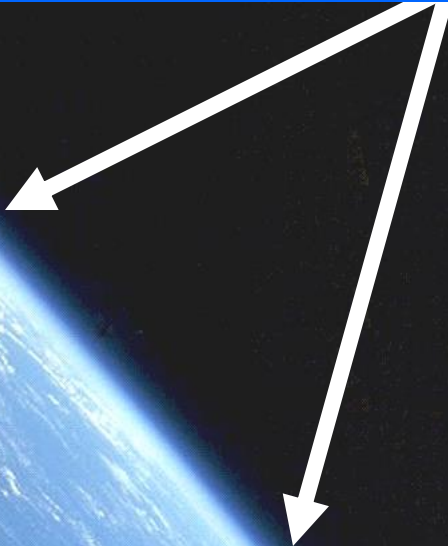
OXYGEN ATMOSPHERE



EARTH



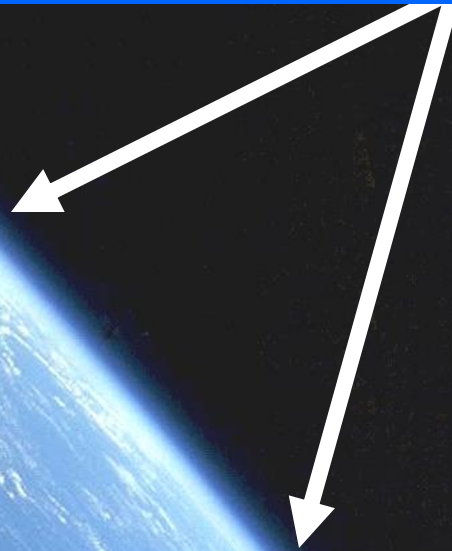
?



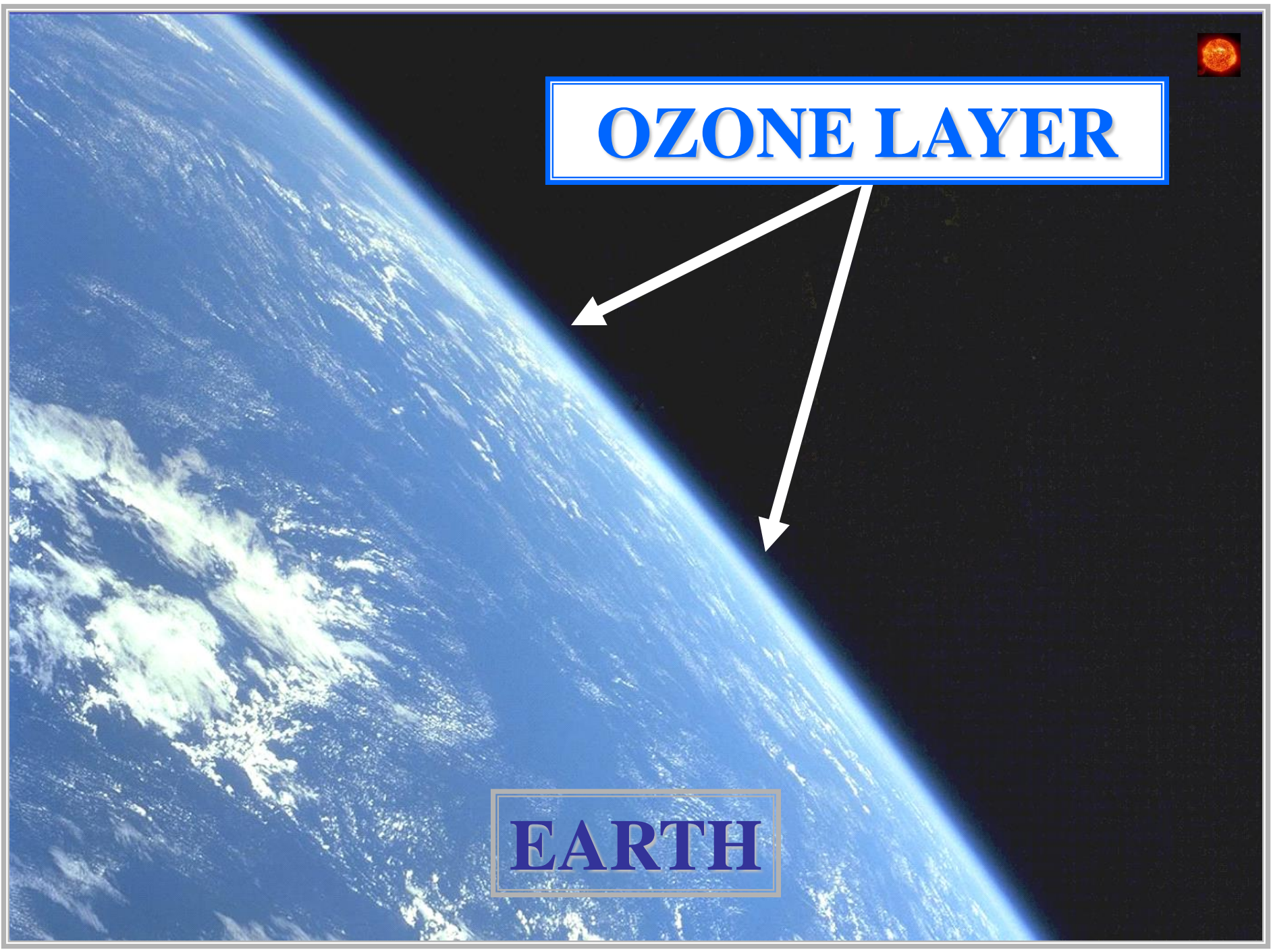
EARTH

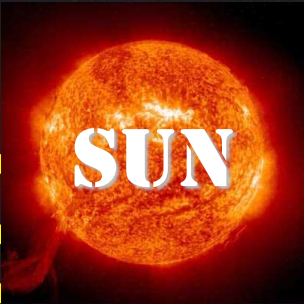


OZONE LAYER



EARTH

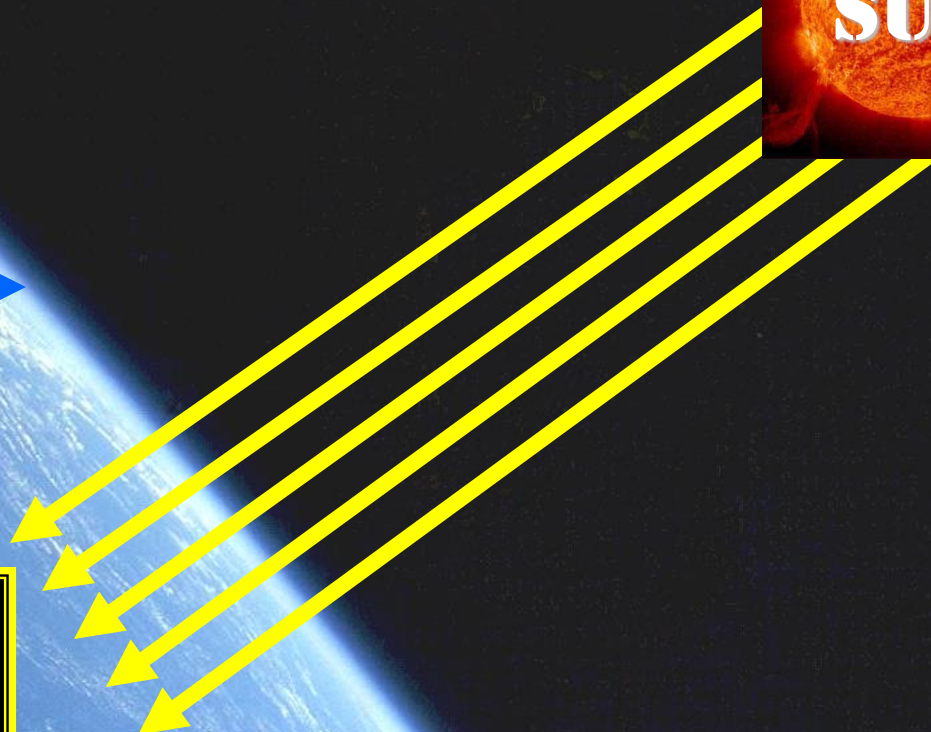




OZONE LAYER

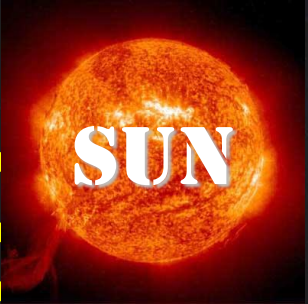


**ELECTROMAGNETIC
ENERGY
RADIATION**



EARTH





HARMFUL RADIATION

OZONE LAYER

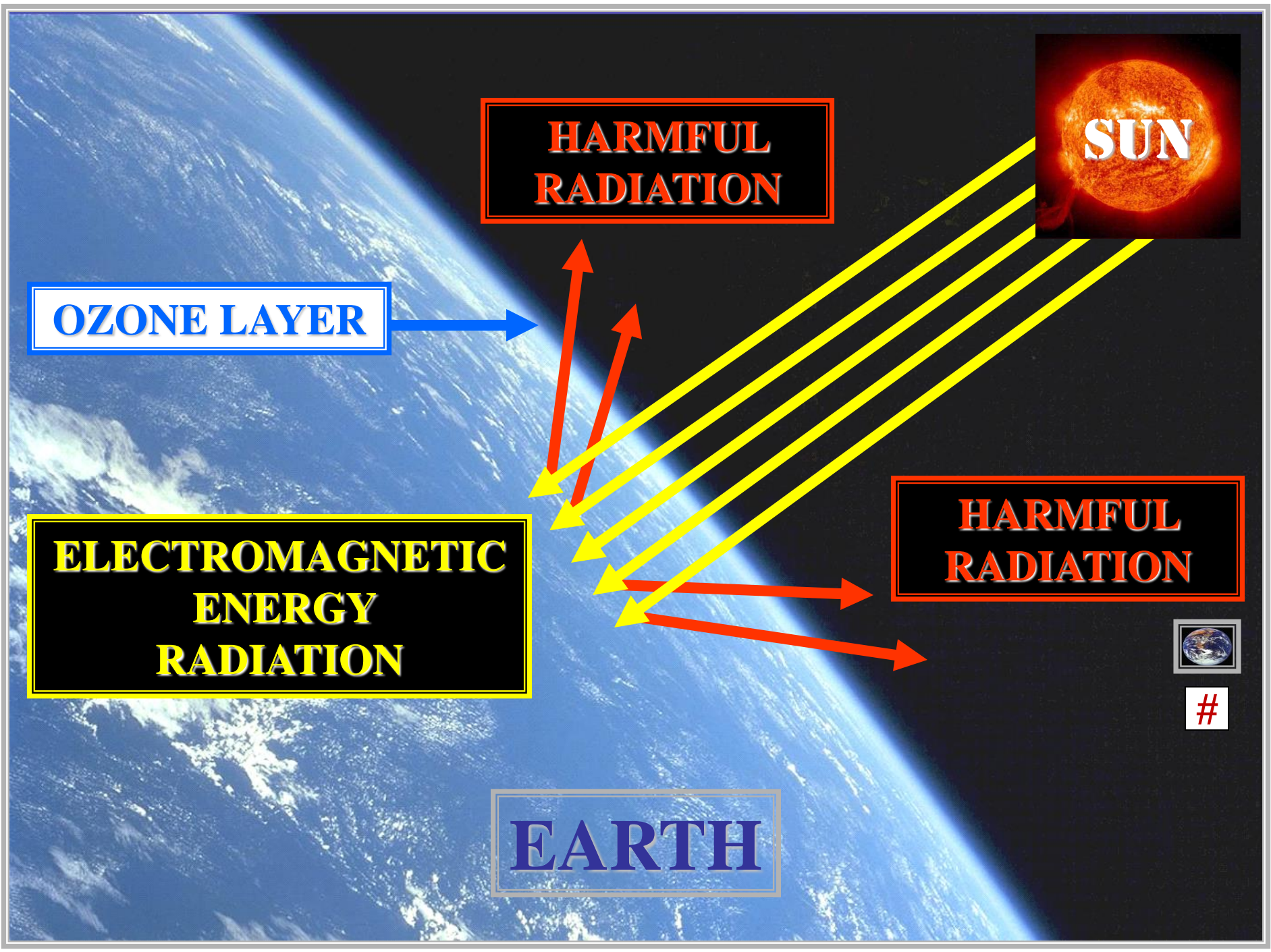
ELECTROMAGNETIC ENERGY RADIATION

HARMFUL RADIATION

EARTH



#

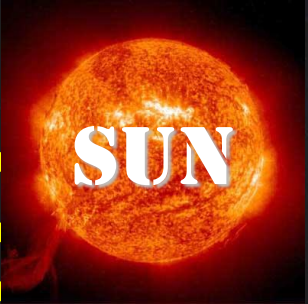




~10 MILLION SPECIES



EARTH



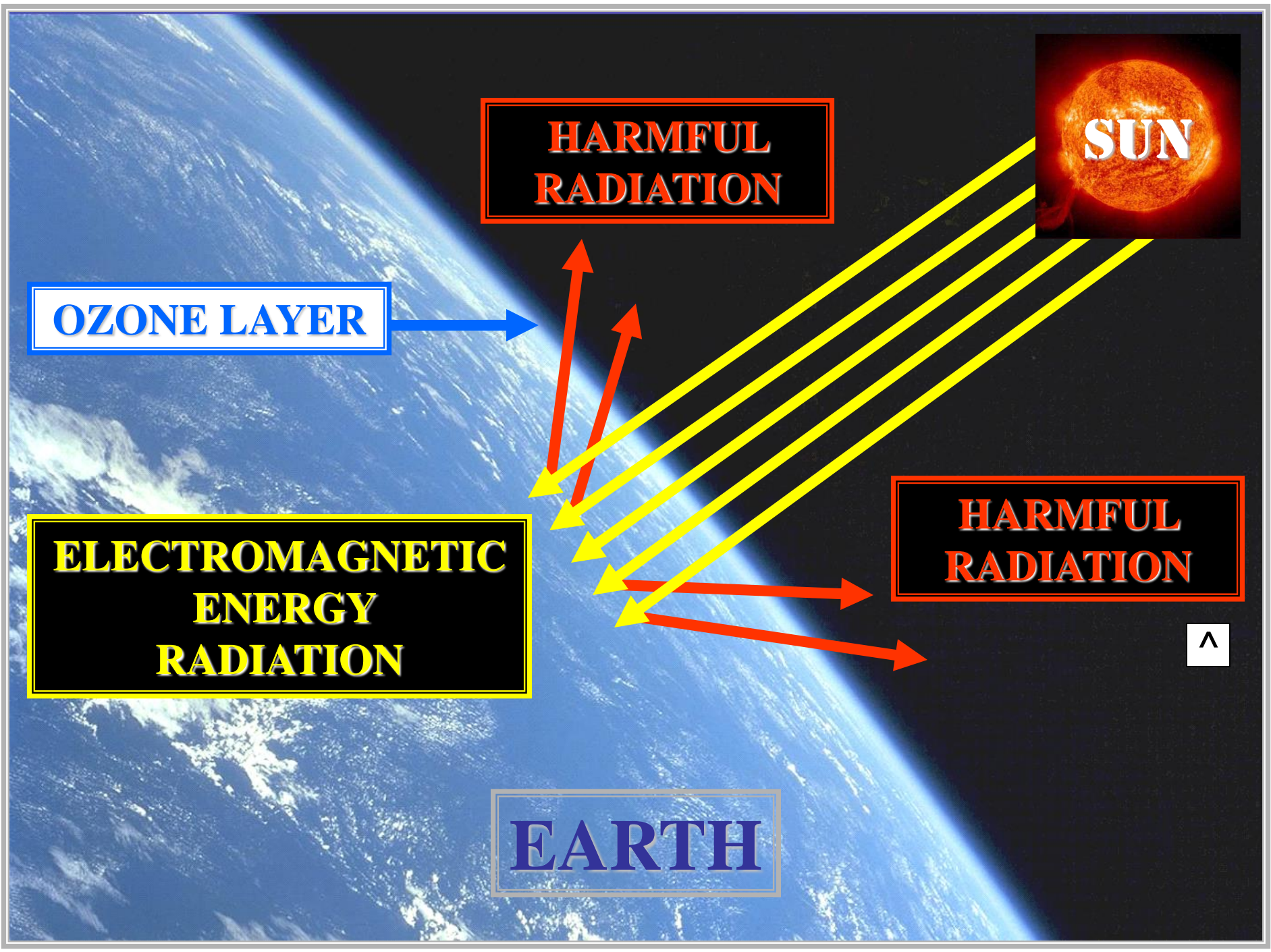
HARMFUL RADIATION

OZONE LAYER

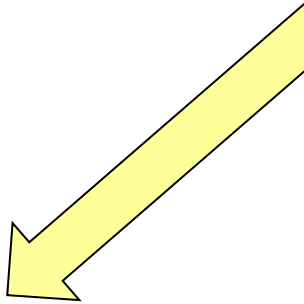
ELECTROMAGNETIC ENERGY RADIATION

HARMFUL RADIATION

EARTH



LIGHT ENERGY



WATER

SPLIT

ENZYME
COMPLEX
Mn
Manganese
COFACTOR

H+

THYLAKOID SPACE

O

ATMOSPHERE

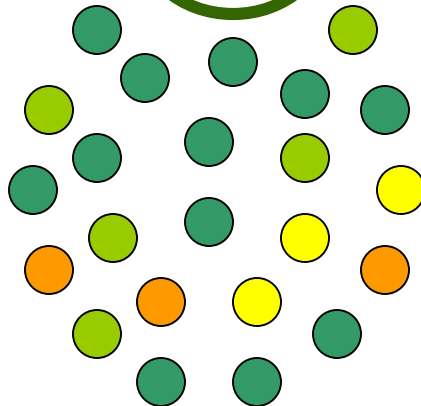
E-

PHOTOLYSIS

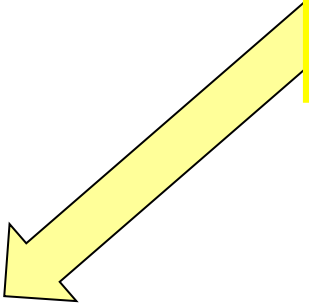
PS-II

CHL-A
P680

P680 OXIDIZED



LIGHT ENERGY



WATER

SPLIT

ENZYME
COMPLEX
Mn
Manganese
COFACTOR

H+



THYLAKOID SPACE

O



ATMOSPHERE

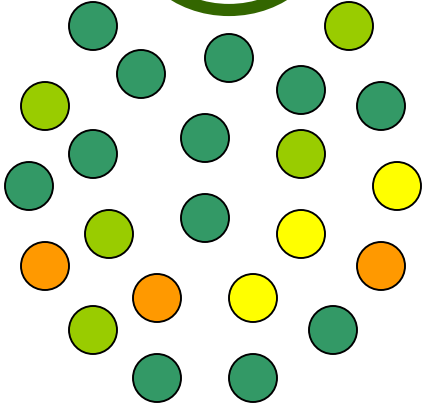
E-



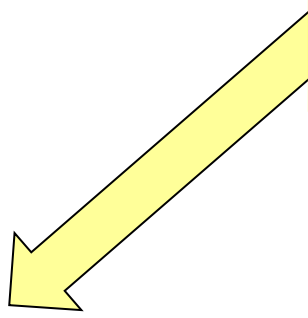
PHOTOLYSIS



P680 OXIDIZED



LIGHT ENERGY



WATER

SPLIT

ENZYME
COMPLEX
Mn
Manganese
COFACTOR

H+



THYLAKOID SPACE

O



ATMOSPHERE

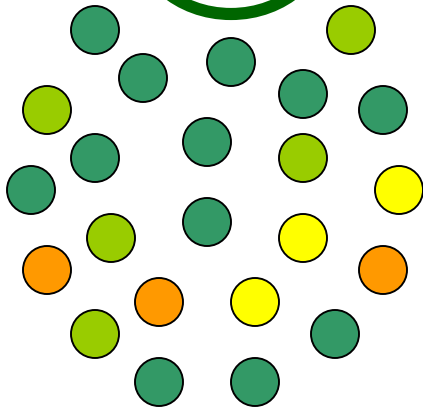
E-

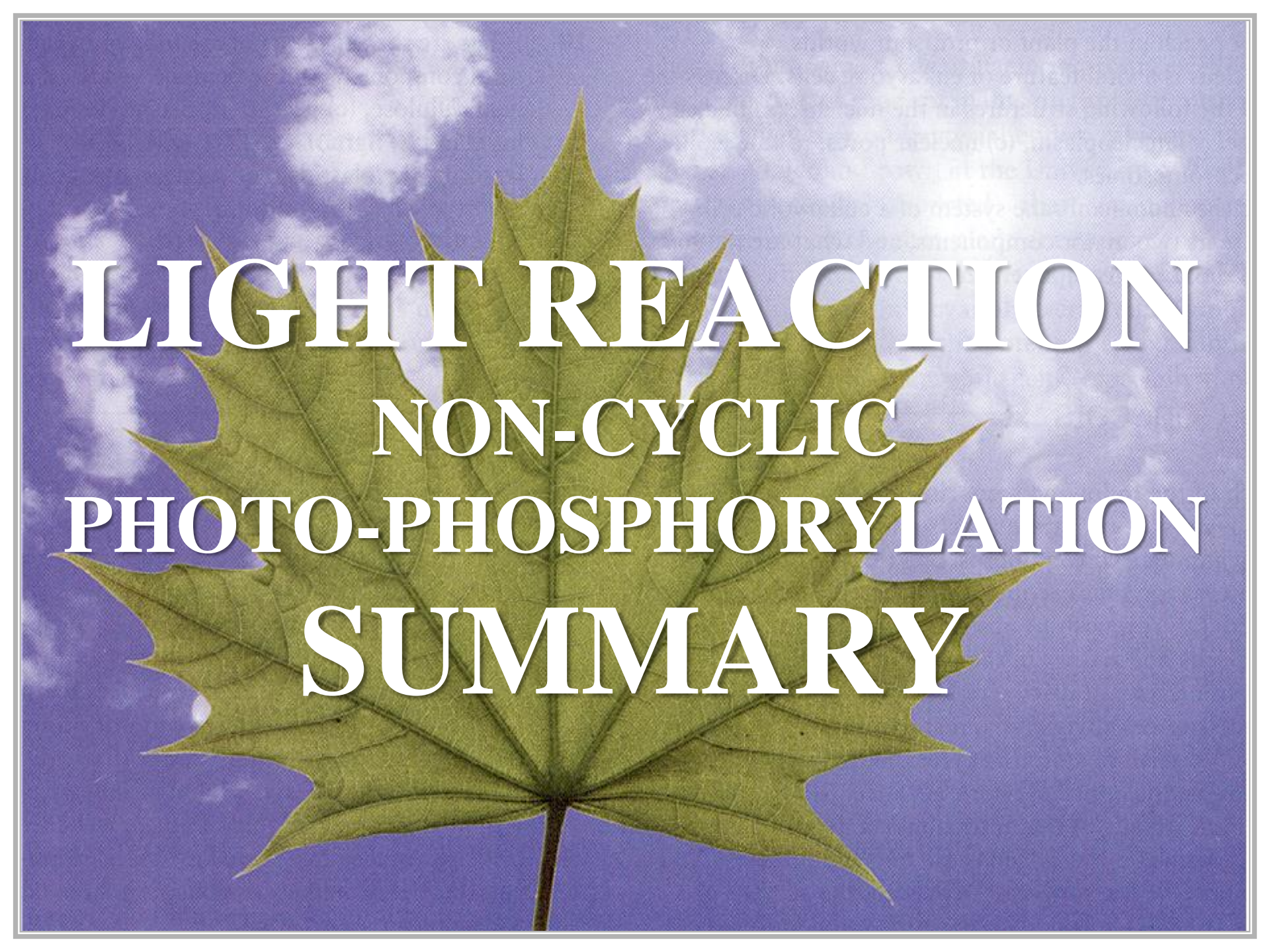


PHOTOLYSIS

CHL-A
P680

P680 REDUCED

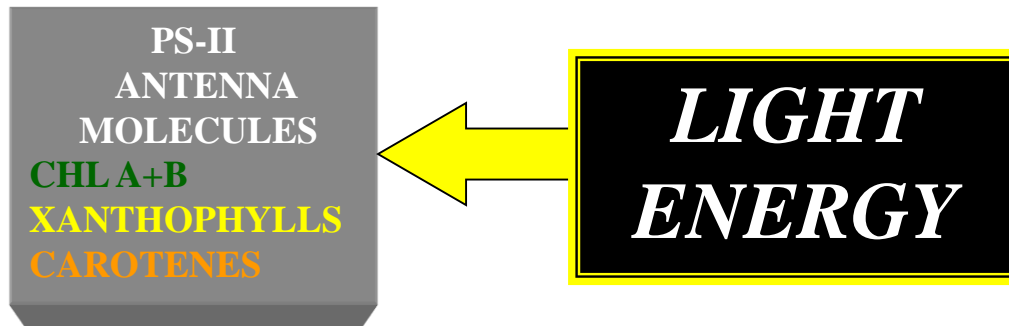


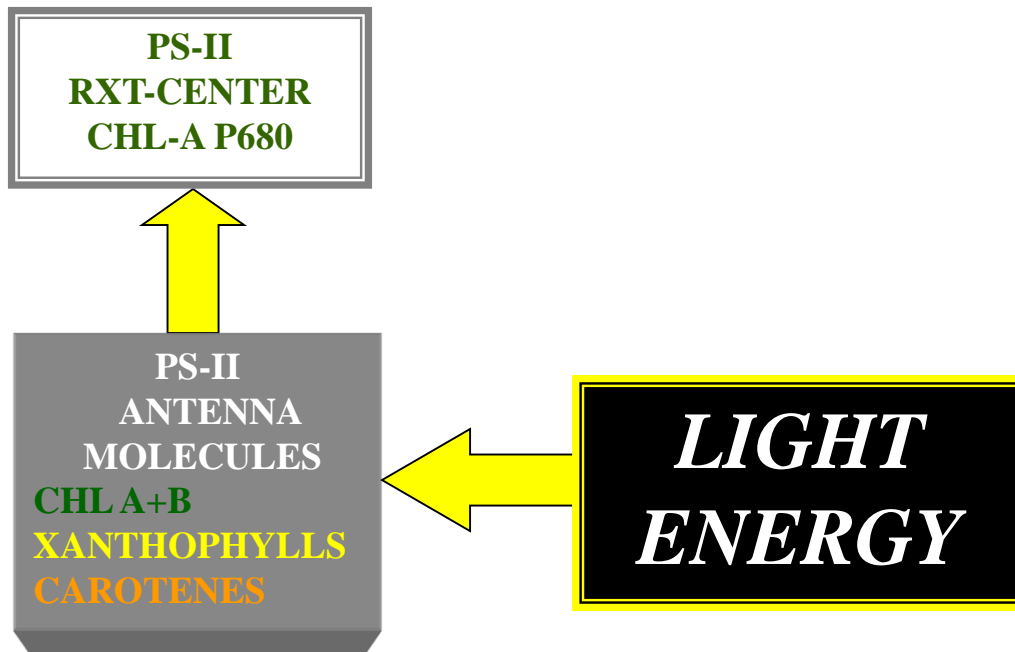
A green maple leaf is centered in the frame, set against a background of a blue sky with scattered white clouds. The leaf's veins are clearly visible, and its stem points downwards. The overall image has a slightly grainy texture.

