

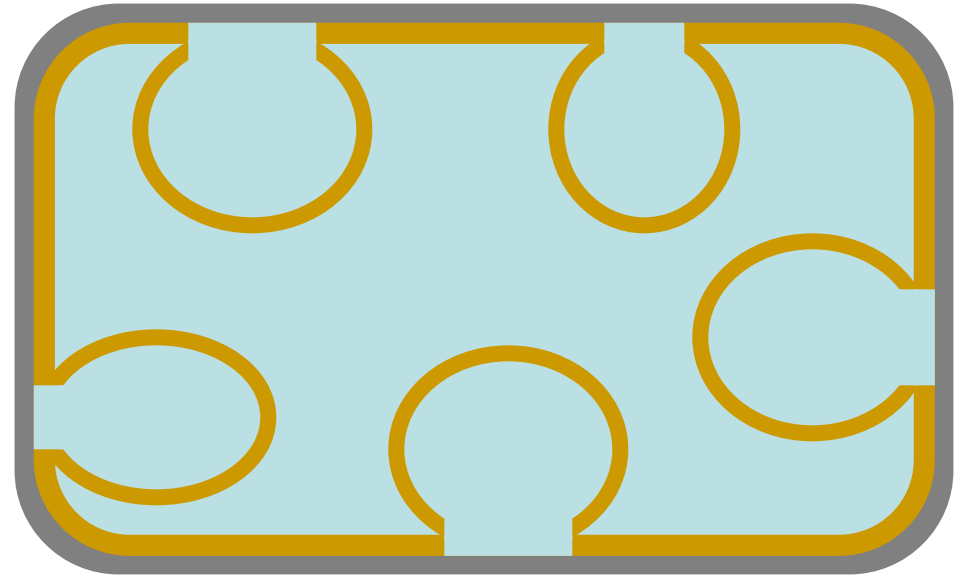


AEROBIC RESPIRATION



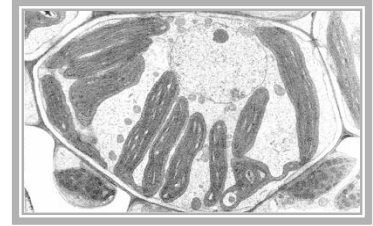
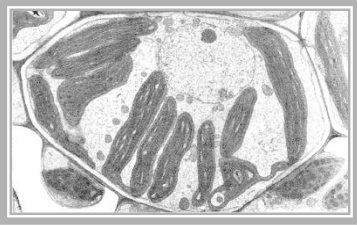
G

K

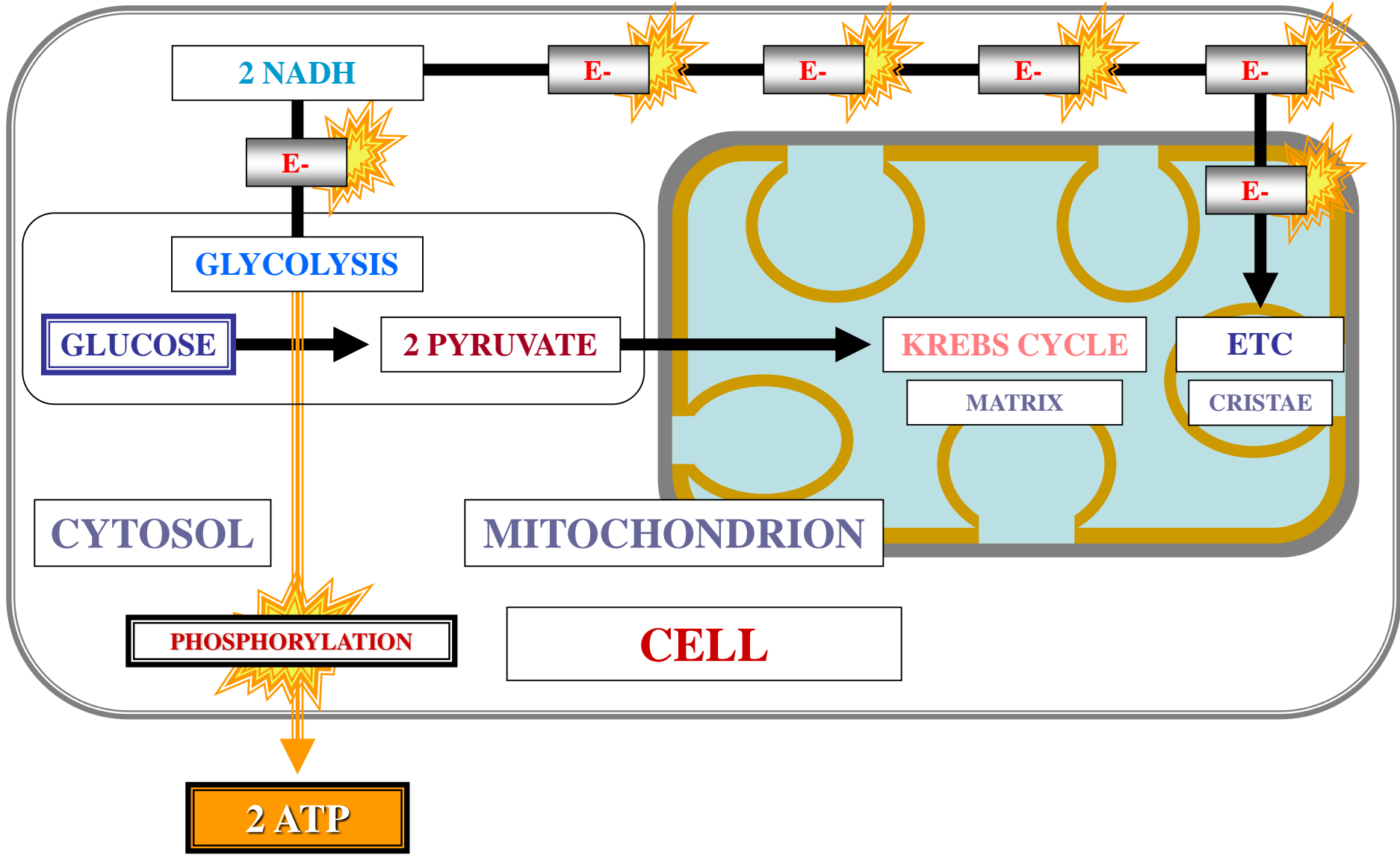


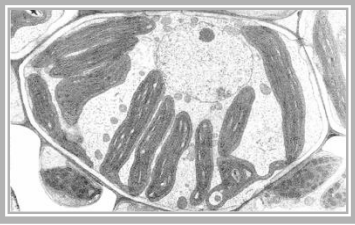
CELL

AEROBIC RESPIRATION