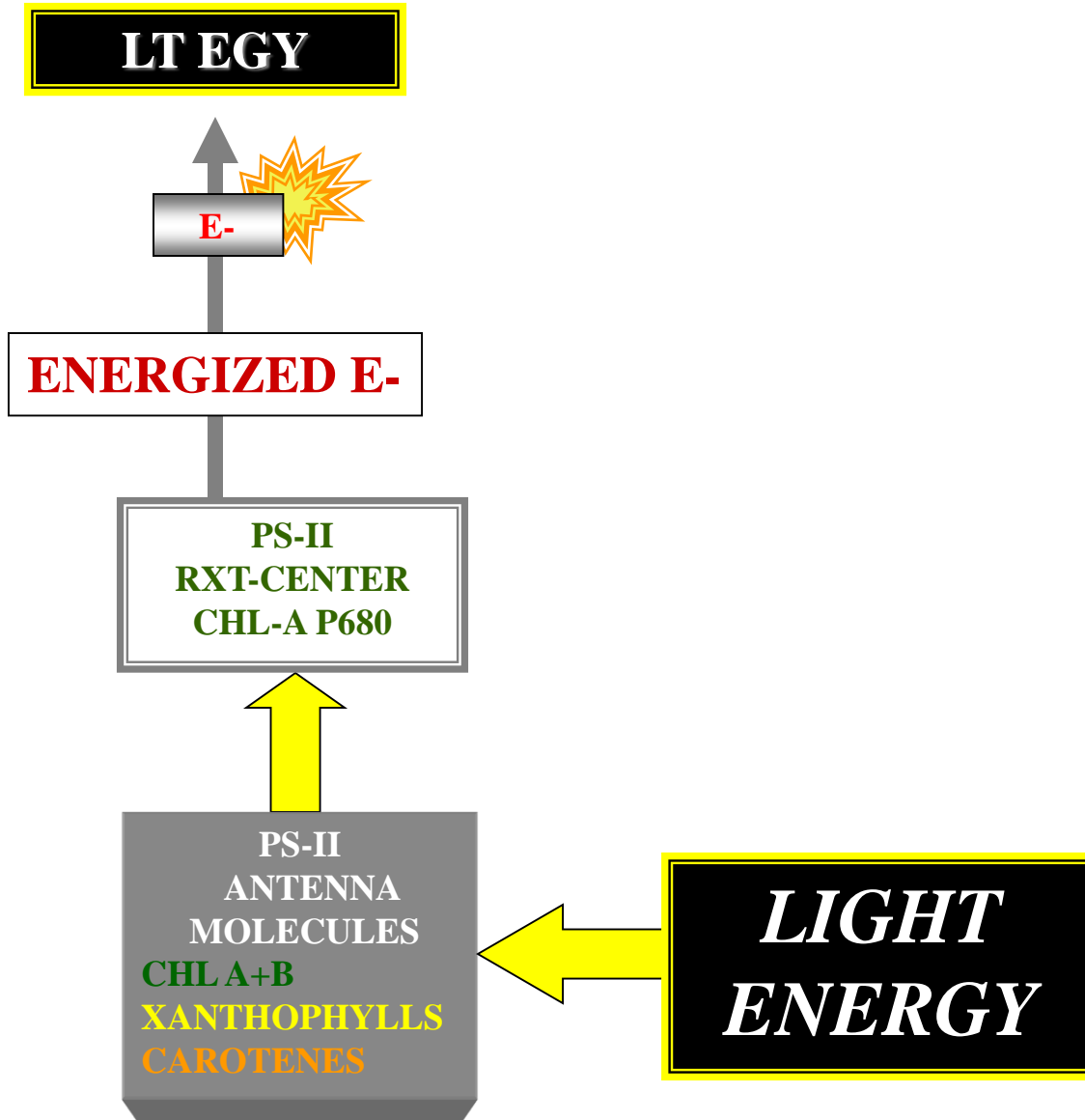
LIGHT REACTION
NON-CYCLIC
PHOTO-PHOSPHORYLATION
SUMMARY

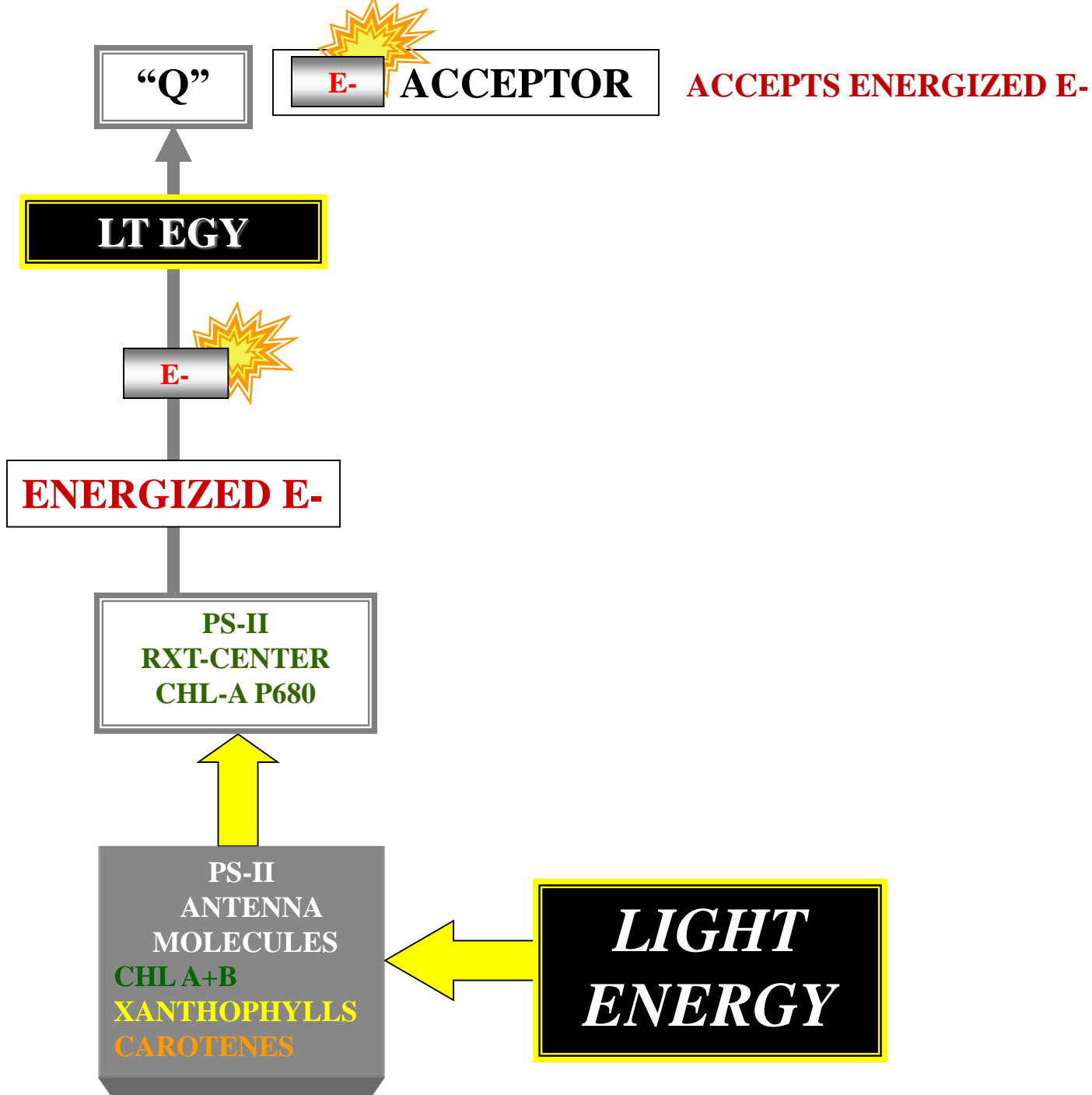


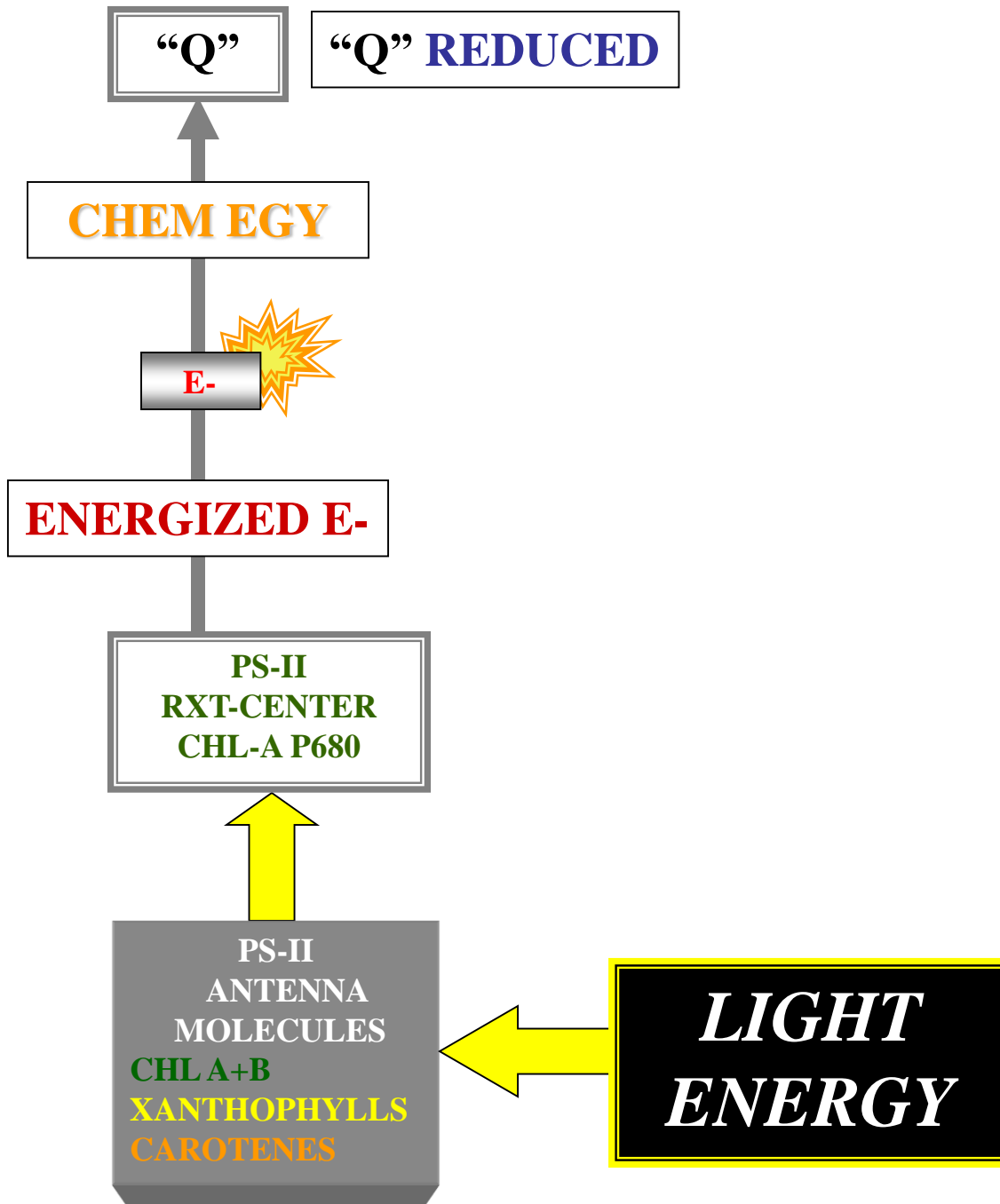
*LIGHT
ENERGY*

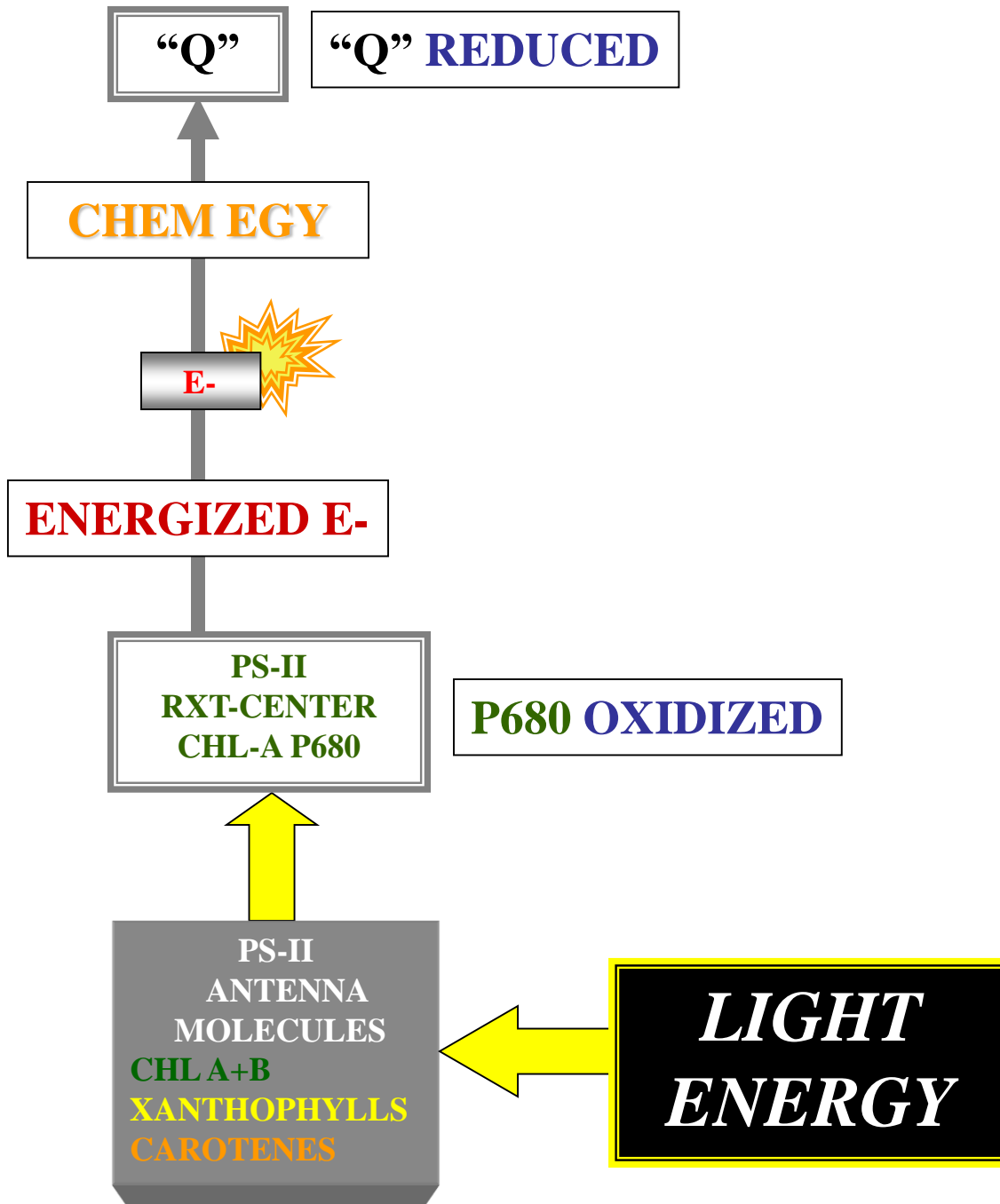


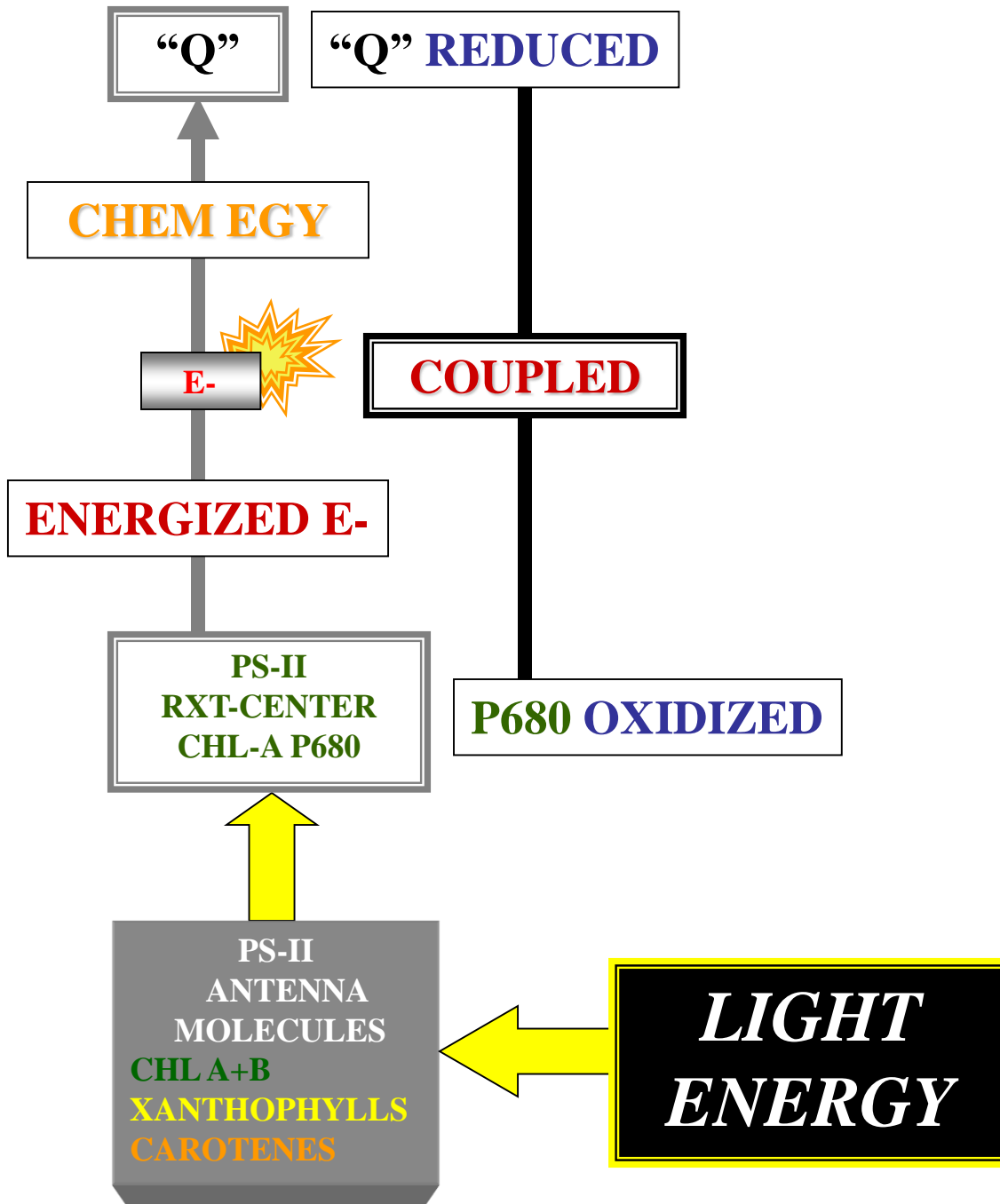


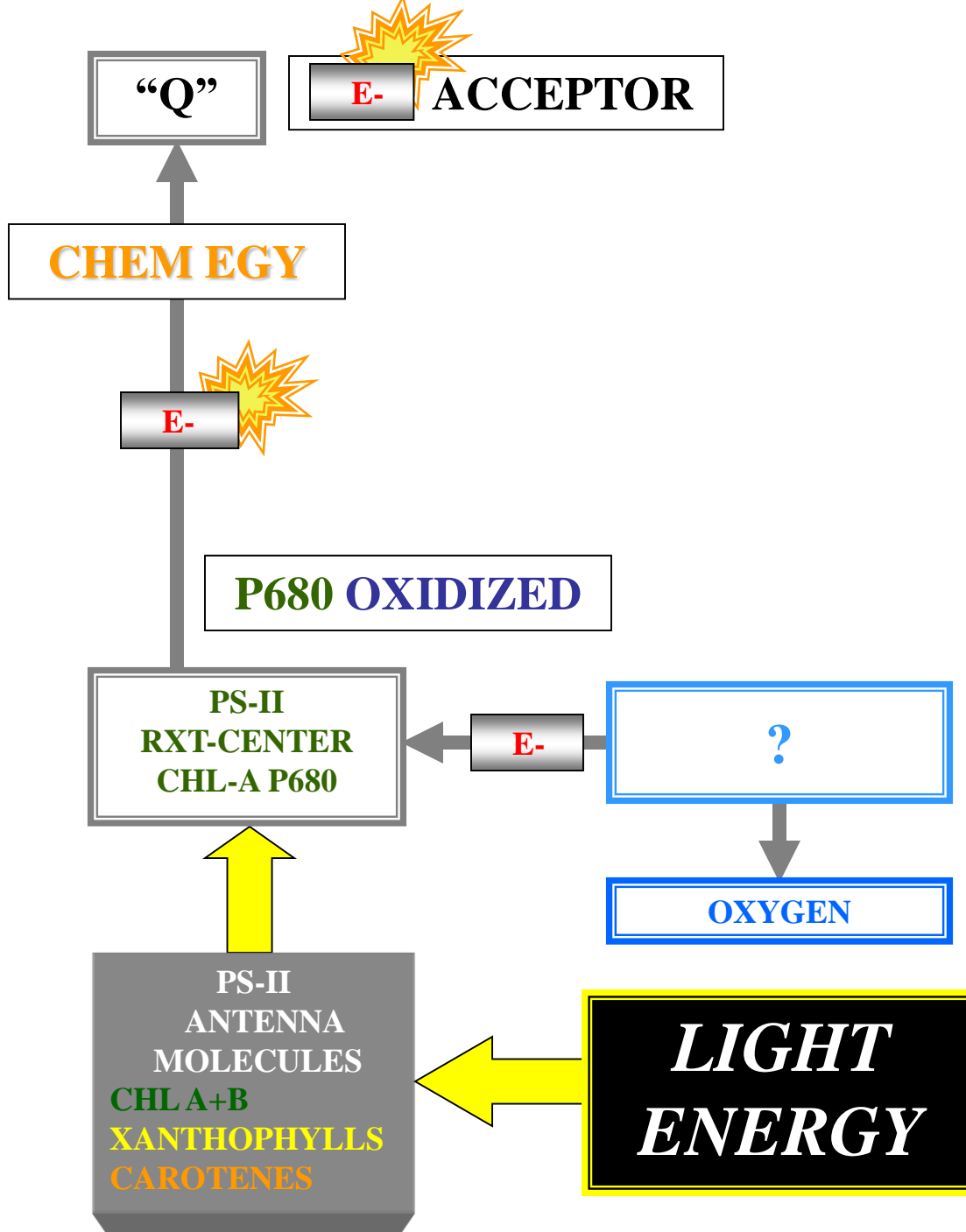


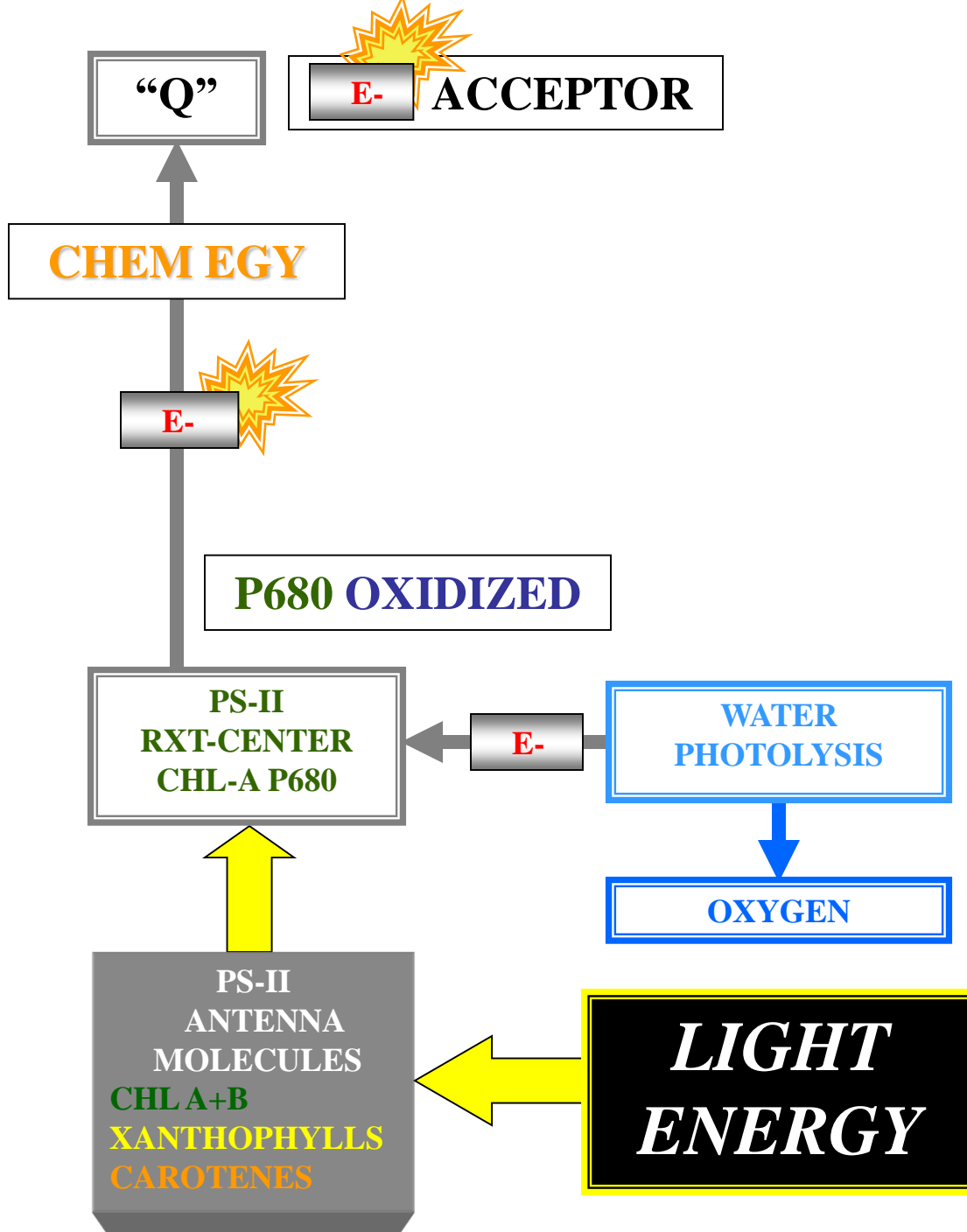


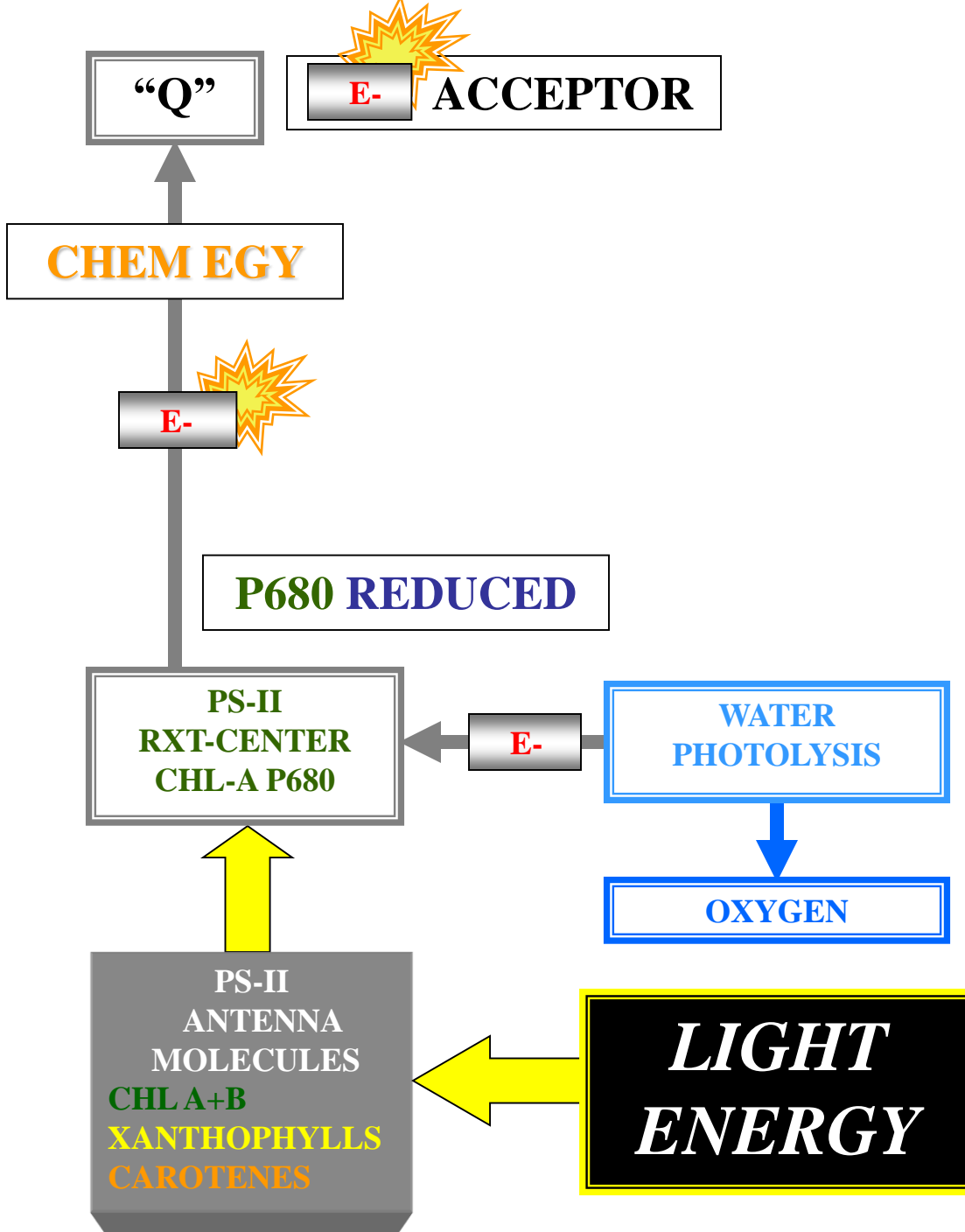


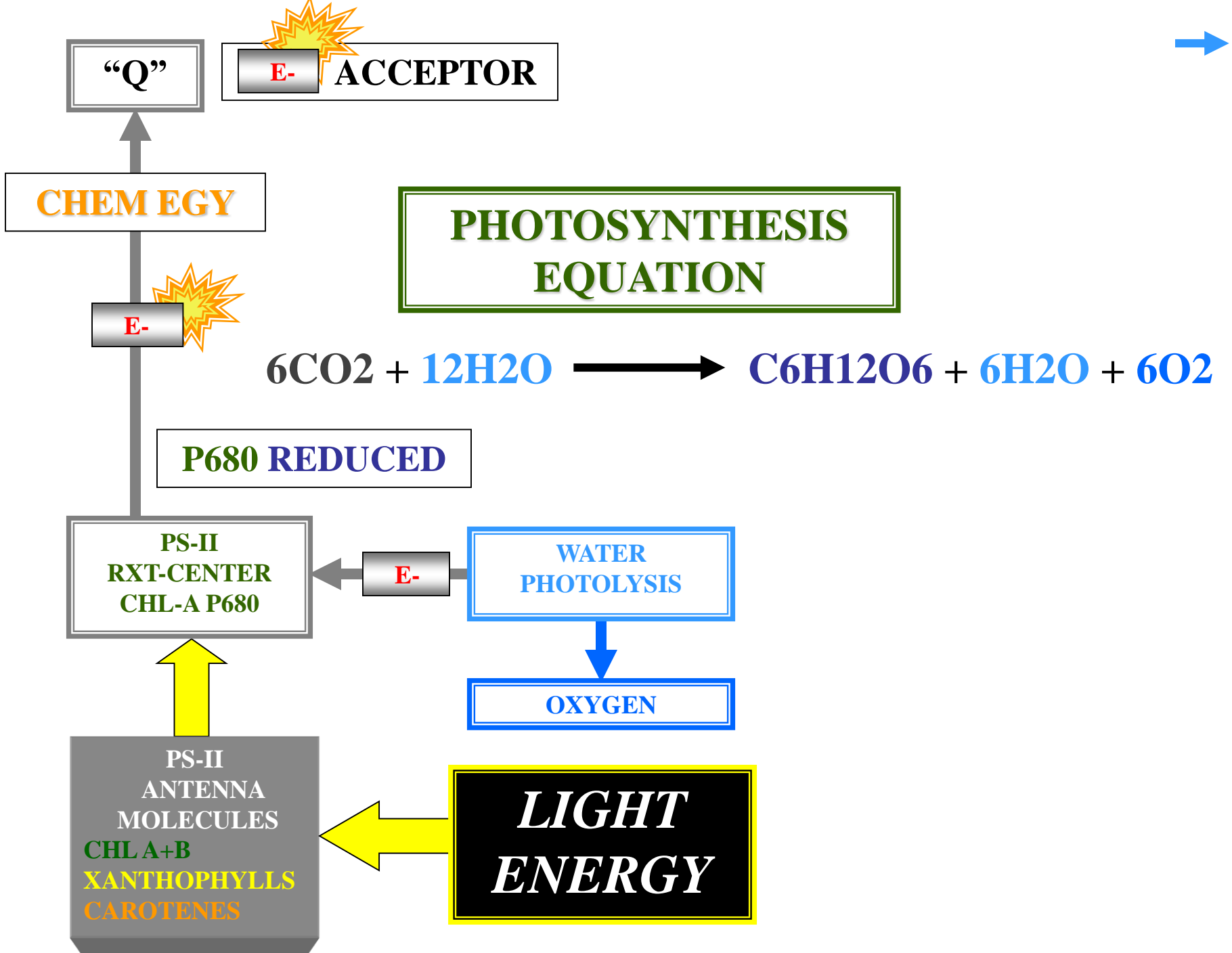


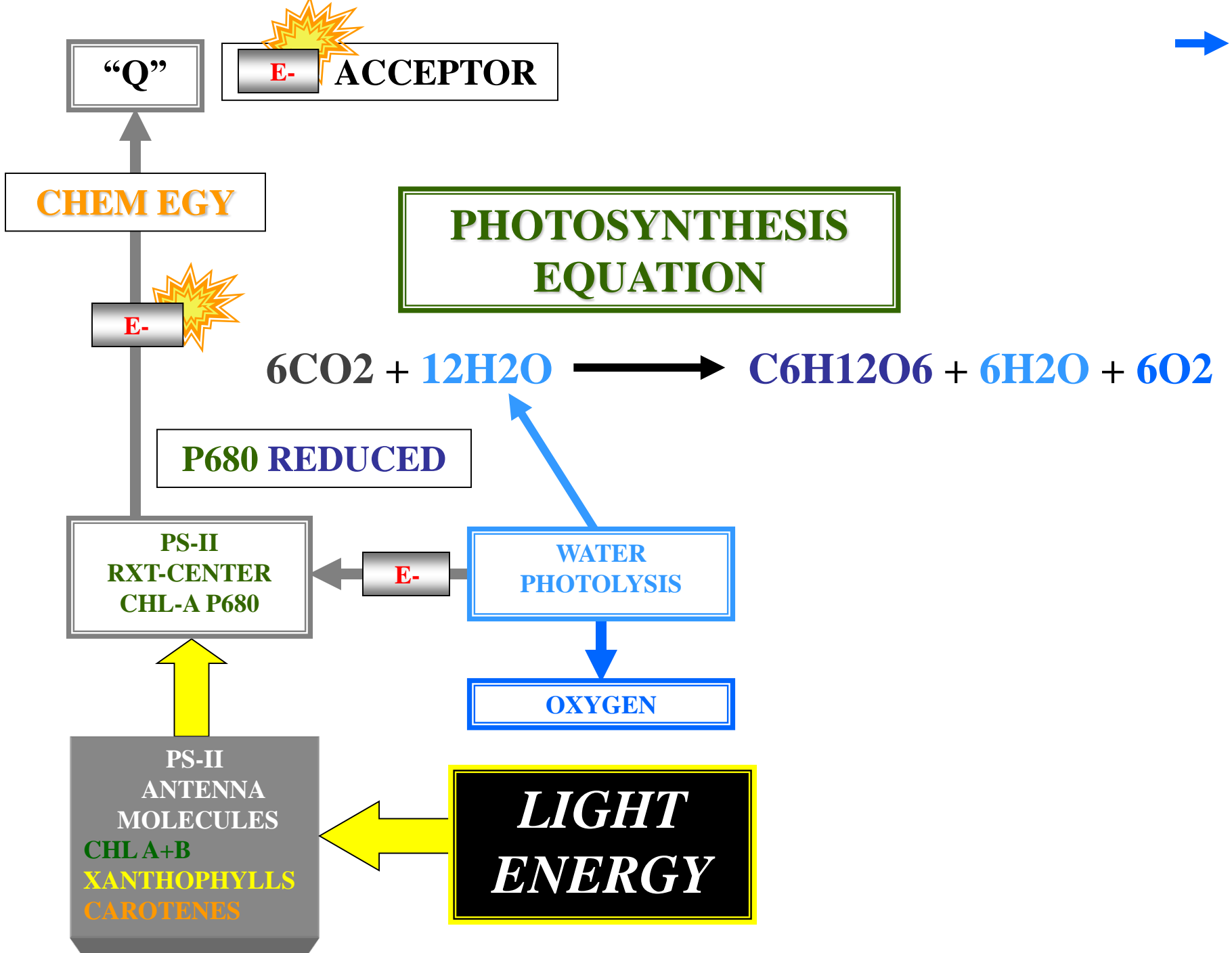


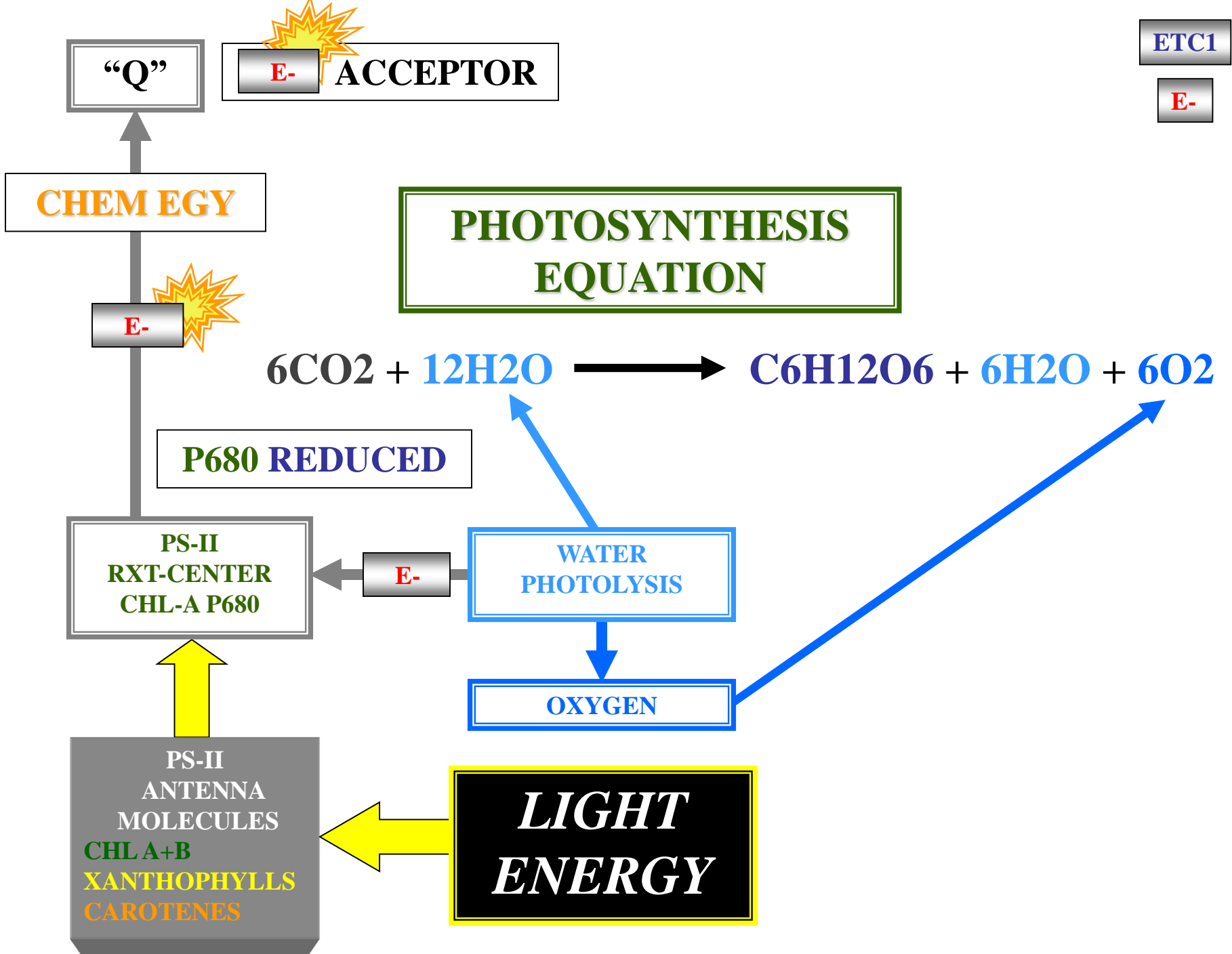


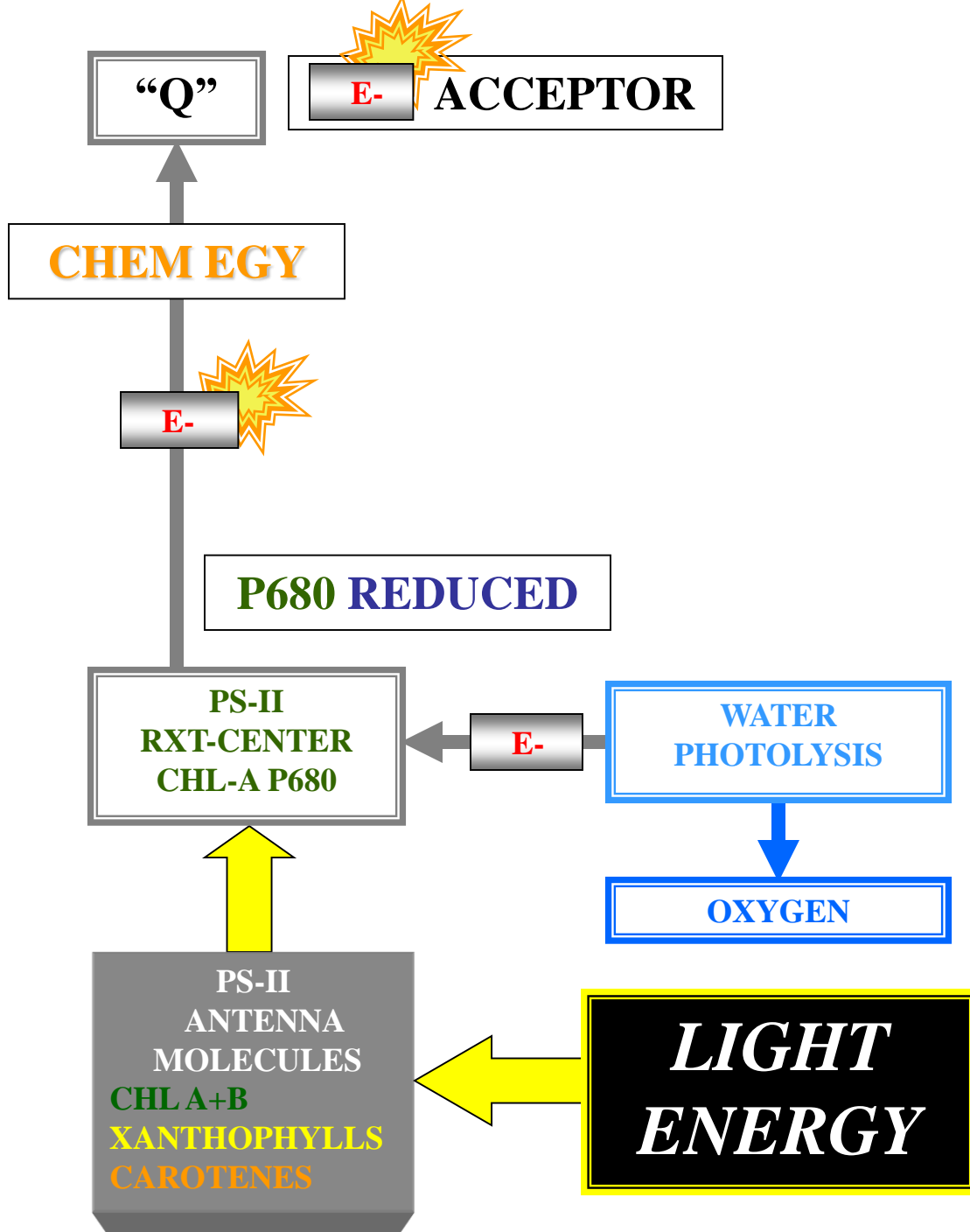






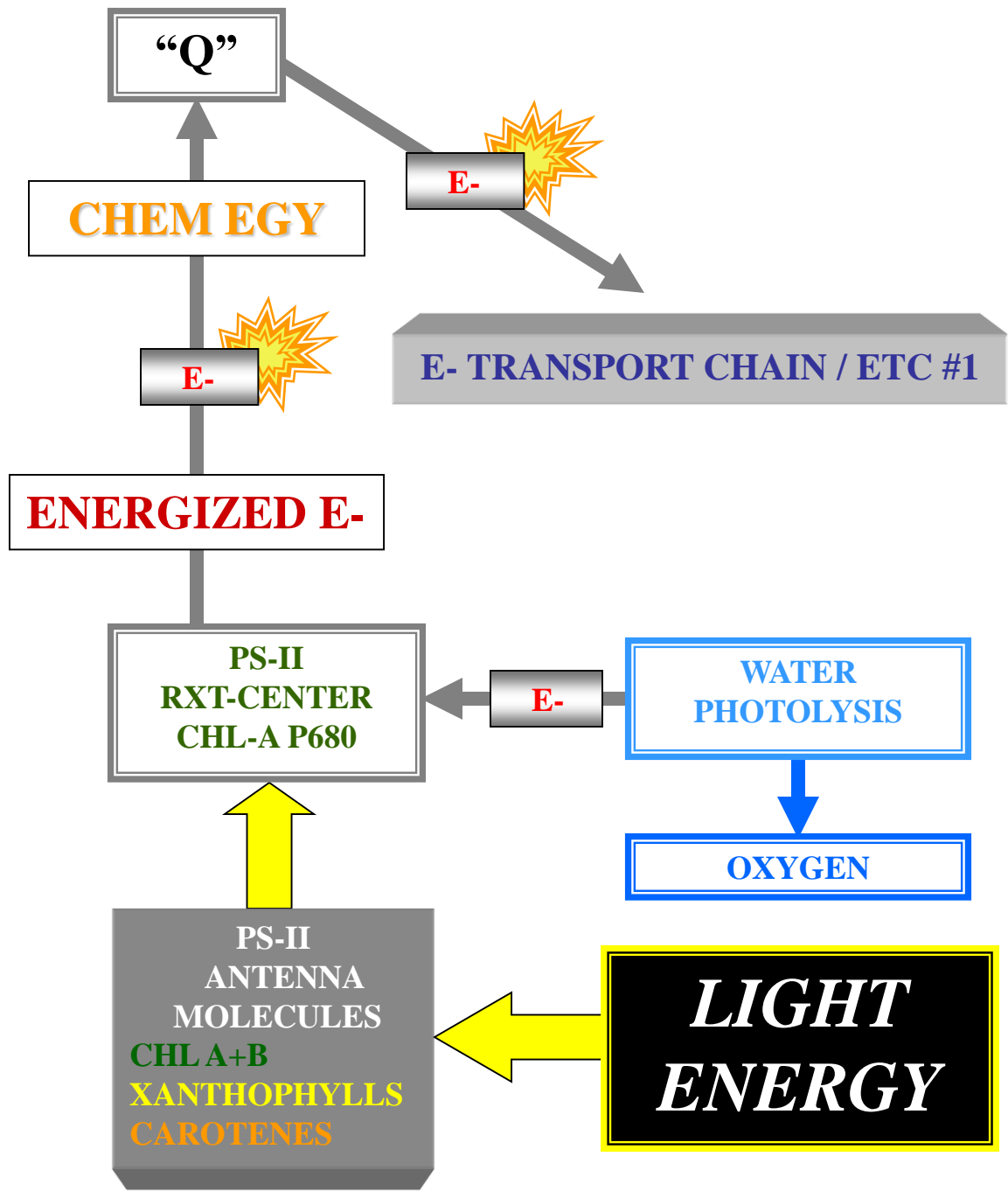






ETC1

E-



ELECTRON TRANSPORT CHAIN

#1

ELECTRON TRANSPORT CHAIN

#1

E- TRANSPORT CHAIN #1

SERIES

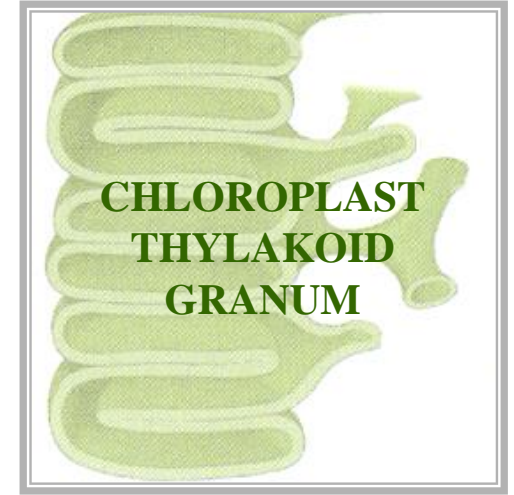
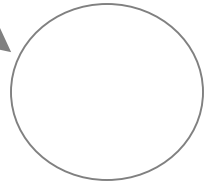
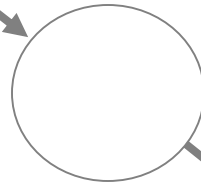
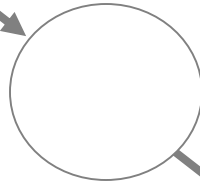
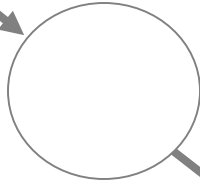
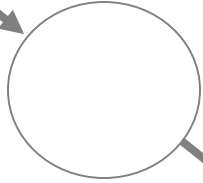
REDOX REACTIONS

E- TRANSPORT CHAIN #1

ELECTRON TRANSPORT CHAIN #1



THYLAKOID GRANUM



CHLOROPLAST
THYLAKOID
GRANUM



= CHEMICAL ENERGY

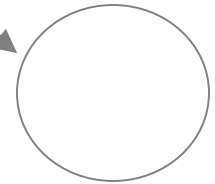
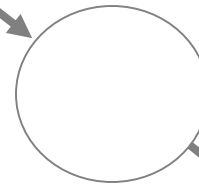
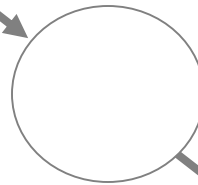
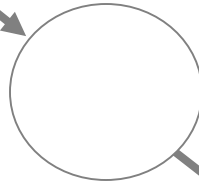
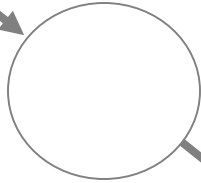


= DISSIPATED HEAT ENERGY

ELECTRON TRANSPORT CHAIN #1



THYLAKOID GRANUM



REDOX RXTS



= **CHEMICAL ENERGY**

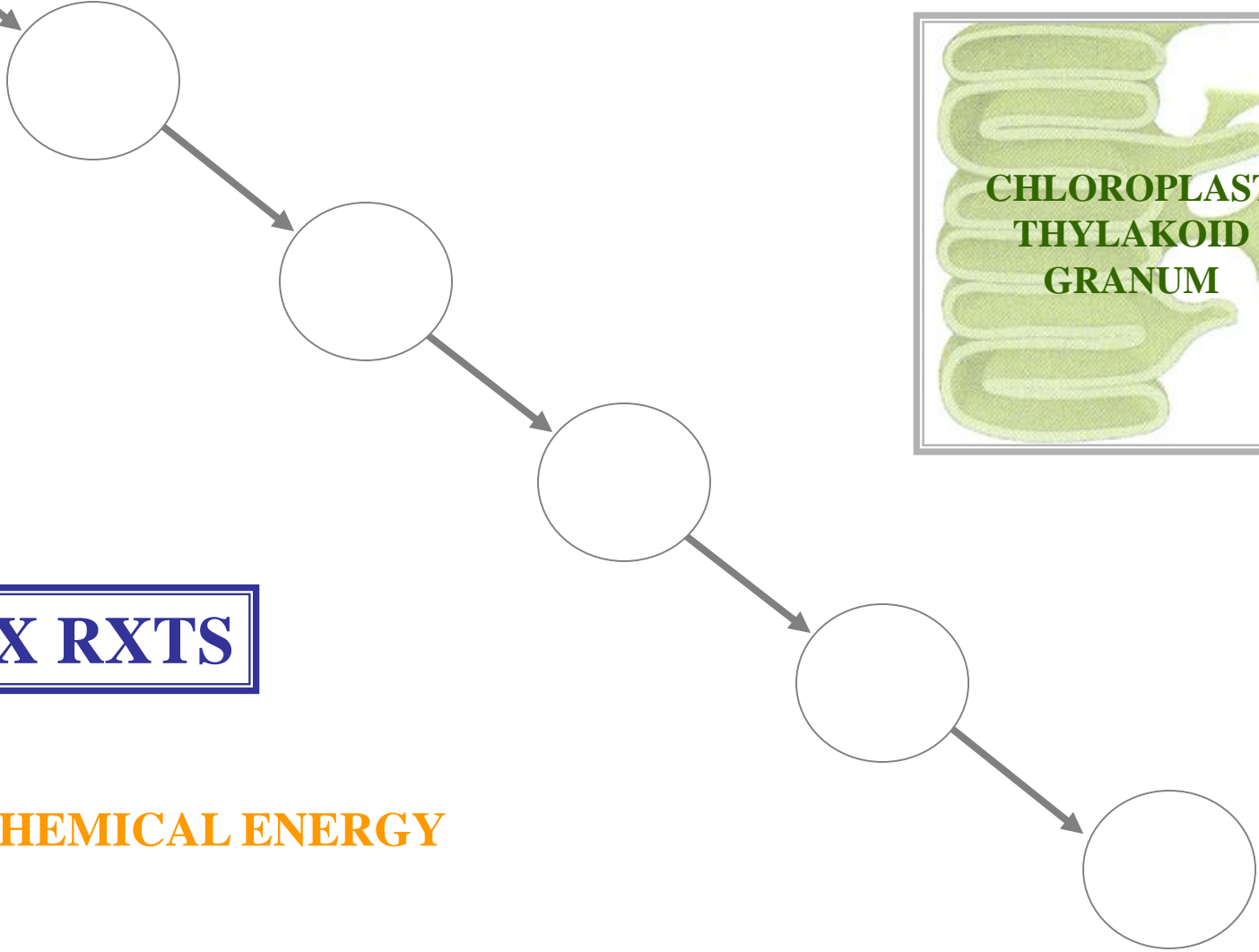


= **DISSIPATED HEAT ENERGY**

ELECTRON TRANSPORT CHAIN #1

E-

THYLAKOID GRANUM



REDOX RXTS

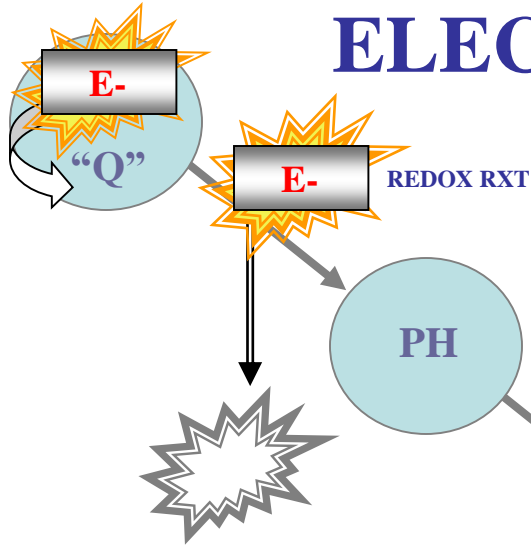
 = CHEMICAL ENERGY

 = DISSIPATED HEAT ENERGY

ELECTRON TRANSPORT CHAIN #1



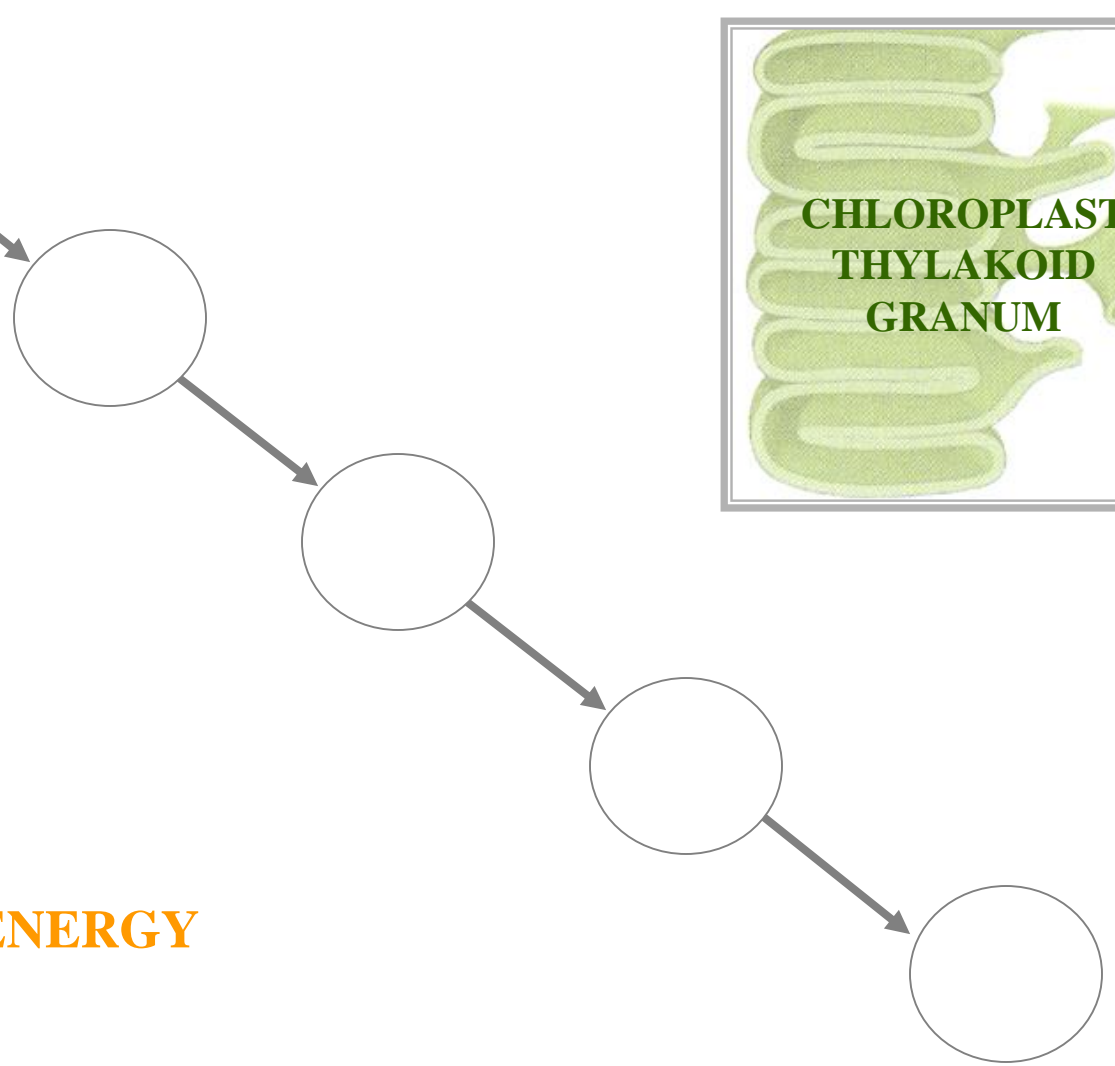
THYLAKOID GRANUM



REDOX RXTS

 = **CHEMICAL ENERGY**

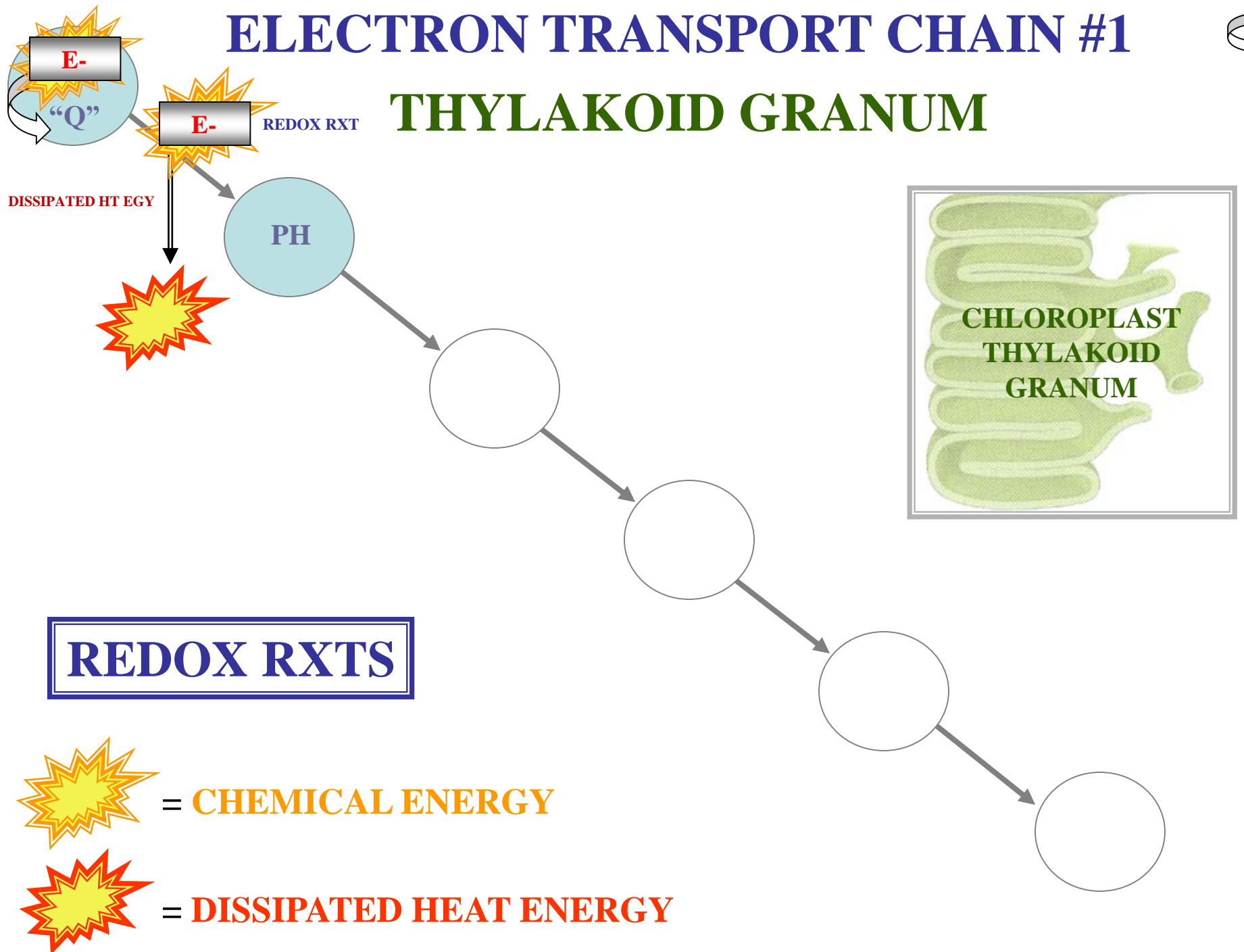
 = **DISSIPATED HEAT ENERGY**



ELECTRON TRANSPORT CHAIN #1



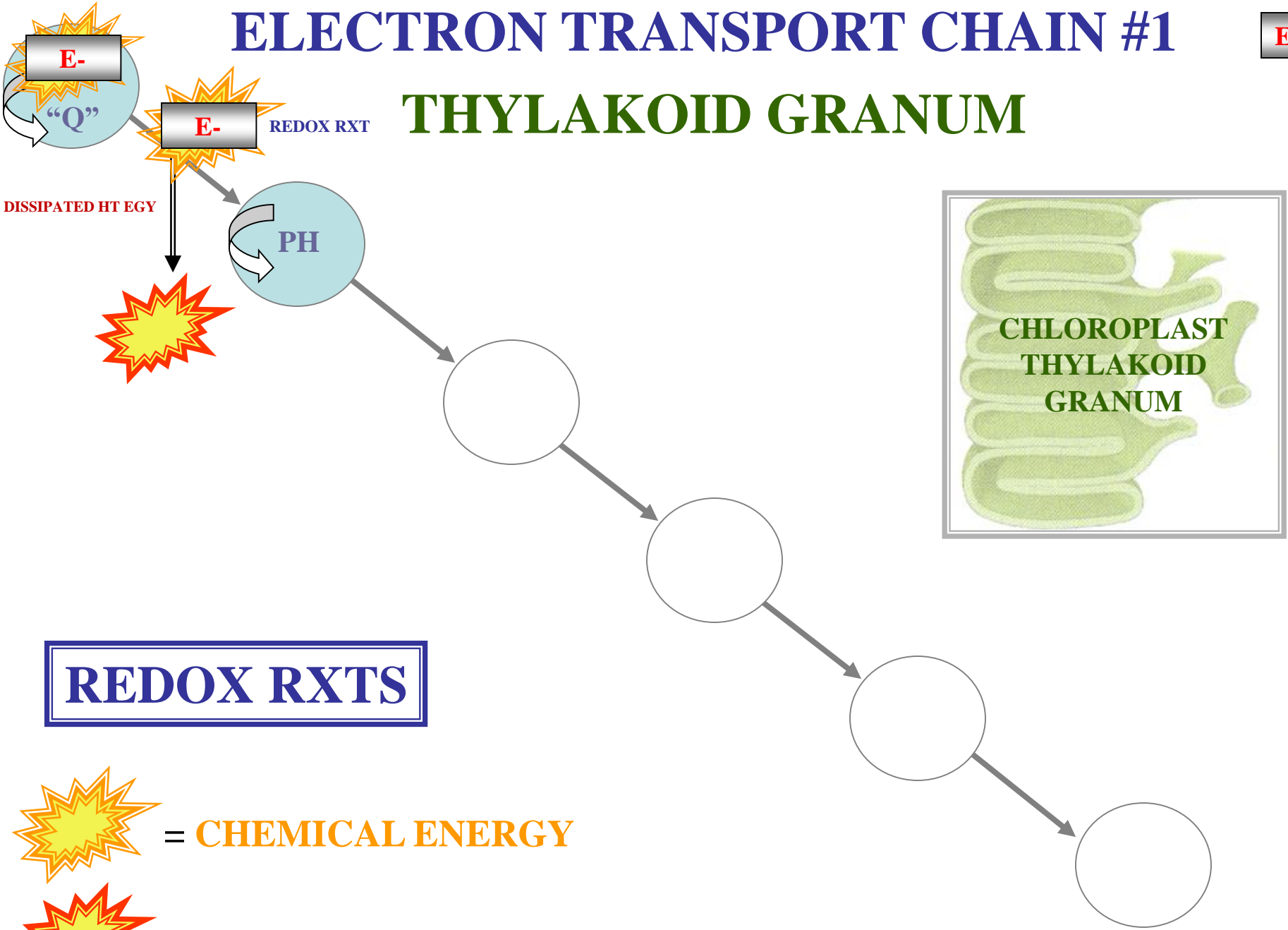
THYLAKOID GRANUM



ELECTRON TRANSPORT CHAIN #1

E-

THYLAKOID GRANUM



REDOX RXTS

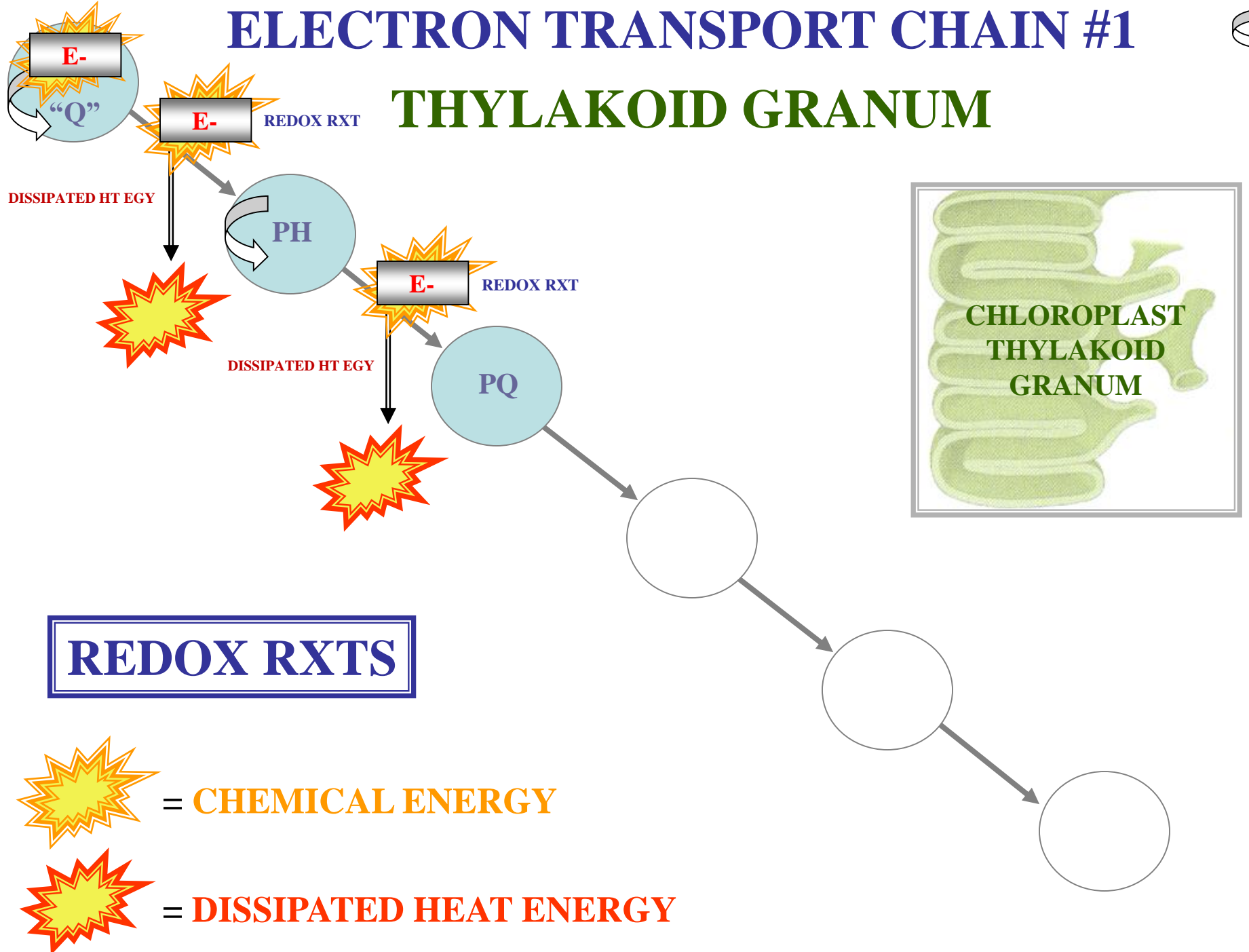
CHEMICAL ENERGY

DISSIPATED HEAT ENERGY

ELECTRON TRANSPORT CHAIN #1



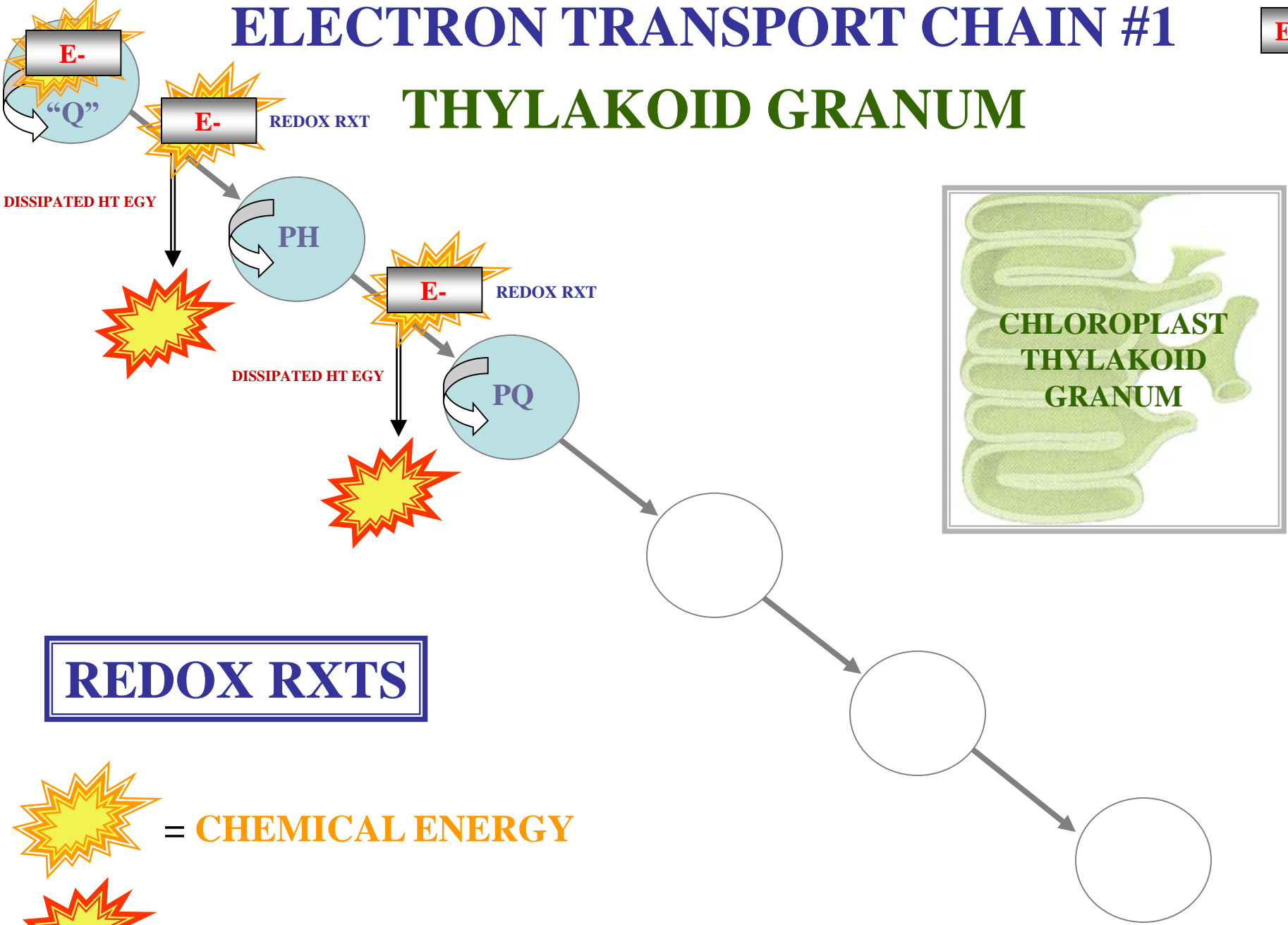
THYLAKOID GRANUM



ELECTRON TRANSPORT CHAIN #1

E-

THYLAKOID GRANUM



REDOX RXTS

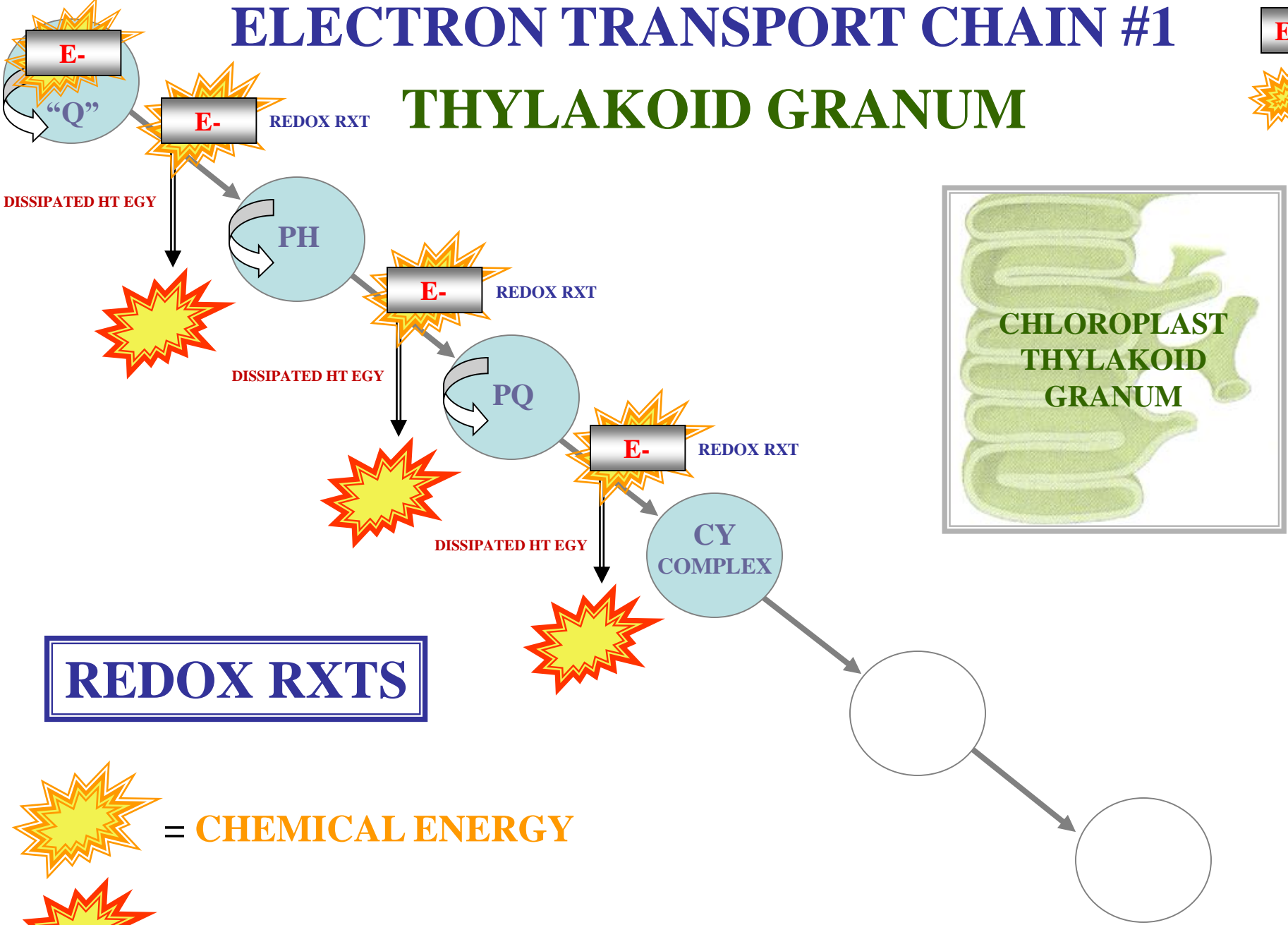
 = CHEMICAL ENERGY

 = DISSIPATED HEAT ENERGY

ELECTRON TRANSPORT CHAIN #1

E-

THYLAKOID GRANUM



REDOX RXTS

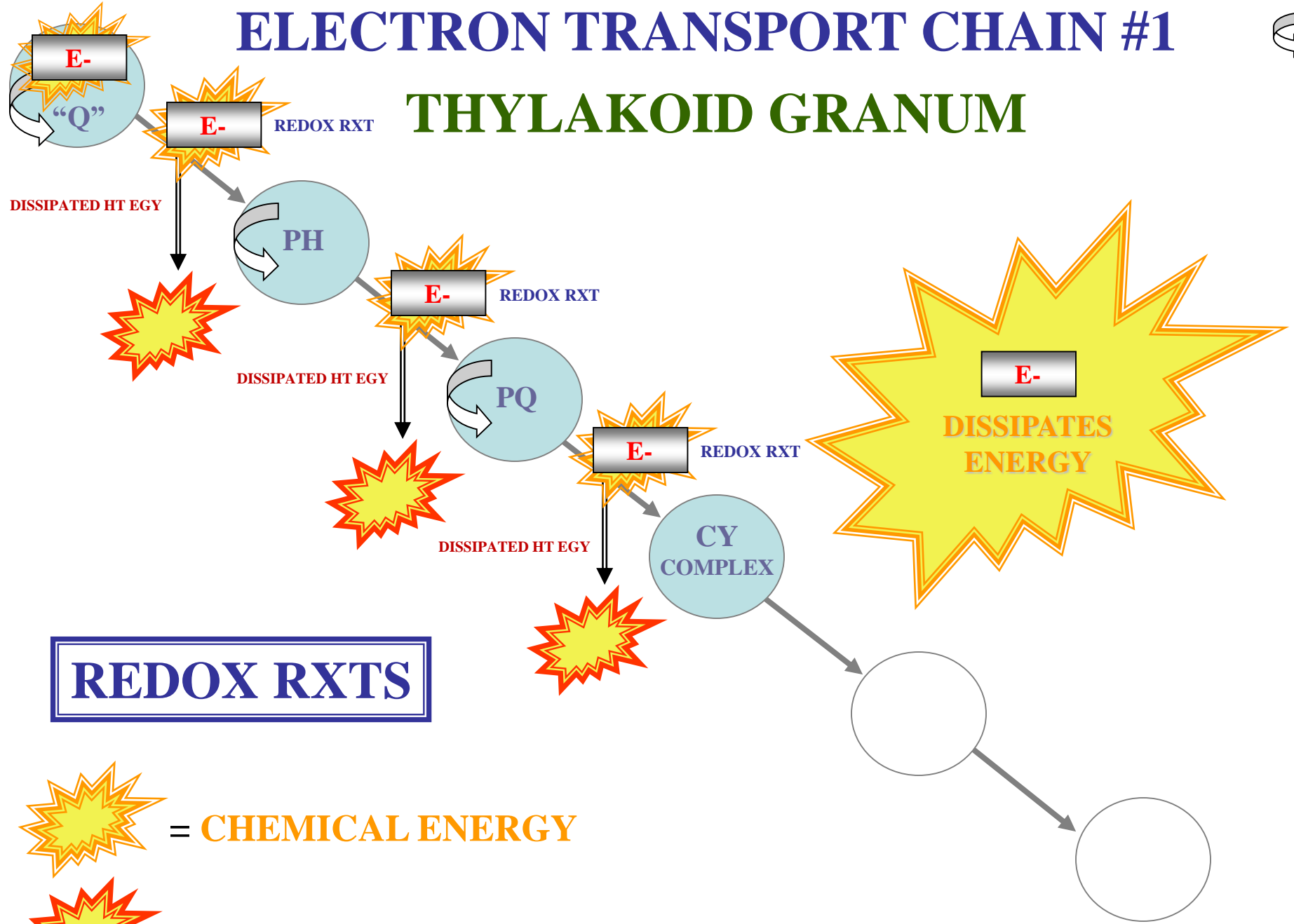
= **CHEMICAL ENERGY**

= **DISSIPATED HEAT ENERGY**

ELECTRON TRANSPORT CHAIN #1



THYLAKOID GRANUM



REDOX RXTS

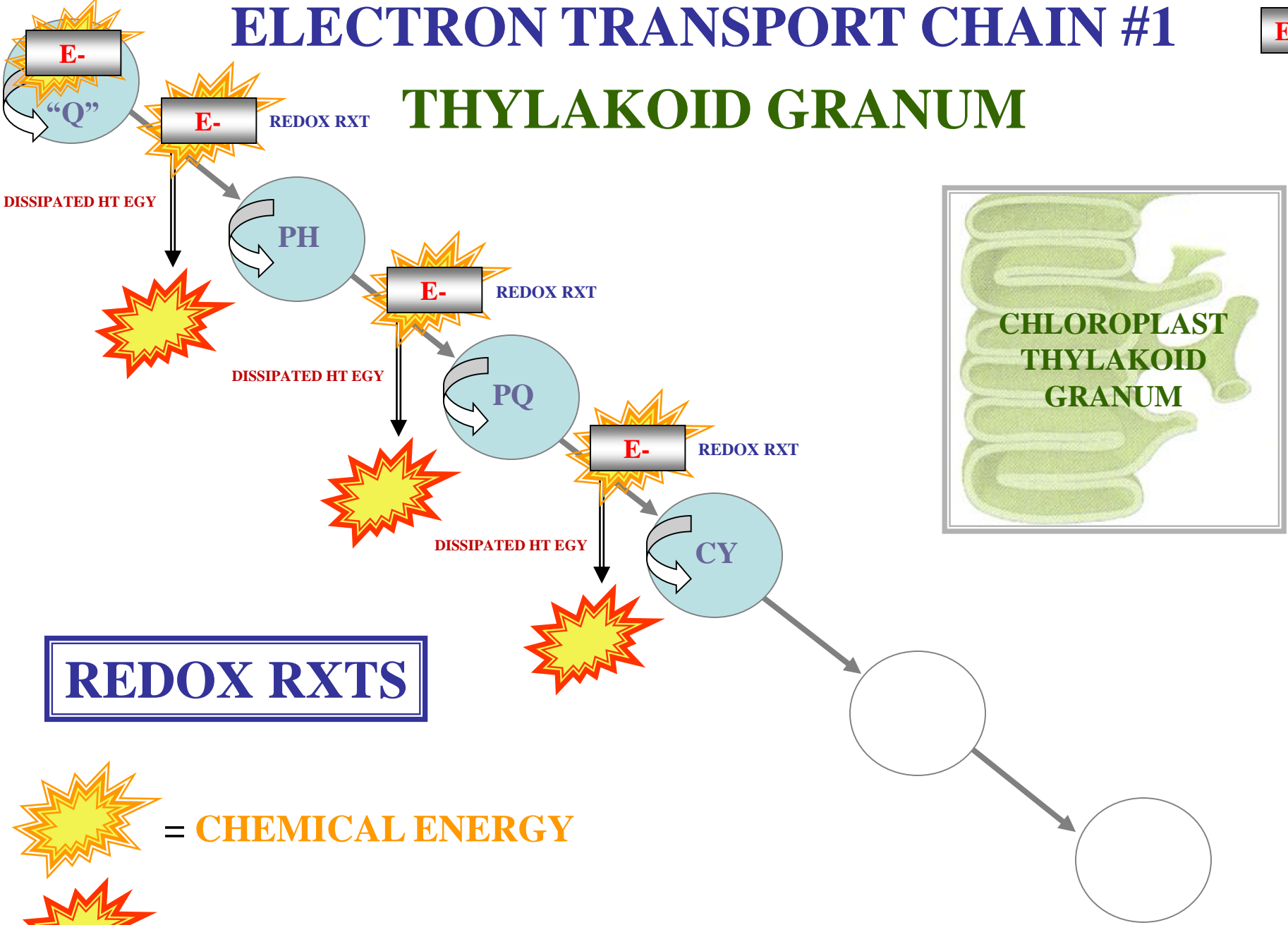
 = CHEMICAL ENERGY

 = DISSIPATED HEAT ENERGY

ELECTRON TRANSPORT CHAIN #1

E-

THYLAKOID GRANUM



REDOX RXTS

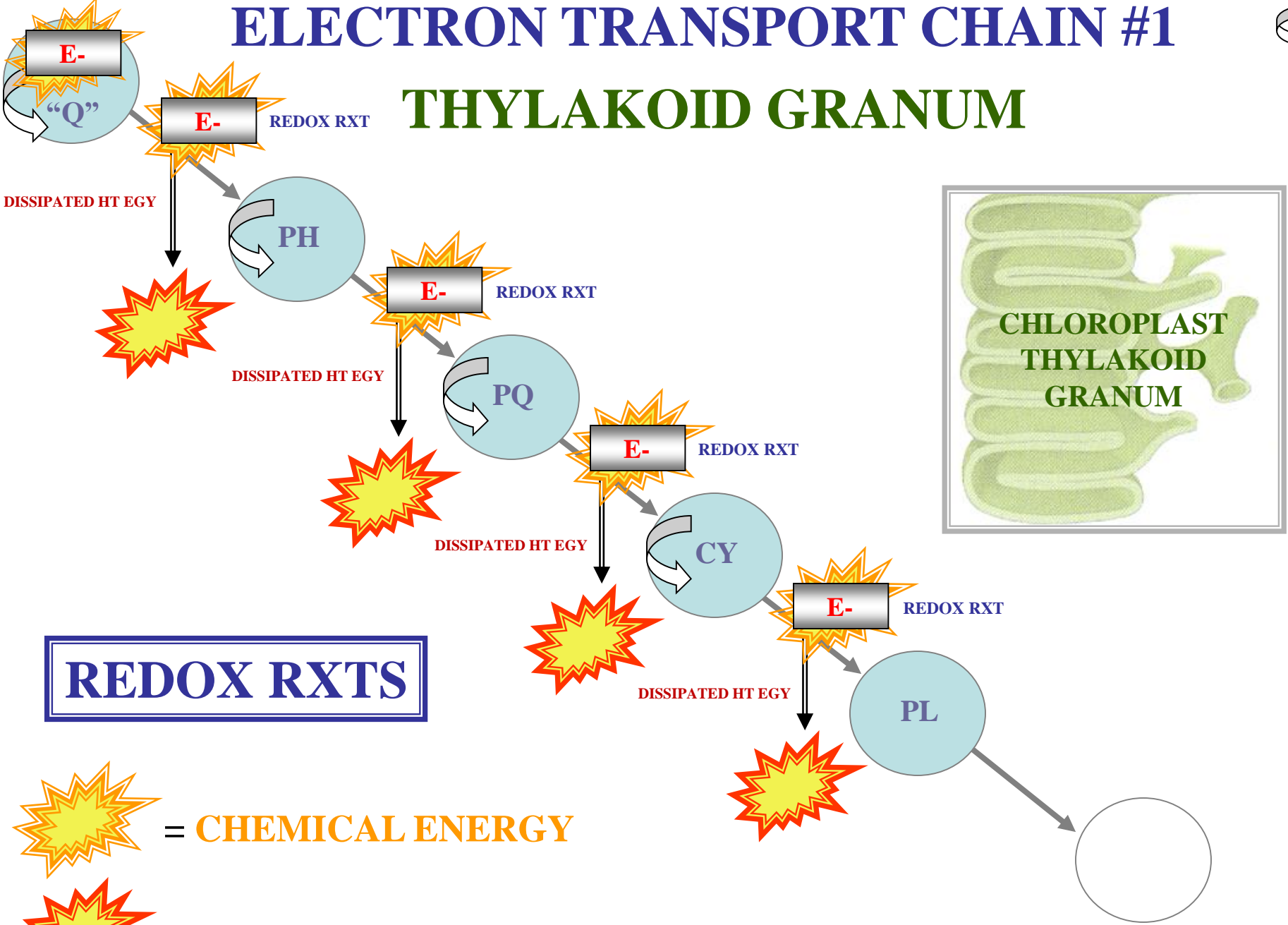
 = CHEMICAL ENERGY

 = DISSIPATED HEAT ENERGY

ELECTRON TRANSPORT CHAIN #1



THYLAKOID GRANUM



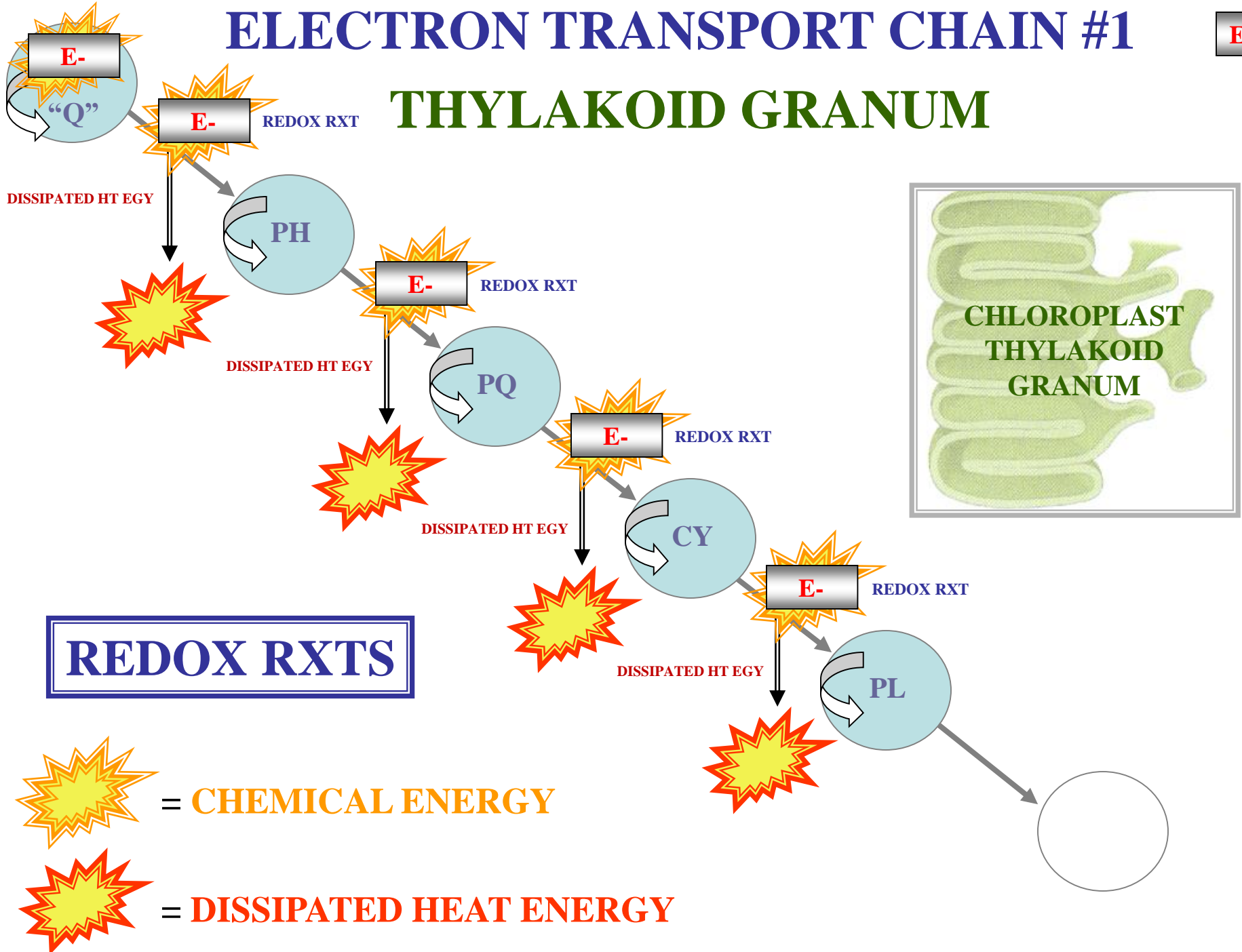
 = CHEMICAL ENERGY

 = DISSIPATED HEAT ENERGY

ELECTRON TRANSPORT CHAIN #1

E-

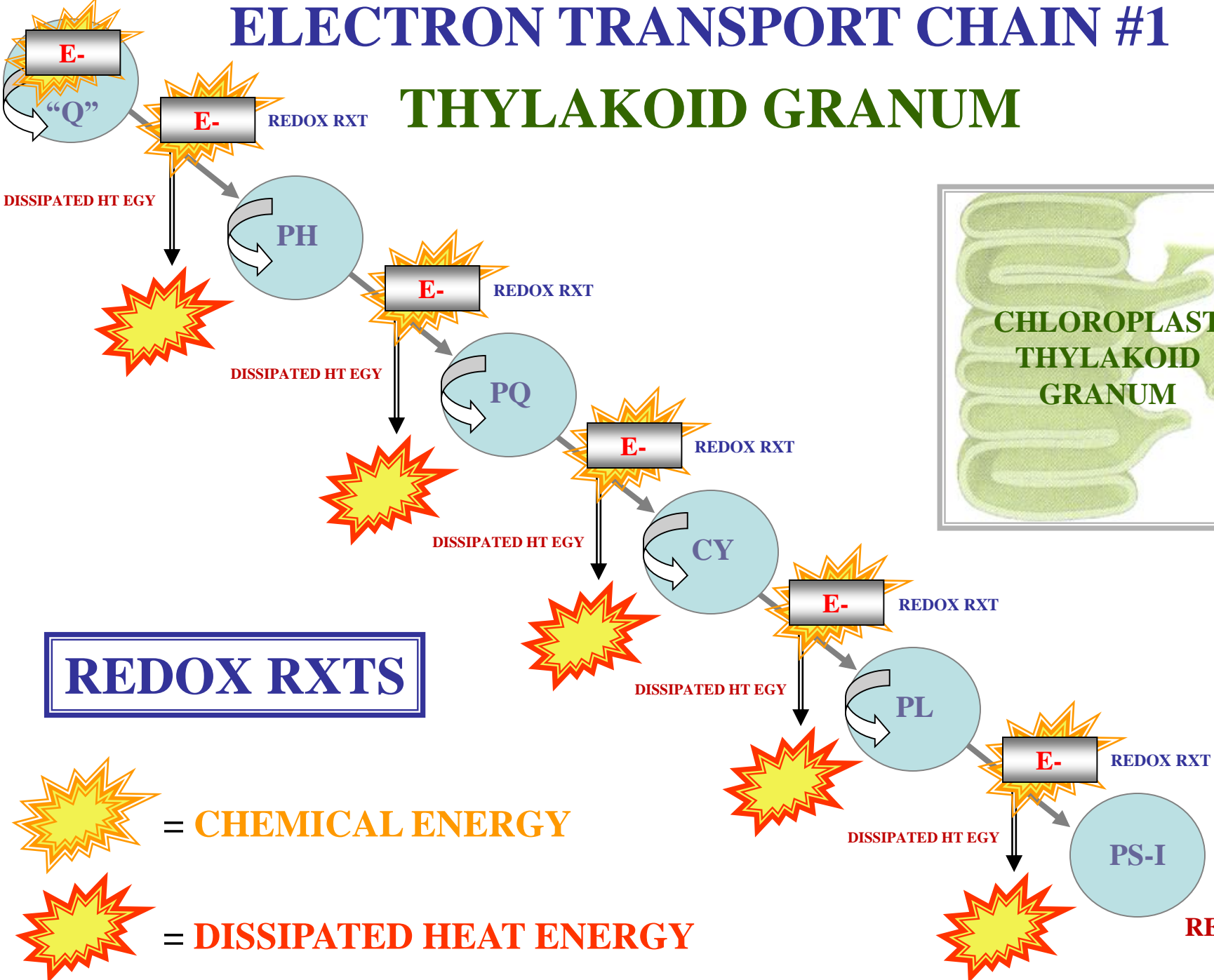
THYLAKOID GRANUM



ELECTRON TRANSPORT CHAIN #1

E-

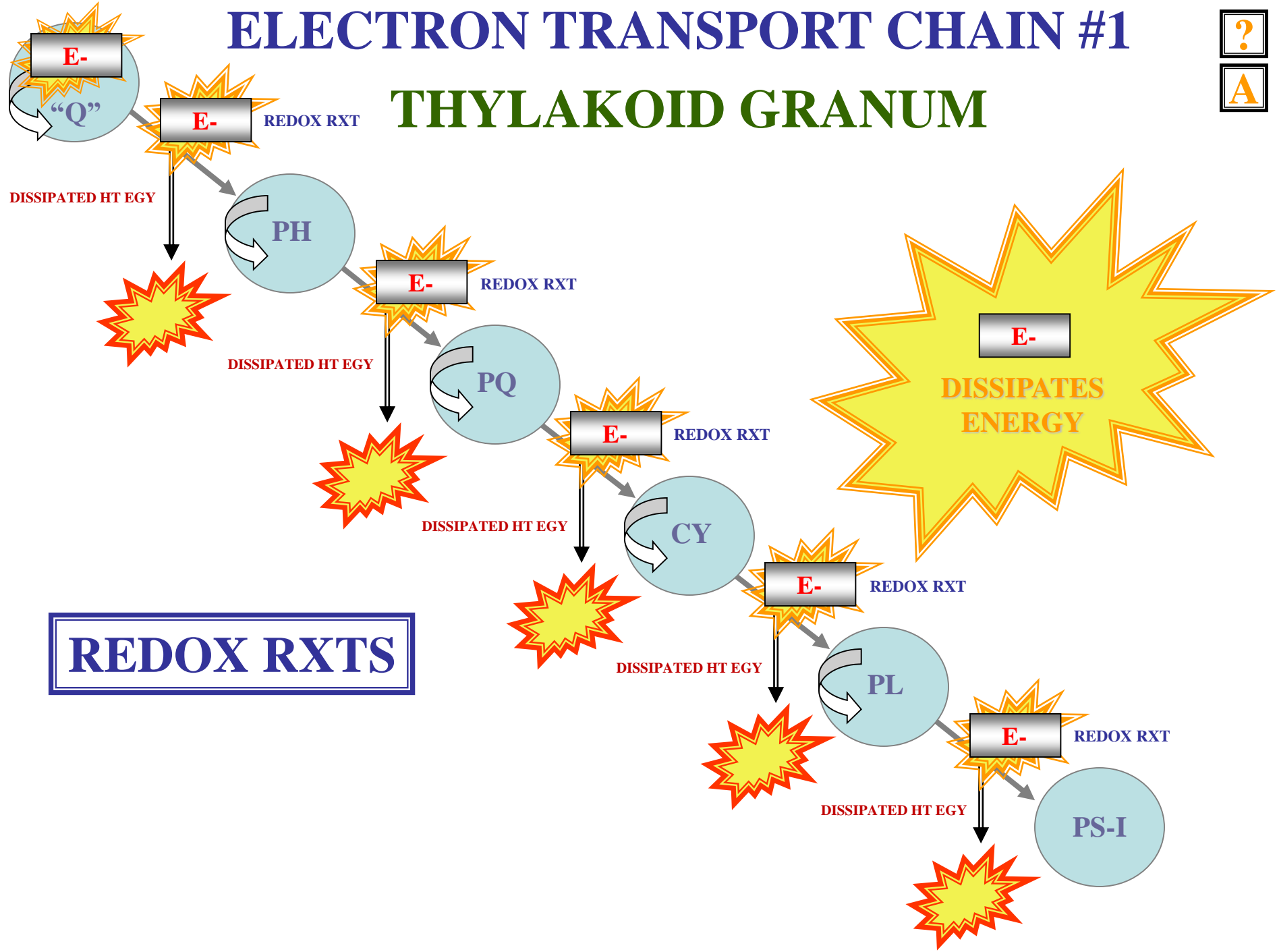
THYLAKOID GRANUM



ELECTRON TRANSPORT CHAIN #1



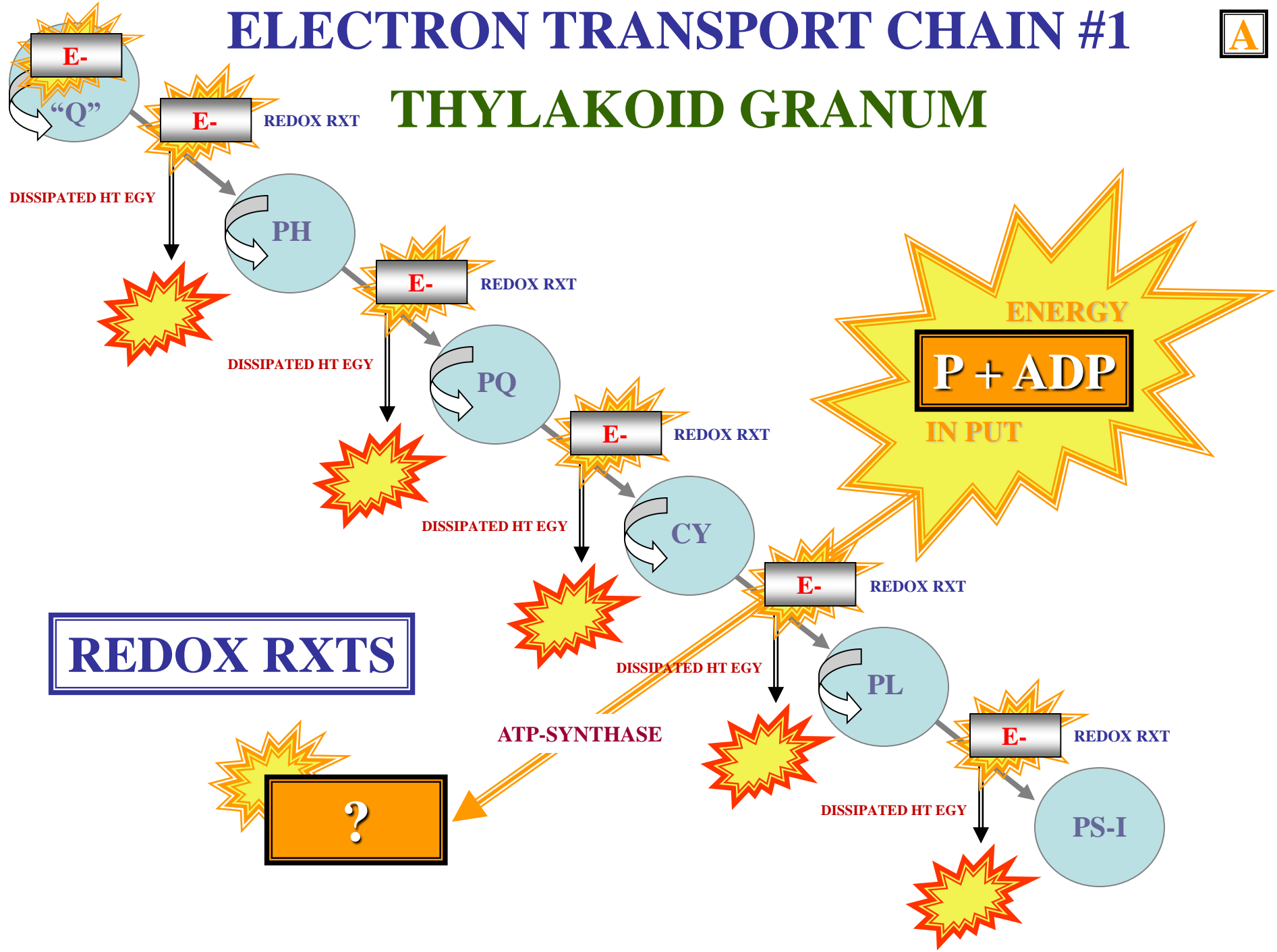
THYLAKOID GRANUM



ELECTRON TRANSPORT CHAIN #1



THYLAKOID GRANUM



PHOTOSYNTHESIS

DK



WATER

LIGHT ENERGY

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

ATP

PASSED



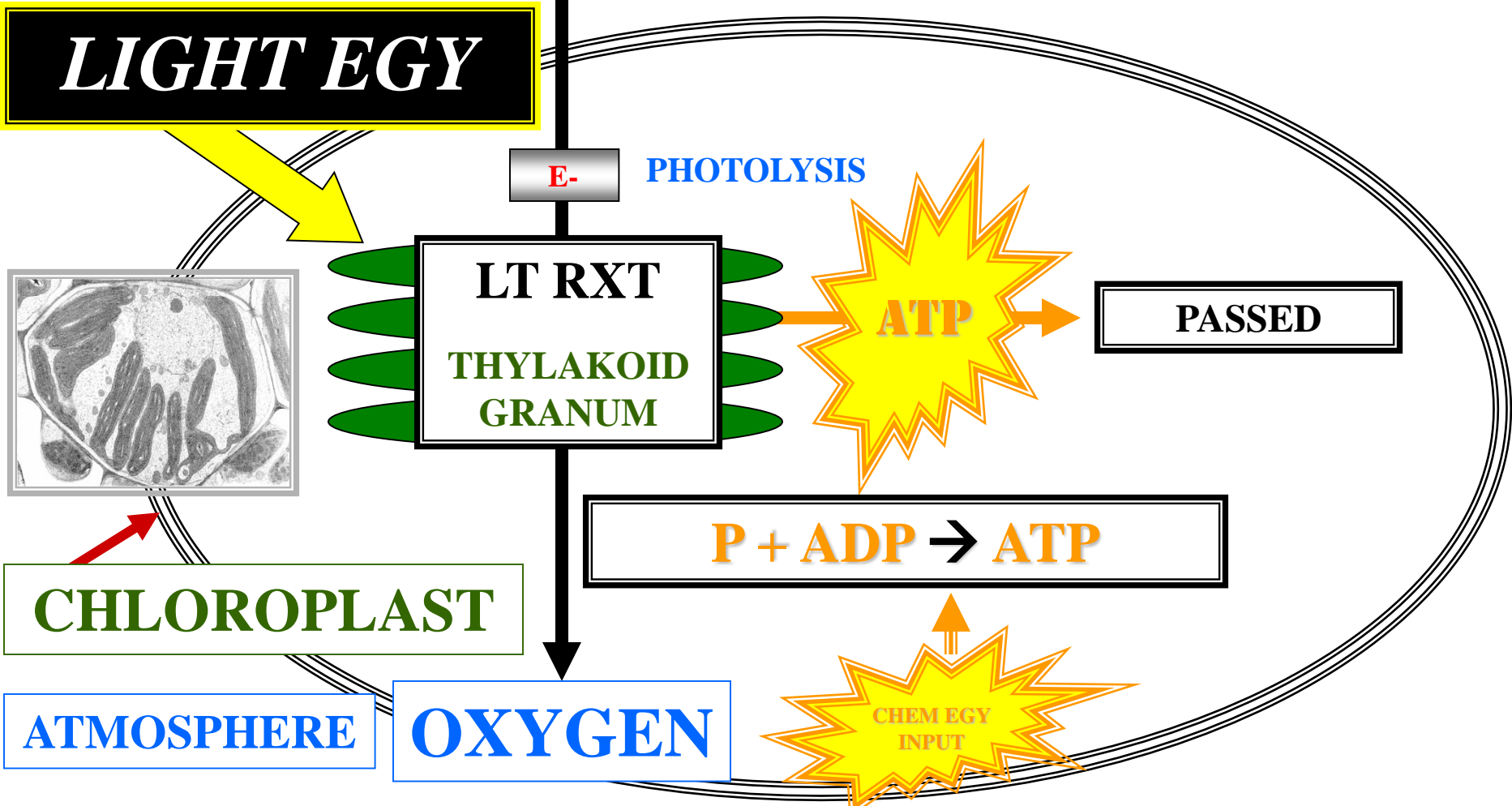
CHLOROPLAST

$P + ADP \rightarrow ATP$

ATMOSPHERE

OXYGEN

CHEM ENERGY
INPUT



PHOTOSYNTHESIS

P



WATER

LIGHT ENERGY

E-

PHOTOLYSIS

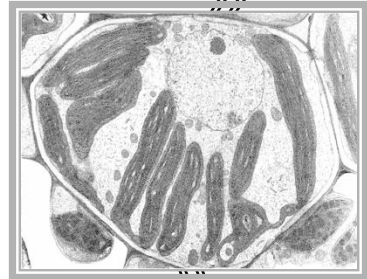
LT RXT

THYLAKOID
GRANUM

ATP

DK RXT

STROMA



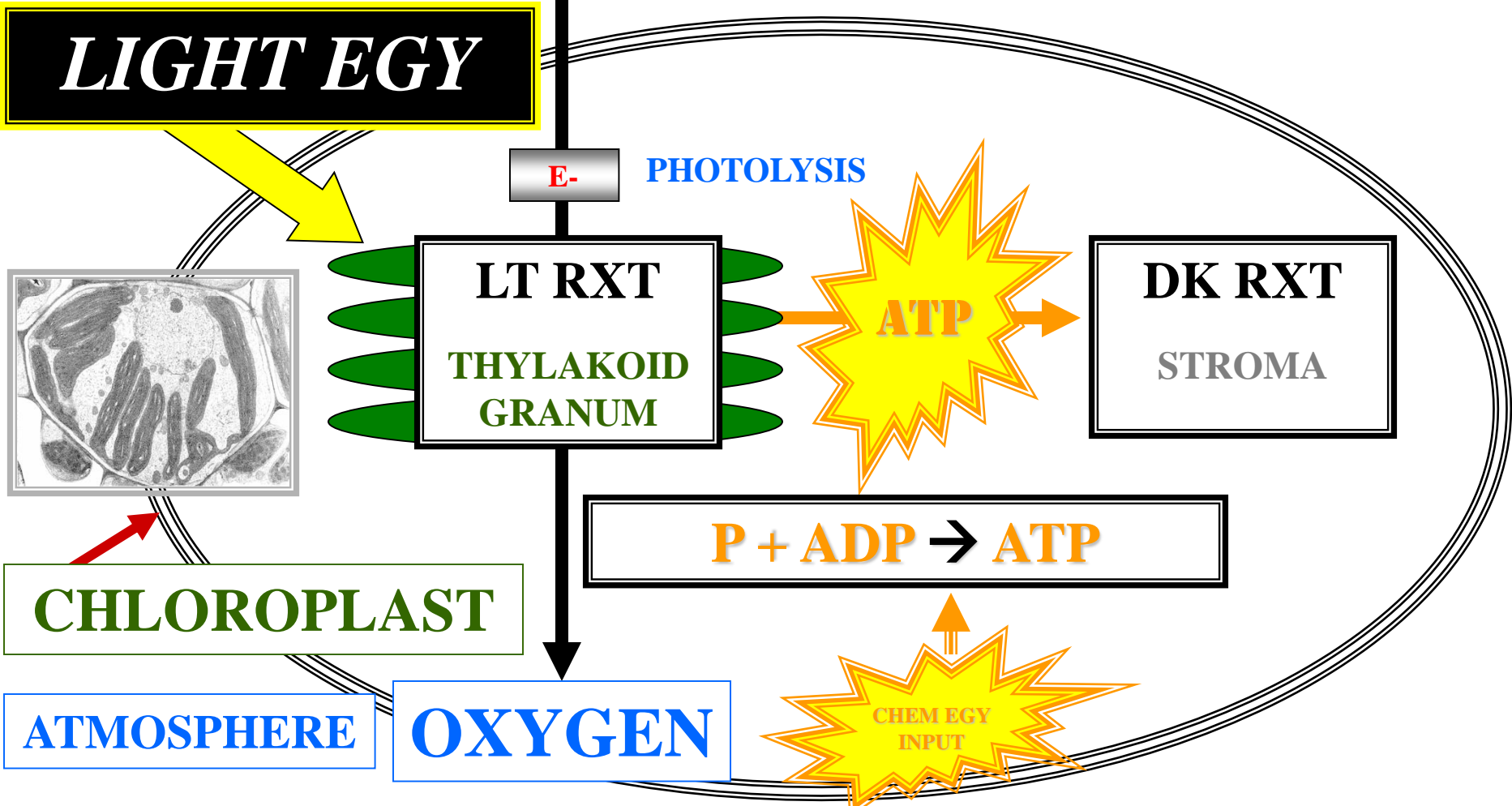
CHLOROPLAST

$P + ADP \rightarrow ATP$

ATMOSPHERE

OXYGEN

CHEM ENERGY
INPUT



PHOTOSYNTHESIS



LT

P

WATER

LIGHT ENERGY

PHOSPHORYLATION

E-

PHOTOLYSIS

LT RXT

**THYLAKOID
GRANUM**

ATP

DK RXT

STROMA

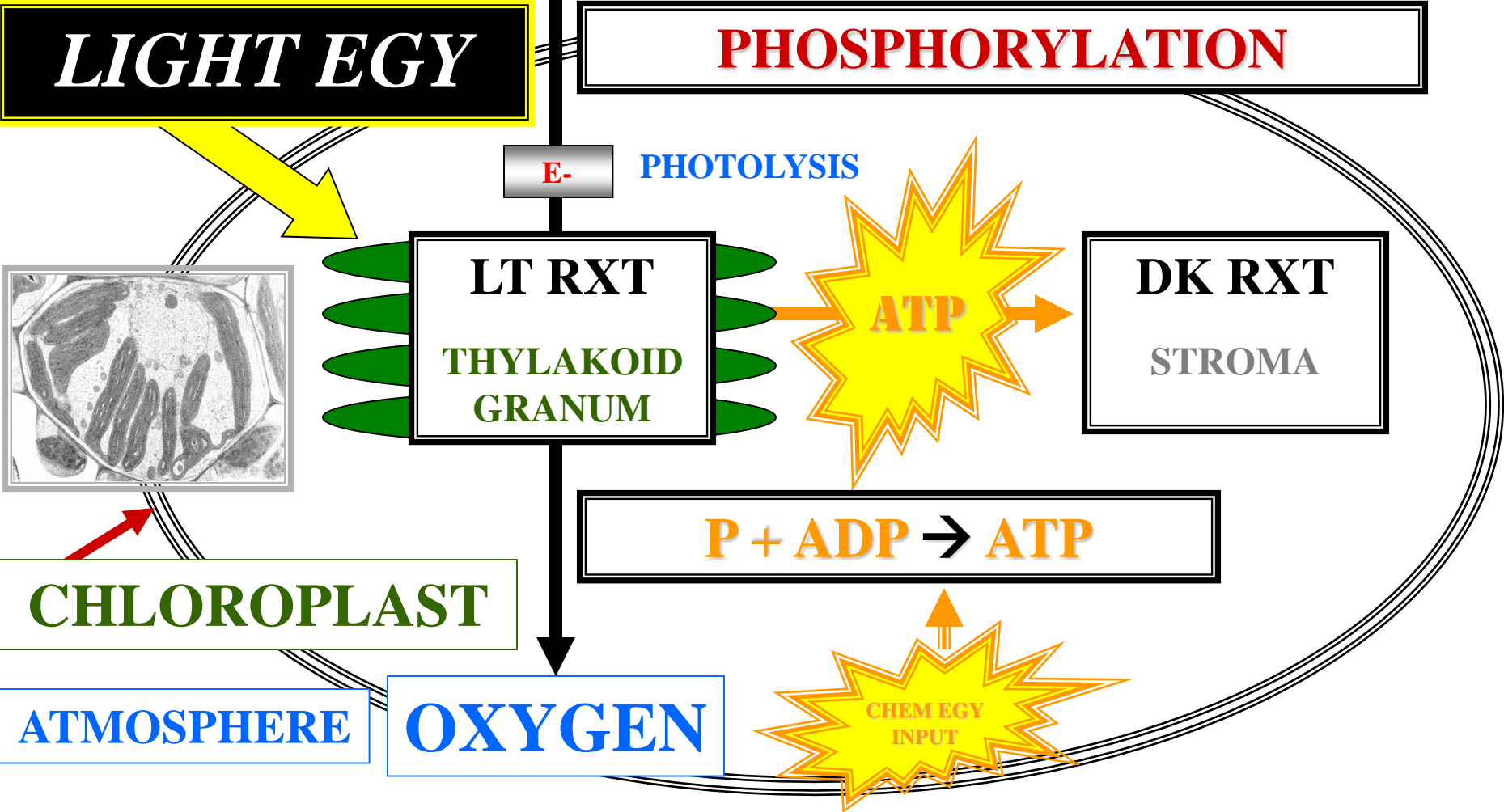
P + ADP → ATP

CHLOROPLAST

ATMOSPHERE

OXYGEN

**CHEM ENERGY
INPUT**



PHOTOSYNTHESIS



N

>

WATER

LIGHT ENERGY

PHOTO-PHOSPHORYLATION

E-

PHOTOLYSIS

LT RXT

THYLAKOID
GRANUM

ATP

DK RXT

STROMA

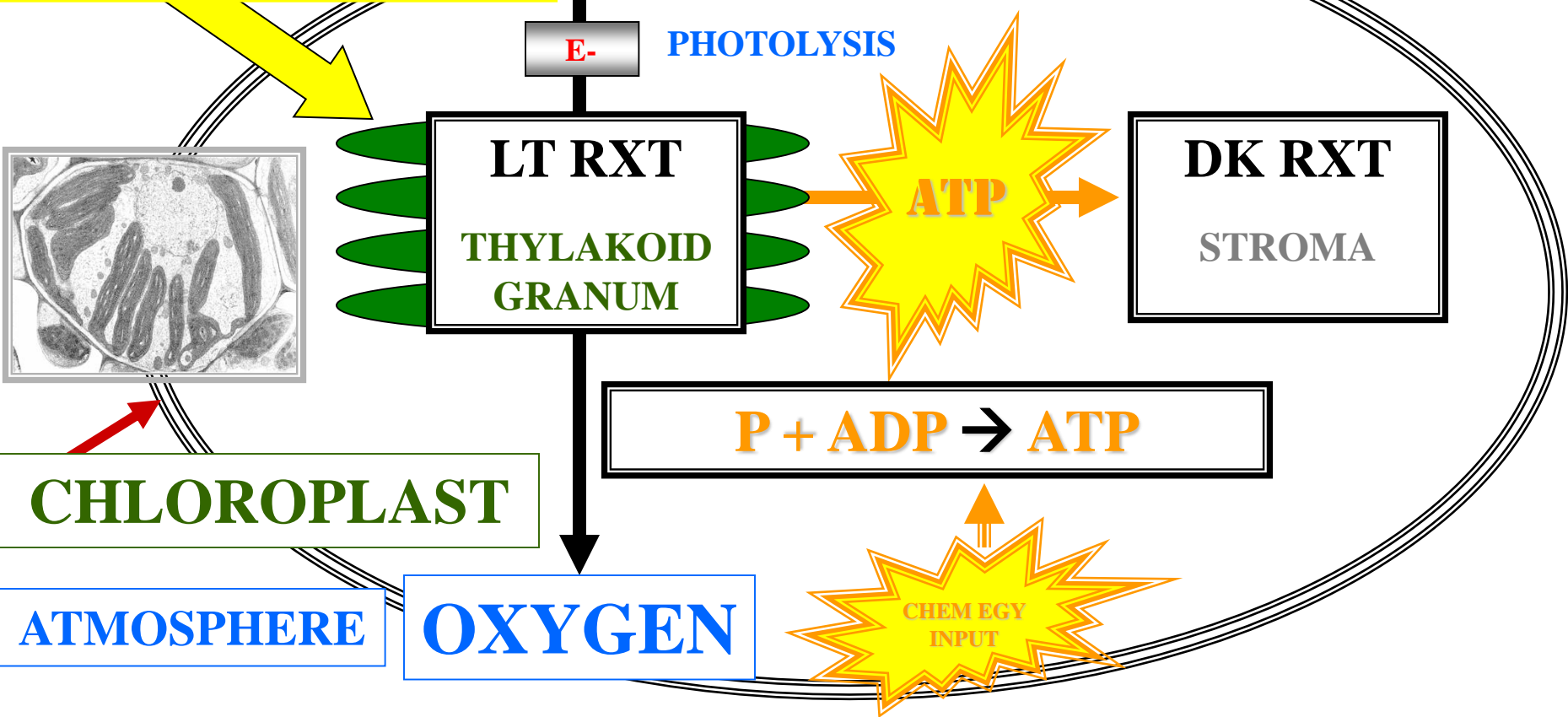
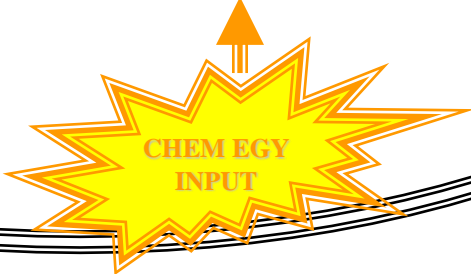
$P + ADP \rightarrow ATP$

CHLOROPLAST

ATMOSPHERE

OXYGEN

CHEM ENERGY
INPUT



PHOTOSYNTHESIS



WATER

NON-CYCLIC

LIGHT ENERGY

PHOTO-PHOSPHORYLATION

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

ATP

DK RXT

STROMA

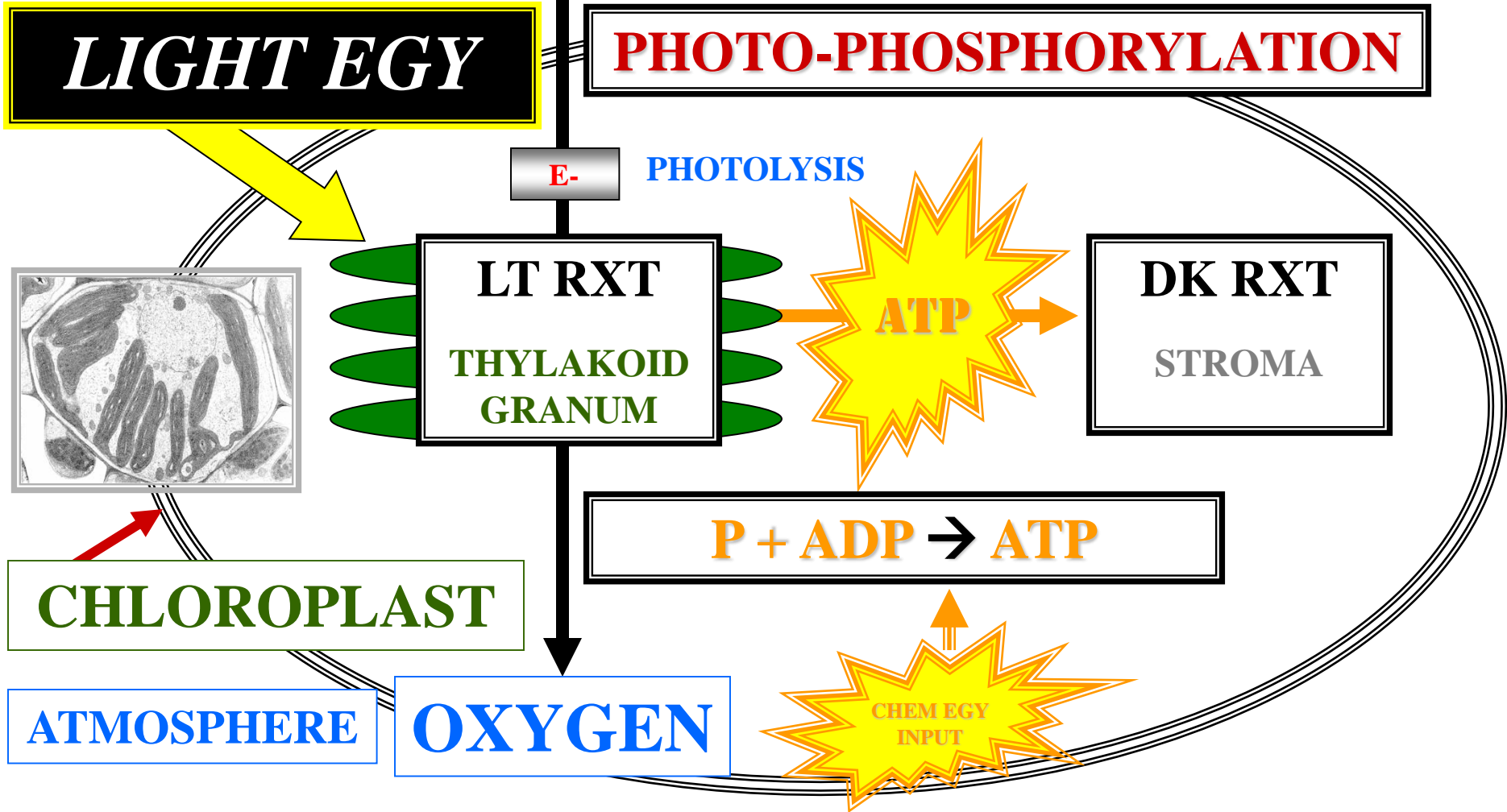
CHLOROPLAST

$P + ADP \rightarrow ATP$

ATMOSPHERE

OXYGEN

CHEM ENERGY
INPUT



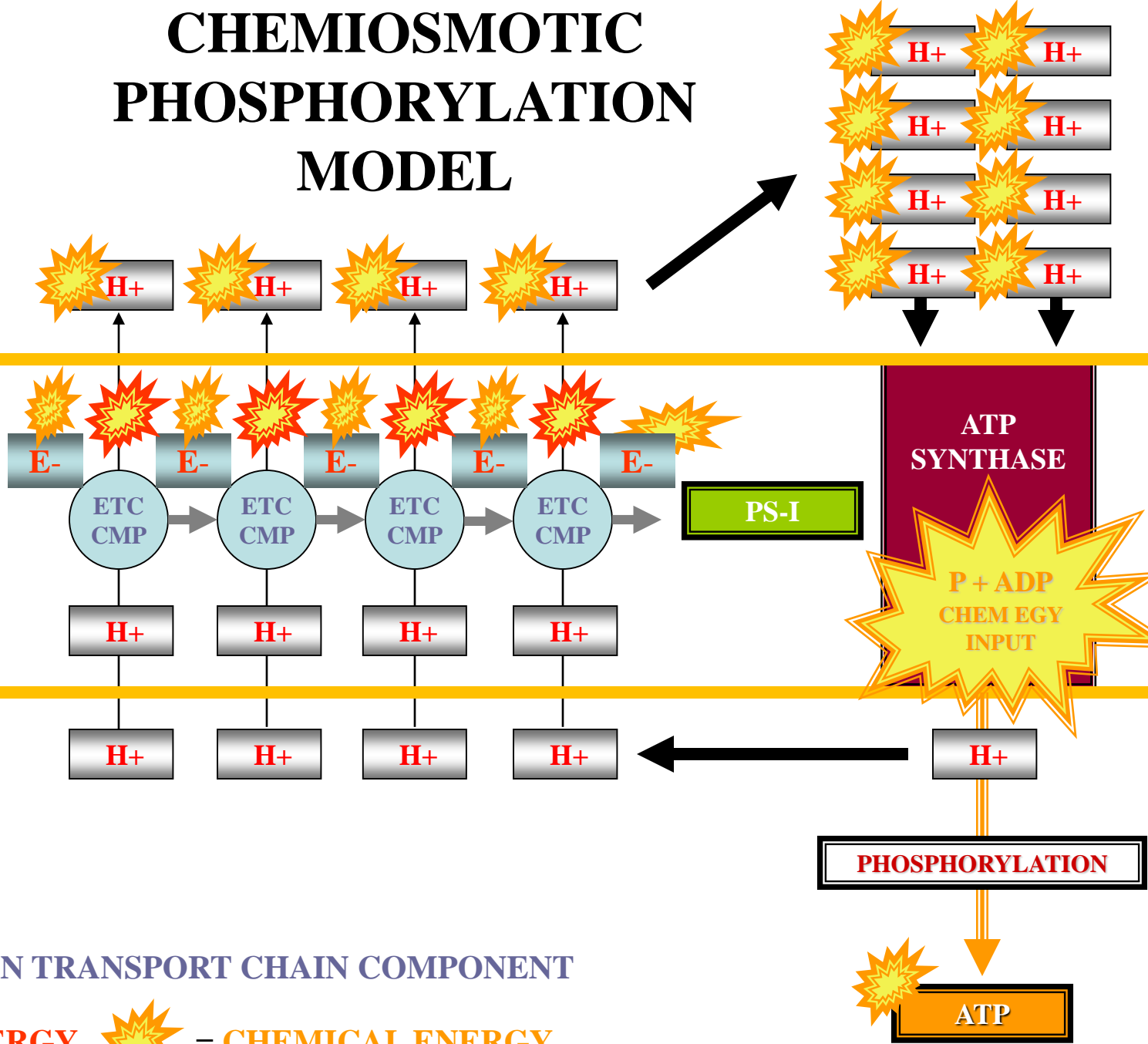
↔ S NC

CHEMIOSMOTIC PHOSPHORYLATION MODEL

CHLOROPLAST THYLAKOID SPACE

PS-II / PS-I
CHLOROPLAST THYLAKOID ETC

CHLOROPLAST STROMA

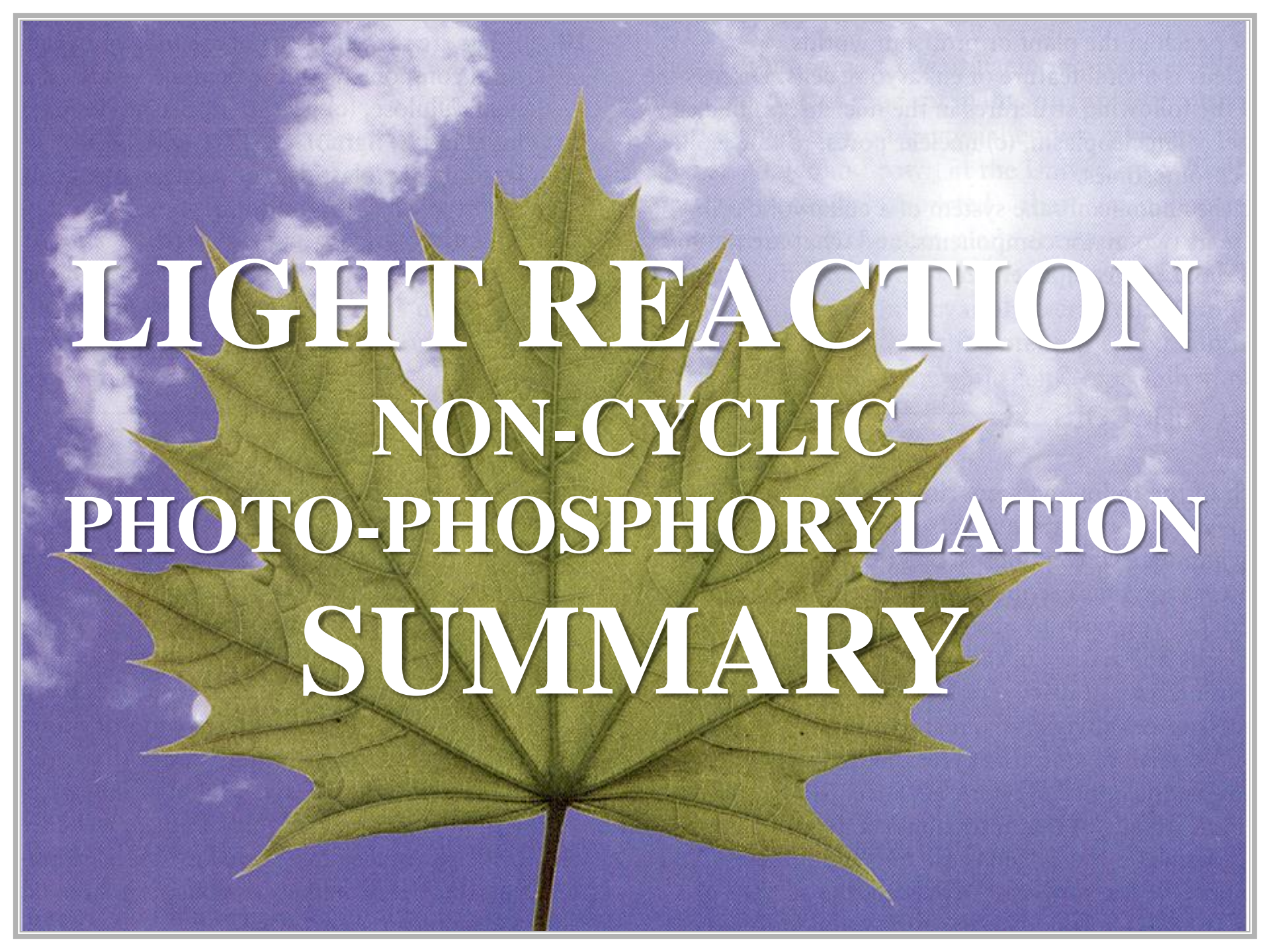


● = ELECTRON TRANSPORT CHAIN COMPONENT

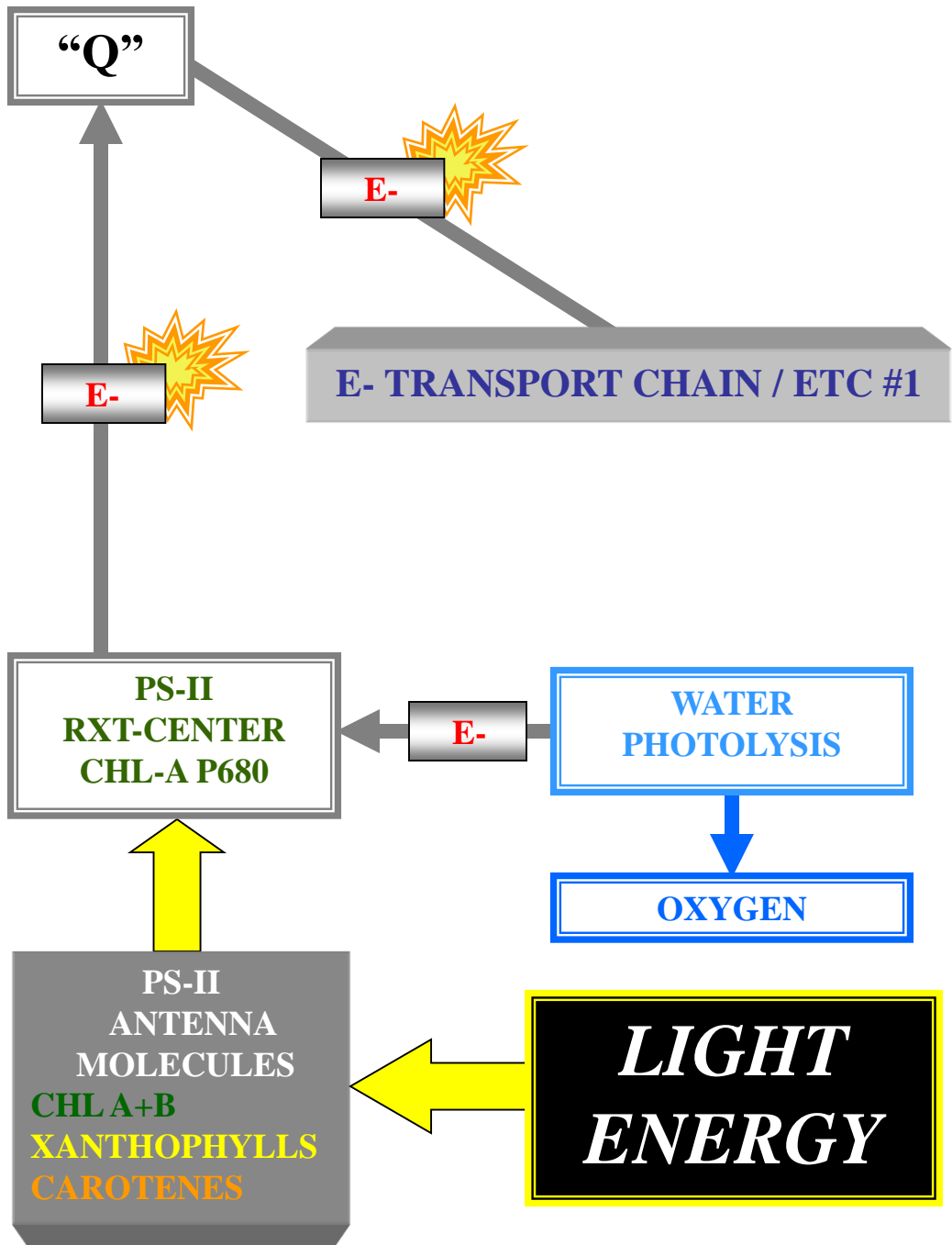
★ = HEAT ENERGY ★ = CHEMICAL ENERGY

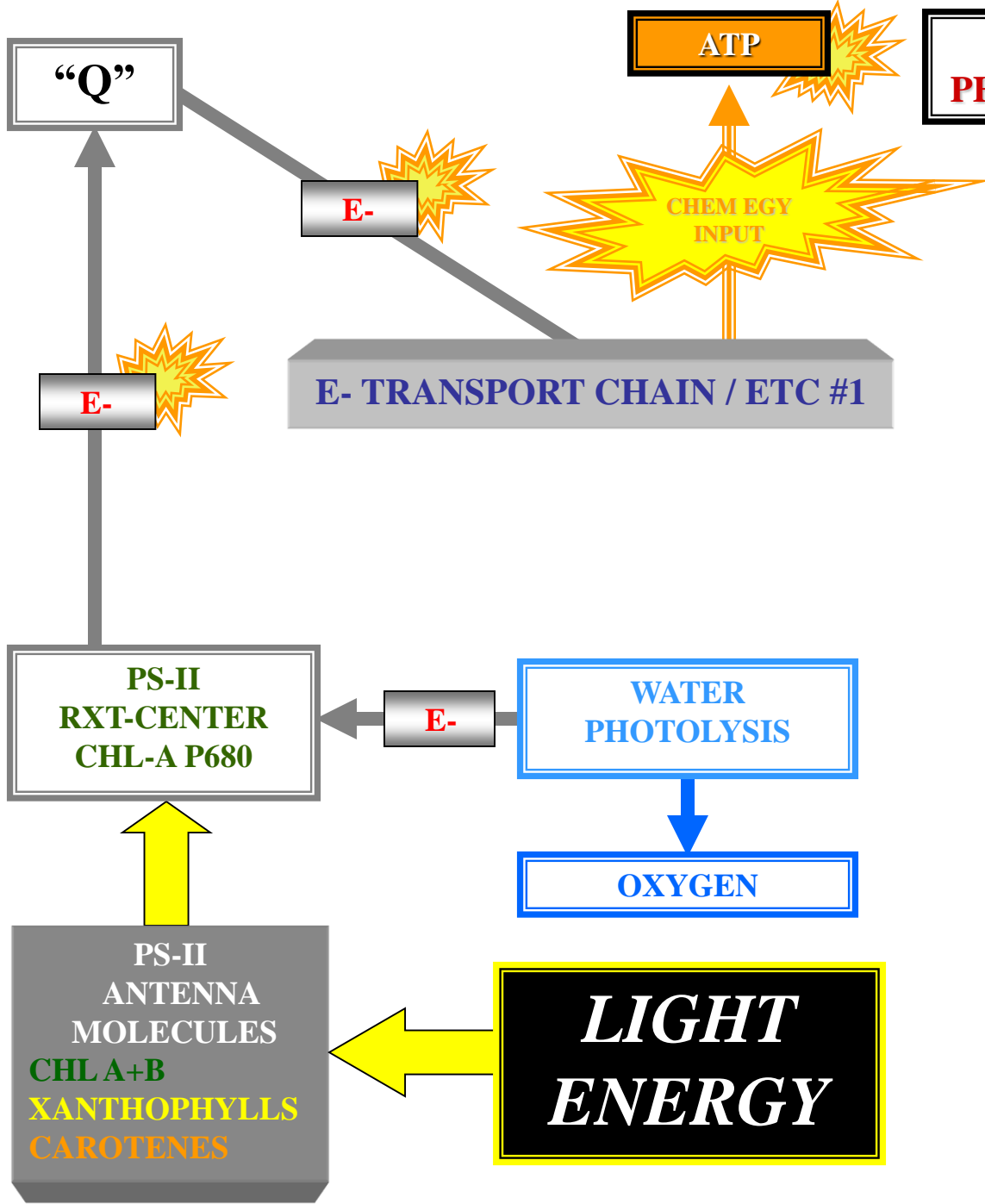
PHOSPHORYLATION

ATP

A green maple leaf is centered in the frame, set against a blue sky with scattered white clouds. The leaf's veins are clearly visible, and its stem points downwards. The text is overlaid on the leaf and sky.

LIGHT REACTION
NON-CYCLIC
PHOTO-PHOSPHORYLATION
SUMMARY

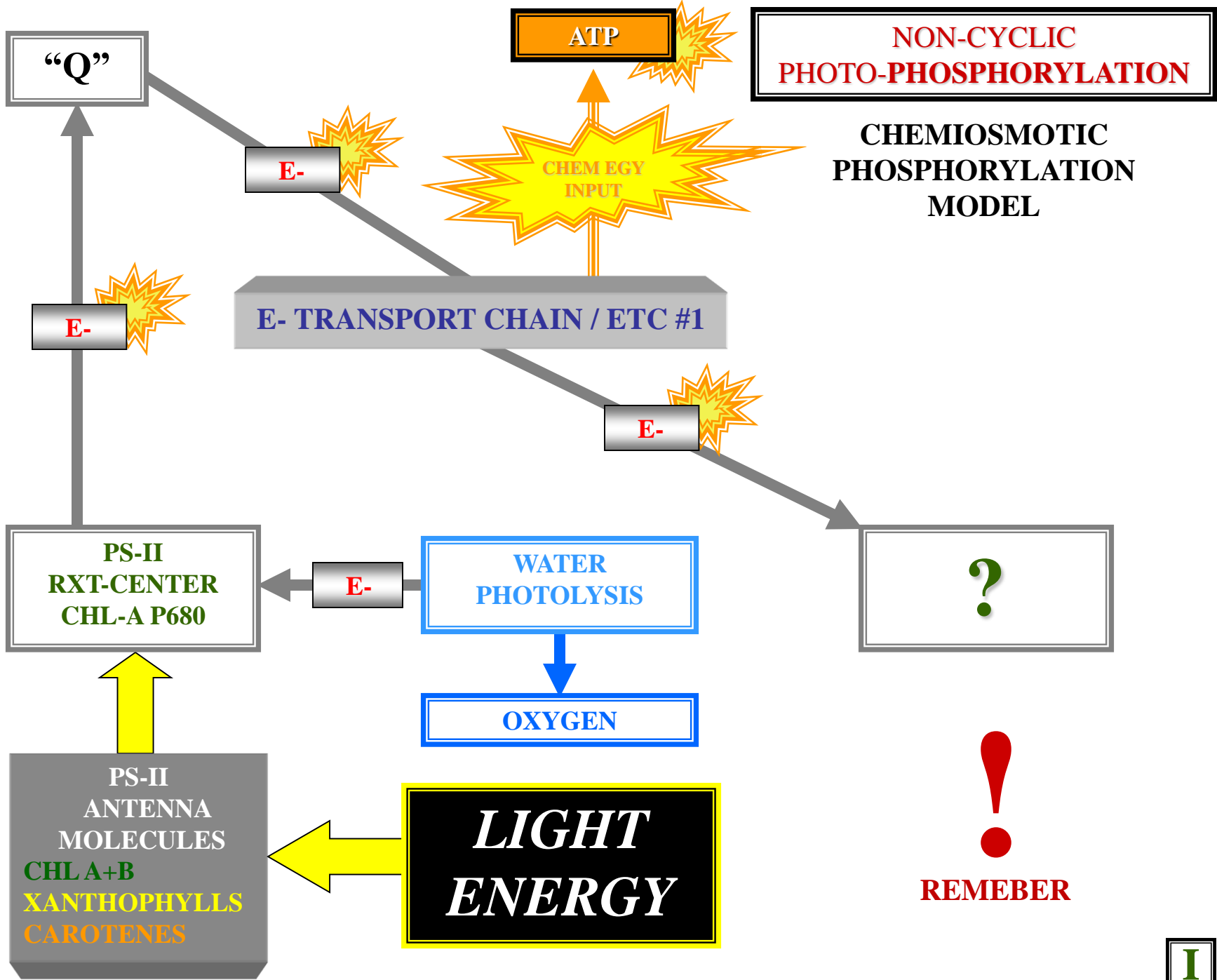


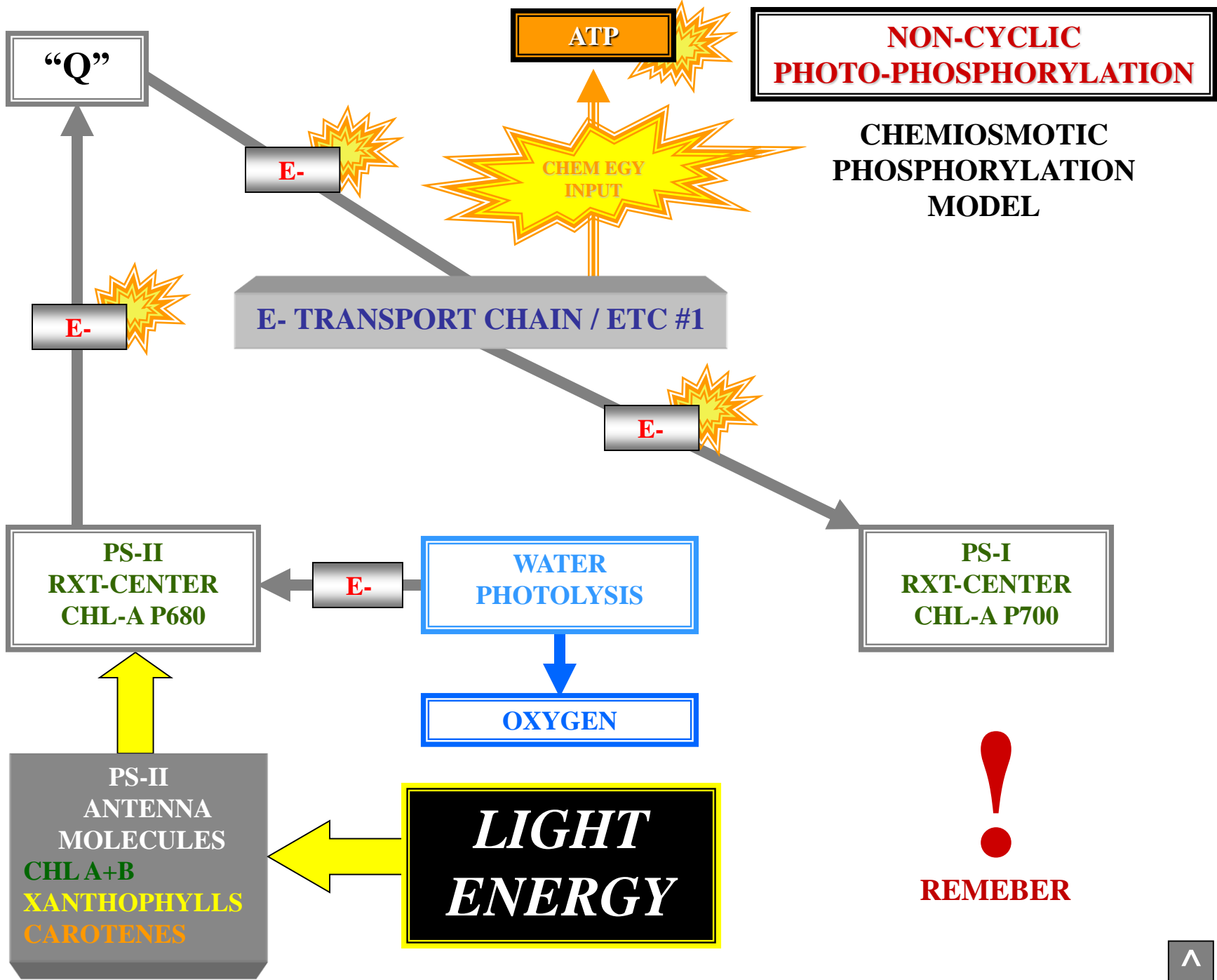


**NON-CYCLIC
PHOTO-PHOSPHORYLATION**

**CHEMIOSMOTIC
PHOSPHORYLATION
MODEL**









PHOTOSYSTEM I

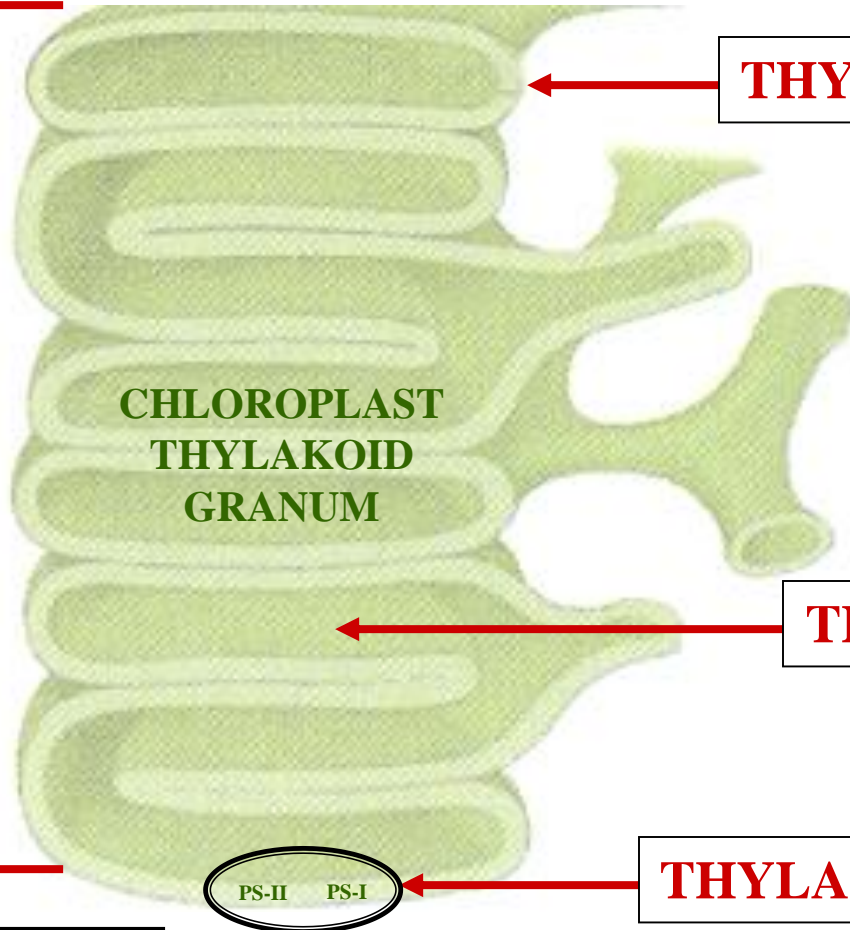
CHLOROPLAST

PS-I

THYLAKOID



GRANUM



THYLAKOID VESICLE

STROMA

**CHLOROPLAST
THYLAKOID
GRANUM**

THYLAKOID SPACE

THYLAKOID MEMBRANE

NON-CYCLIC P-P

PS-II PS-I

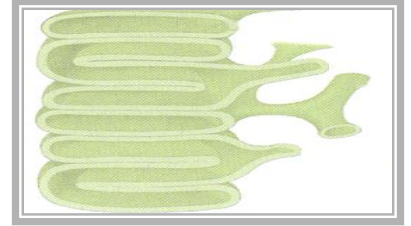
CHLOROPLAST

PS-I

THYLAKOID



**PIGMENT
MOLECULES**



A

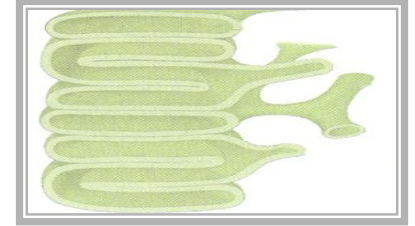
CHLOROPLAST

PS-I

THYLAKOID



**ANTENNA
MOLECULES**



A

ANTENNA MOLECULES



ANTENNA MOLECULES

ABSORB LIGHT ENERGY



ANTENNA MOLECULES



ANTENNA MOLECULES

ABSORB LIGHT ENERGY



REACTION CENTER

ANTENNA MOLECULES

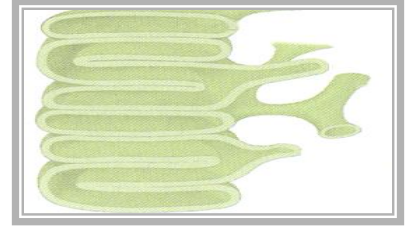
CHLOROPLAST

PS-I

THYLAKOID



**ANTENNA
MOLECULES**



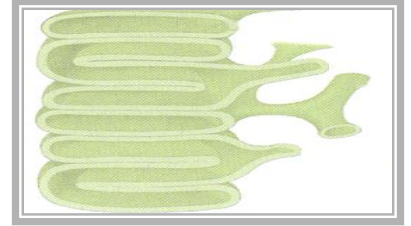
CHLOROPLAST

PS-I

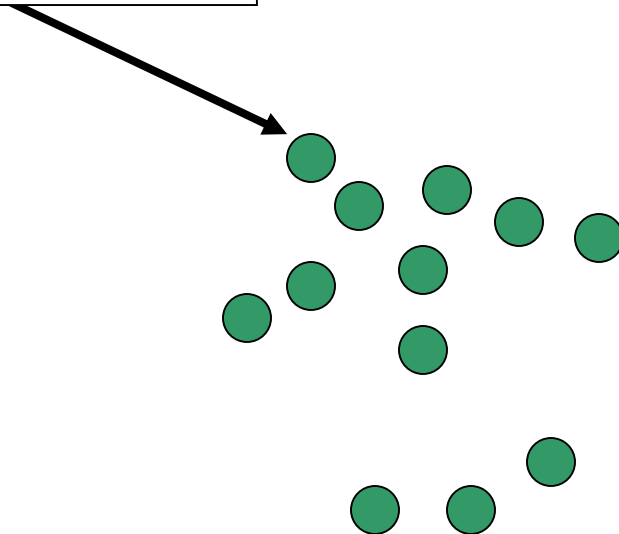
THYLAKOID



**ANTENNA
MOLECULES**



CHLOROPHYLLA



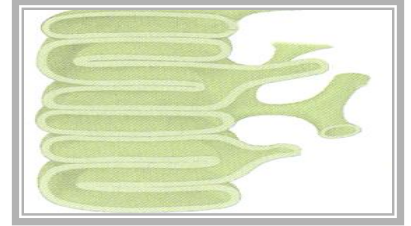
CHLOROPLAST

PS-I

THYLAKOID

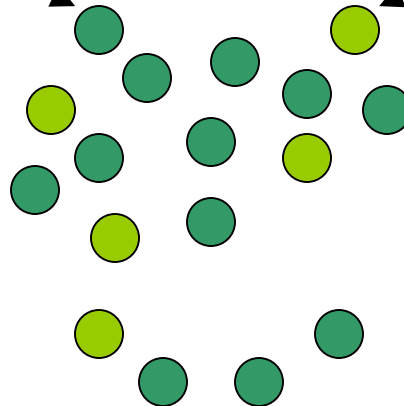


**ANTENNA
MOLECULES**



CHLOROPHYLL A

CHLOROPHYLL B



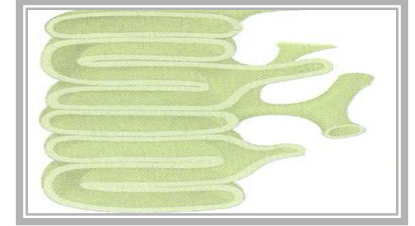
CHLOROPLAST

PS-I

THYLAKOID



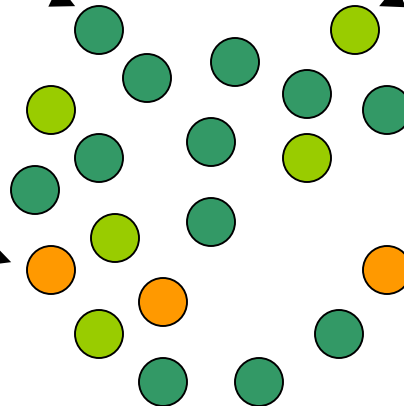
**ANTENNA
MOLECULES**



CHLOROPHYLL A

CHLOROPHYLL B

CAROTENES



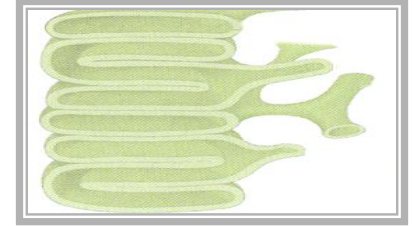
CHLOROPLAST

PS-I

THYLAKOID



**ANTENNA
MOLECULES**

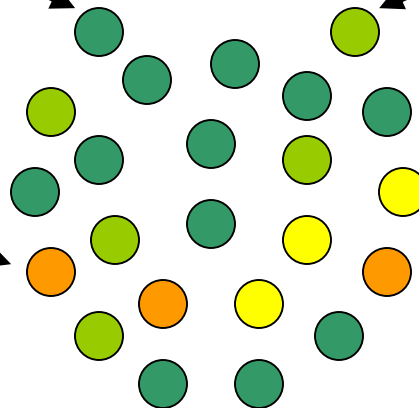


CHLOROPHYLLA

CHLOROPHYLL B

CAROTENES

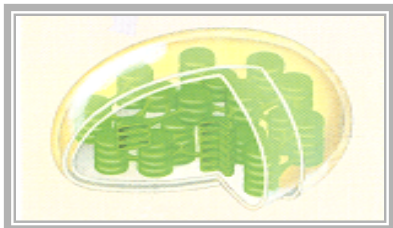
XANTHOPHYLLS



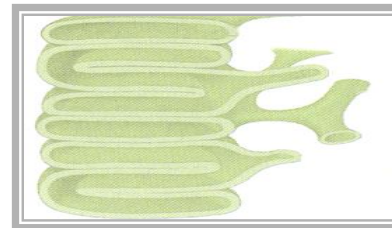
CHLOROPLAST

PS-I

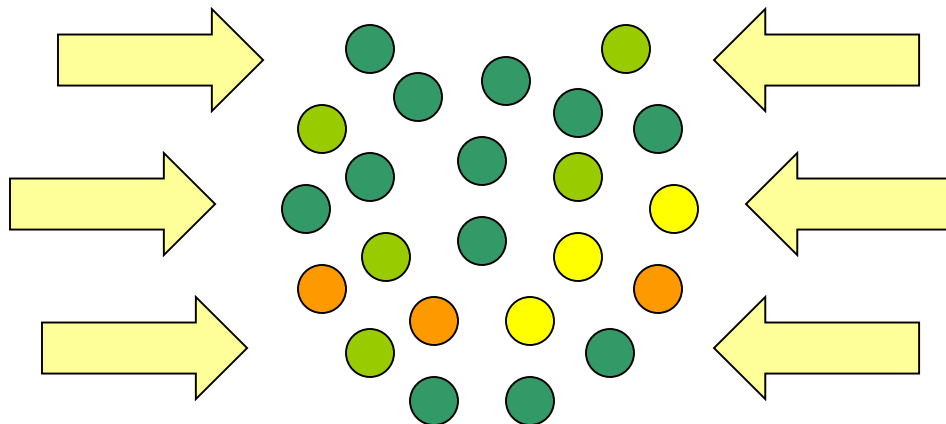
THYLAKOID



**ANTENNA
MOLECULES**



LTEGY



LTEGY

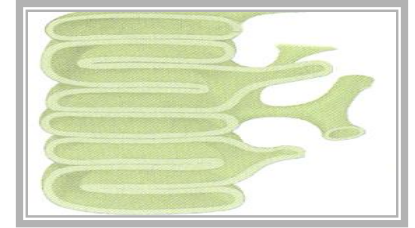
CHLOROPLAST

PS-I

THYLAKOID



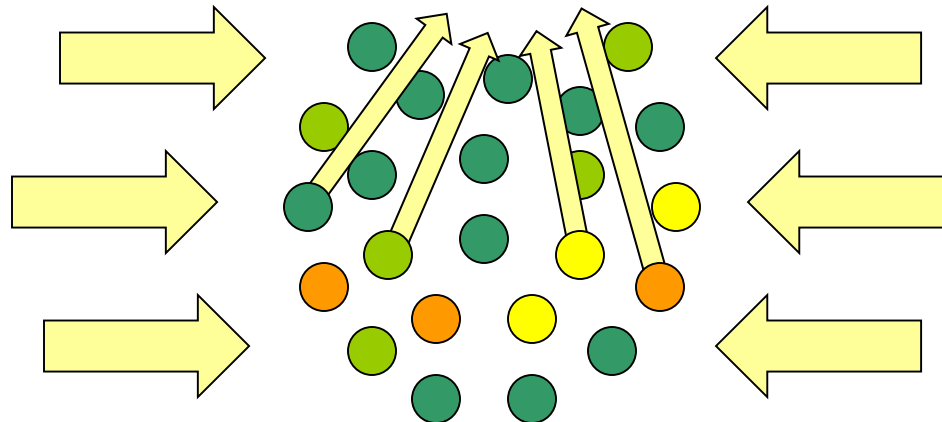
**ANTENNA
MOLECULES**



R



LTEGY



LTEGY



LTEGY

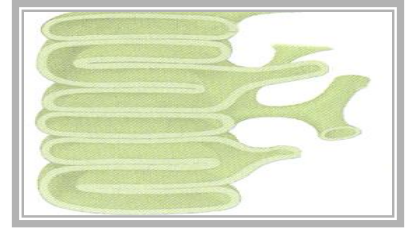
CHLOROPLAST

PS-I

THYLAKOID



**ANTENNA
MOLECULES**

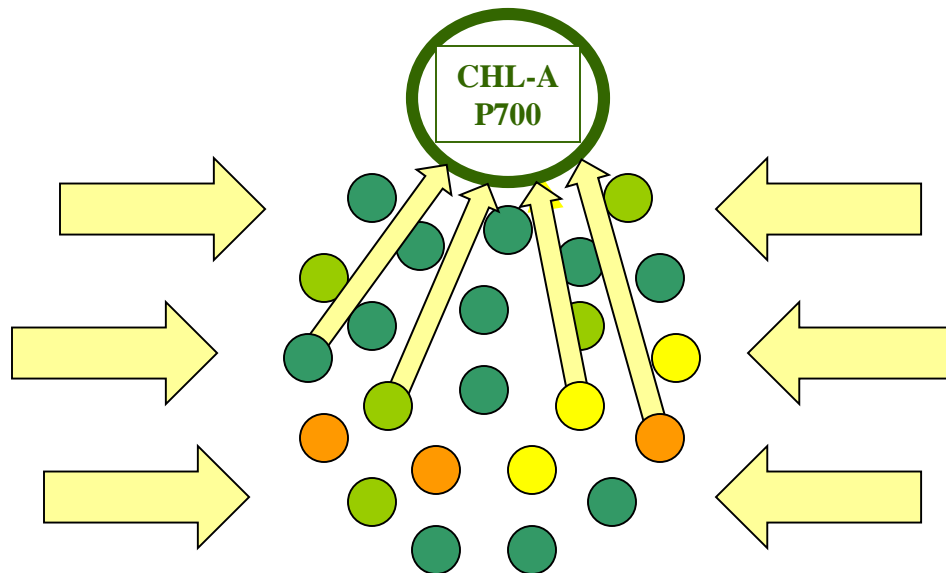


R

REACTION CENTER



LTEGY



LTEGY

**REACTION
CENTER
PS-I**



REACTION CENTER PS-I

CHL A/PROTEIN COMPLEX

PIGMENT 700

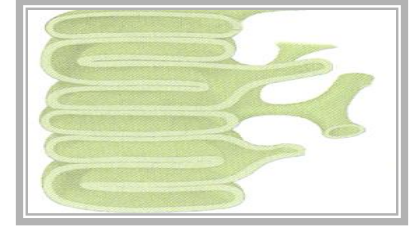
P700

REACTION CENTER PS-I

CHLOROPLAST

PS-I

THYLAKOID



E-



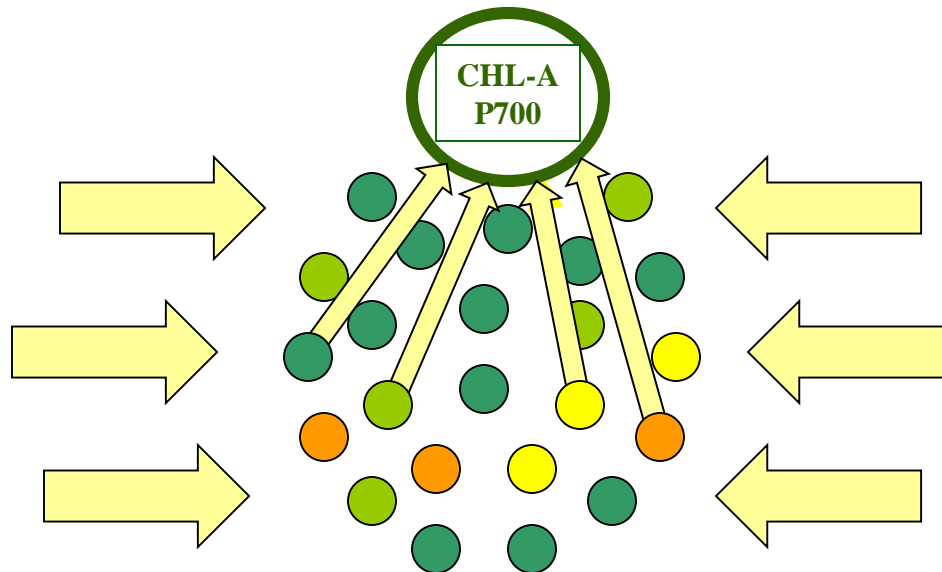
REACTION CENTER: ABSORBS SUFFICIENT LIGHT ENERGY

REACTION CENTER



LTEGY

LTEGY

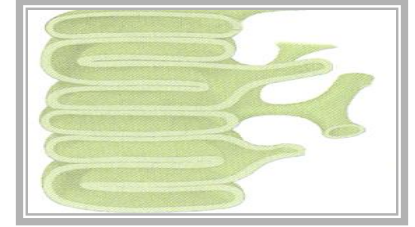


CHLOROPLAST



PS-I

THYLAKOID



 = ENERGY

ENERGIZED E-

A

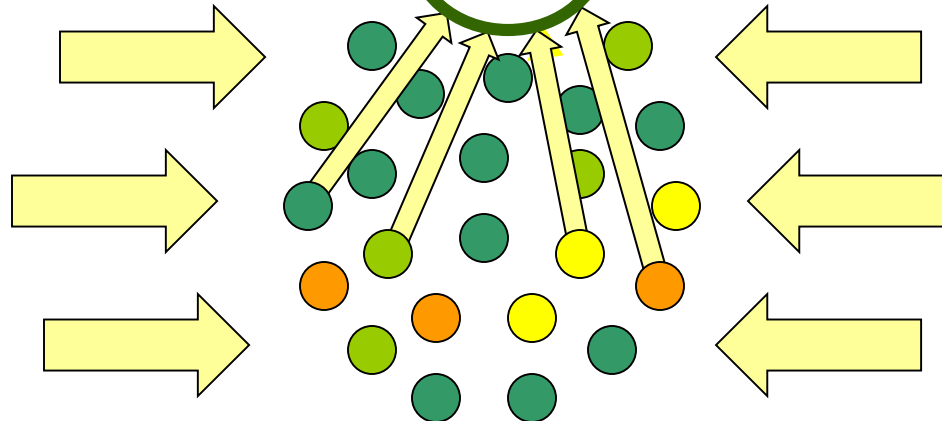
Q2

**CHL-A
P700**



LTEGY

LTEGY



CHLOROPLAST

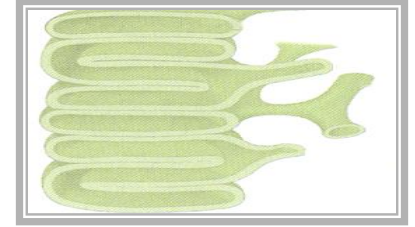


E- ACCEPTOR "Q2"

E-

LTEGY

THYLAKOID



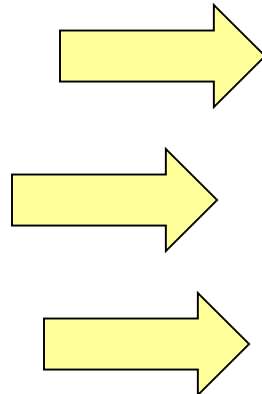
E- ACCEPTOR "Q2": ACCEPTS ENERGIZED E-

C

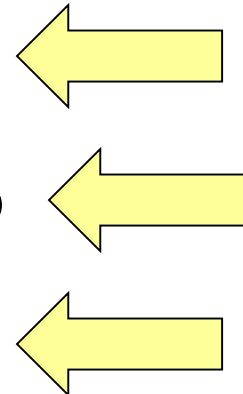
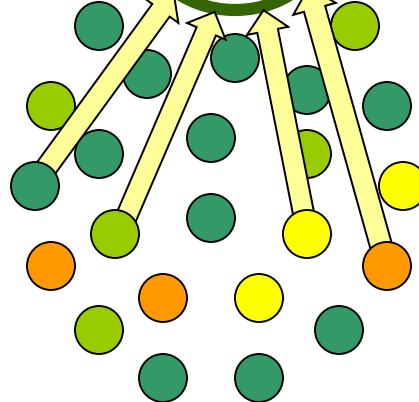
 = ENERGY



LTEGY



CHL-A
P700



LTEGY

CHLOROPLAST

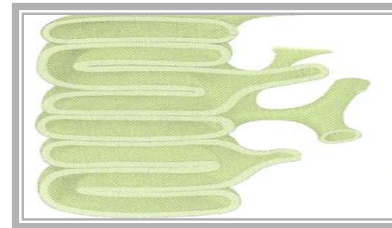


E- ACCEPTOR "Q2"



CHEM EGY

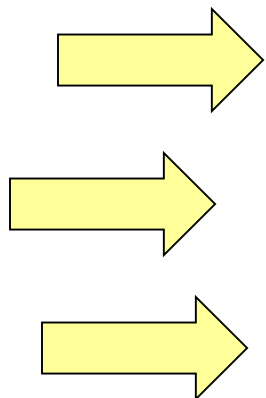
THYLAKOID



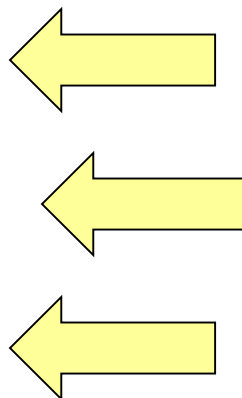
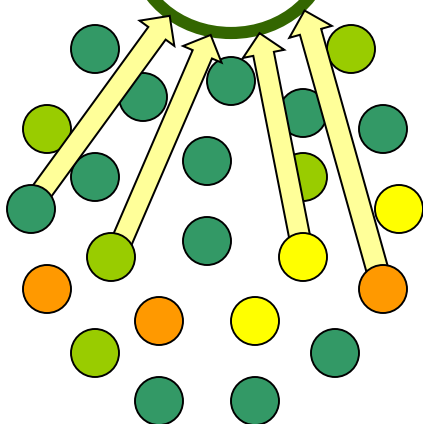
E- ACCEPTOR "Q2": ACCEPTS ENERGIZED E-



LTEGY



CHL-A
P700



LTEGY

P700
REDOX RXT

CHLOROPLAST

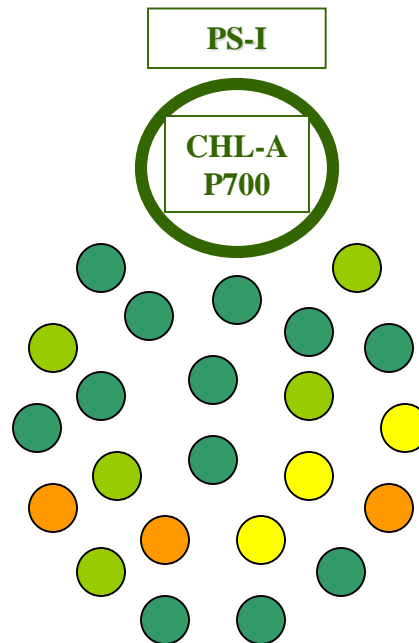
E- ACCEPTOR "Q2"



CHEM EGY

THYLAKOID

R



CHLOROPLAST

E- ACCEPTOR "Q2"

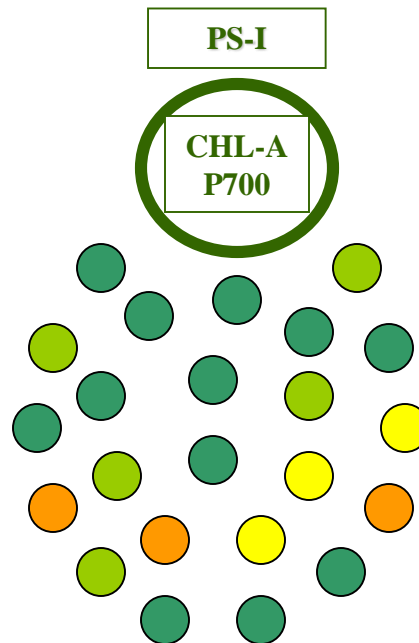


CHEM EGY

THYLAKOID

"Q2" REDUCED

O



CHLOROPLAST

E- ACCEPTOR "Q2"



CHEM EGY

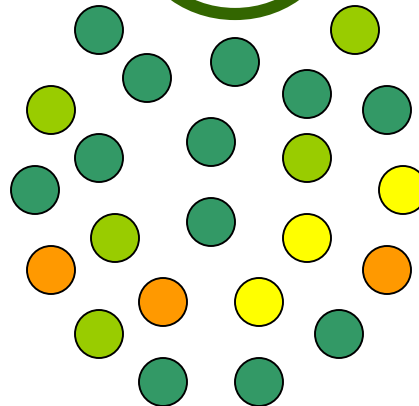
THYLAKOID

"Q2" REDUCED

C

PS-I

CHL-A
P700



P700 OXIDIZED

CHLOROPLAST

E- ACCEPTOR "Q2"



CHEM EGY

THYLAKOID

"Q2" REDUCED

?

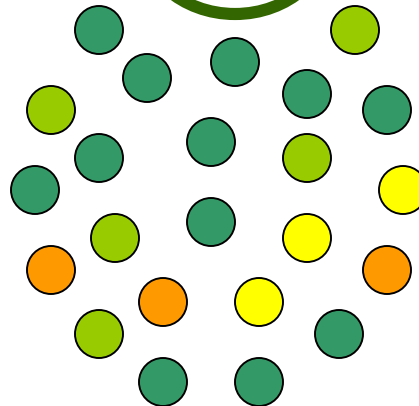
!

COUPLED

P700 OXIDIZED

PS-I

CHL-A
P700



CHLOROPLAST

E- ACCEPTOR "Q2"

E-

CHEM EGY

THYLAKOID

ETC1

?

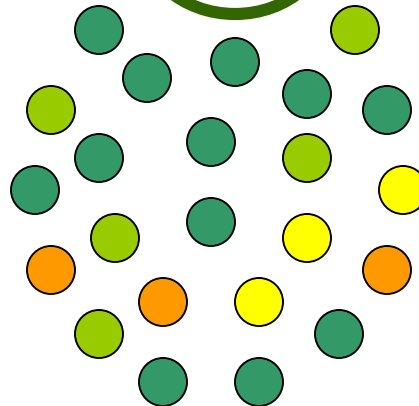
E-

PS-I

CHL-A
P700

P700 OXIDIZED

!
REMEBER



CHLOROPLAST

E- ACCEPTOR "Q2"



CHEM EGY

THYLAKOID

ETC1

+

E- TRANSPORT CHAIN #1

E-

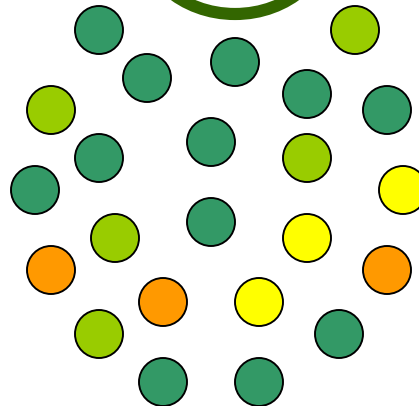
PS-I

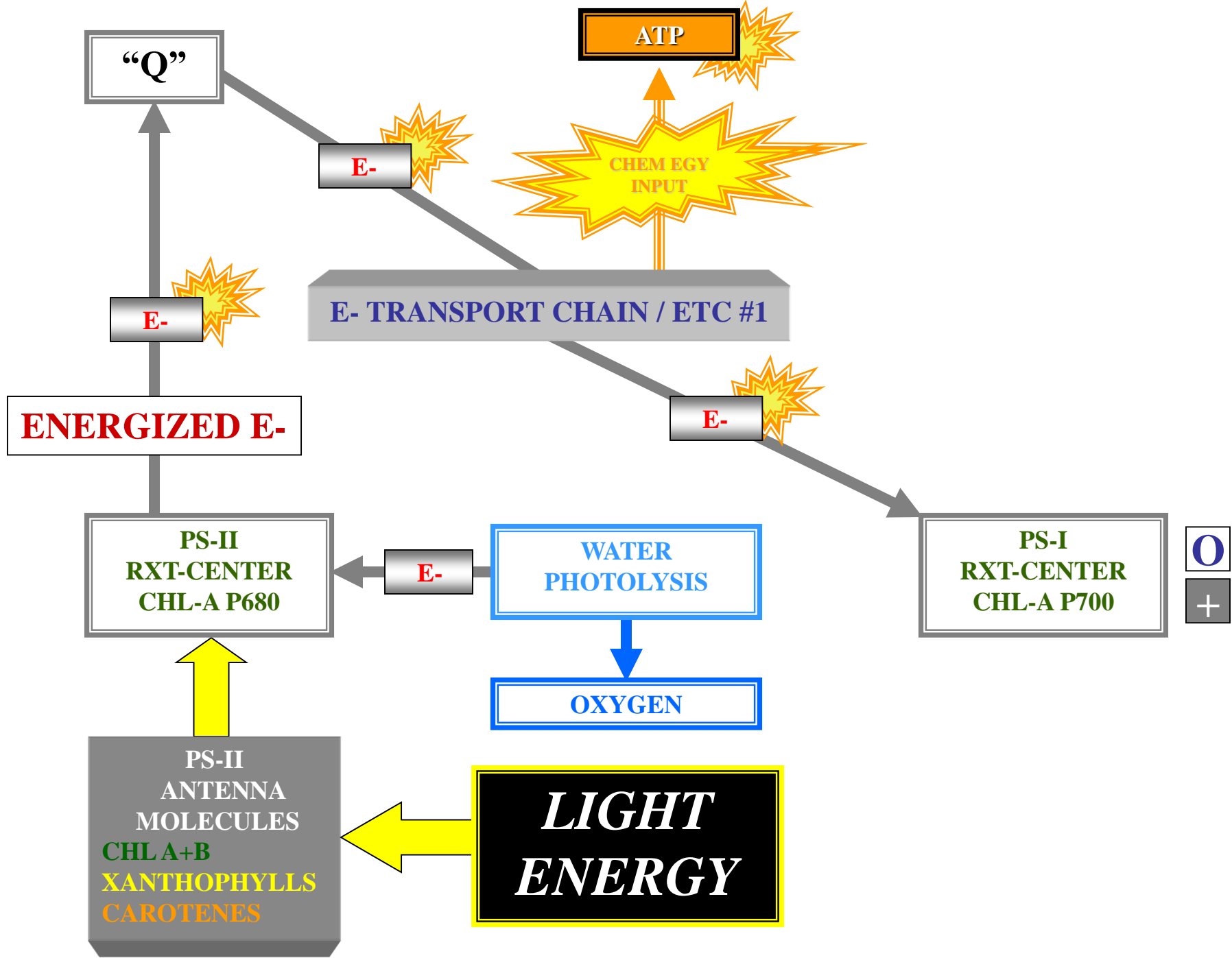
CHL-A
P700

P700 OXIDIZED



REMEBER





CHLOROPLAST

E- ACCEPTOR "Q2"



CHEM EGY

THYLAKOID

R

E- TRANSPORT CHAIN #1



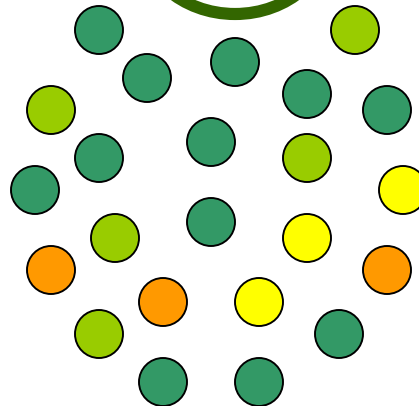
PS-I

**CHL-A
P700**

P700 OXIDIZED



REMEBER



CHLOROPLAST

E- ACCEPTOR "Q2"



CHEM EGY

THYLAKOID

S

NC

E- TRANSPORT CHAIN #1

E-

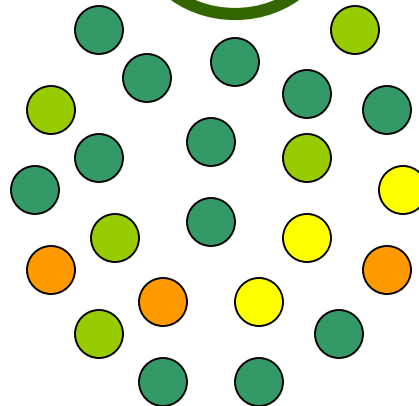
PS-I

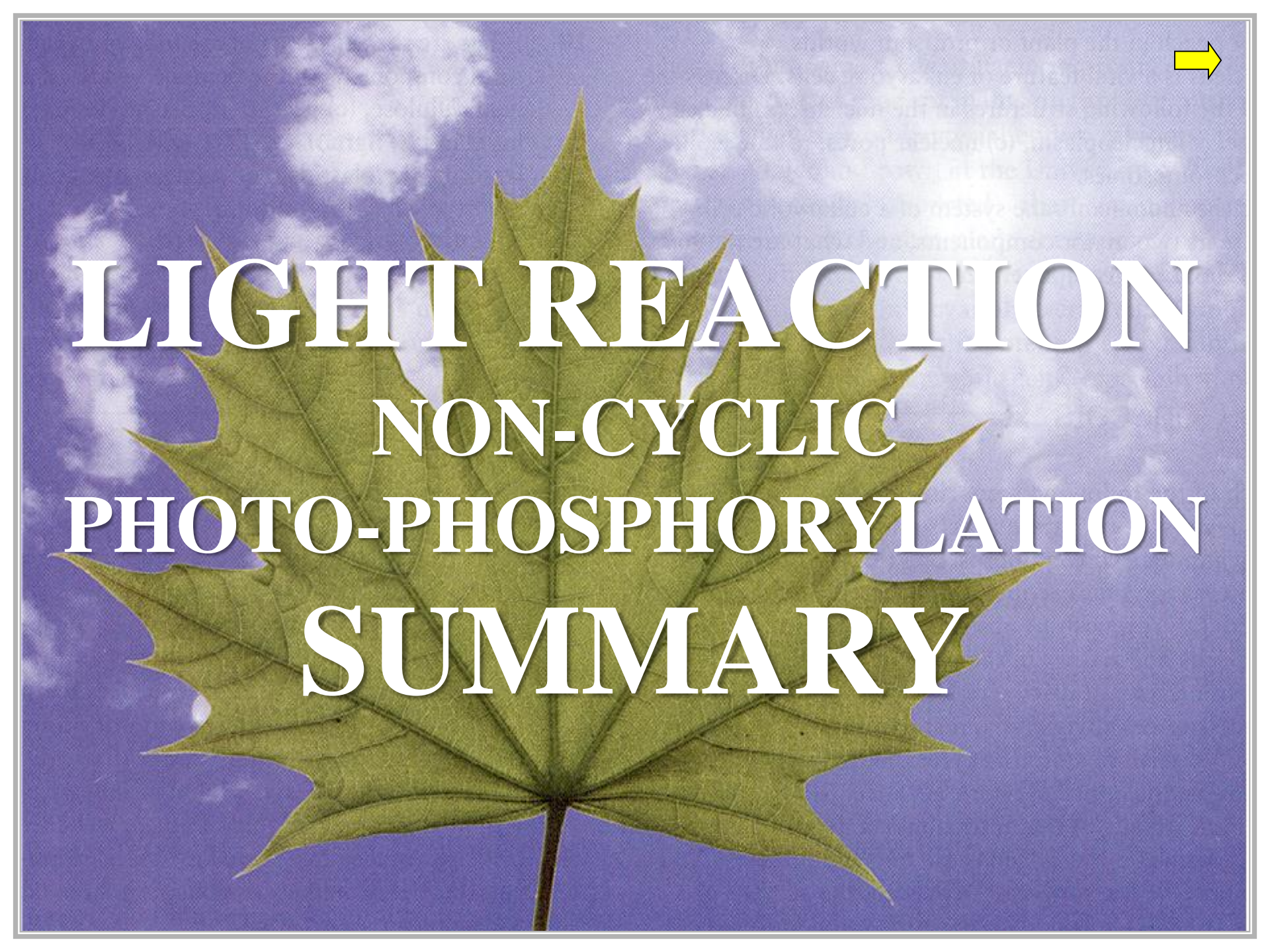
**CHL-A
P700**

P700 REDUCED



REMEBER



A large green maple leaf is centered on a blue sky with white clouds. The text is overlaid on the leaf.

LIGHT REACTION

NON-CYCLIC PHOTO-PHOSPHORYLATION

SUMMARY

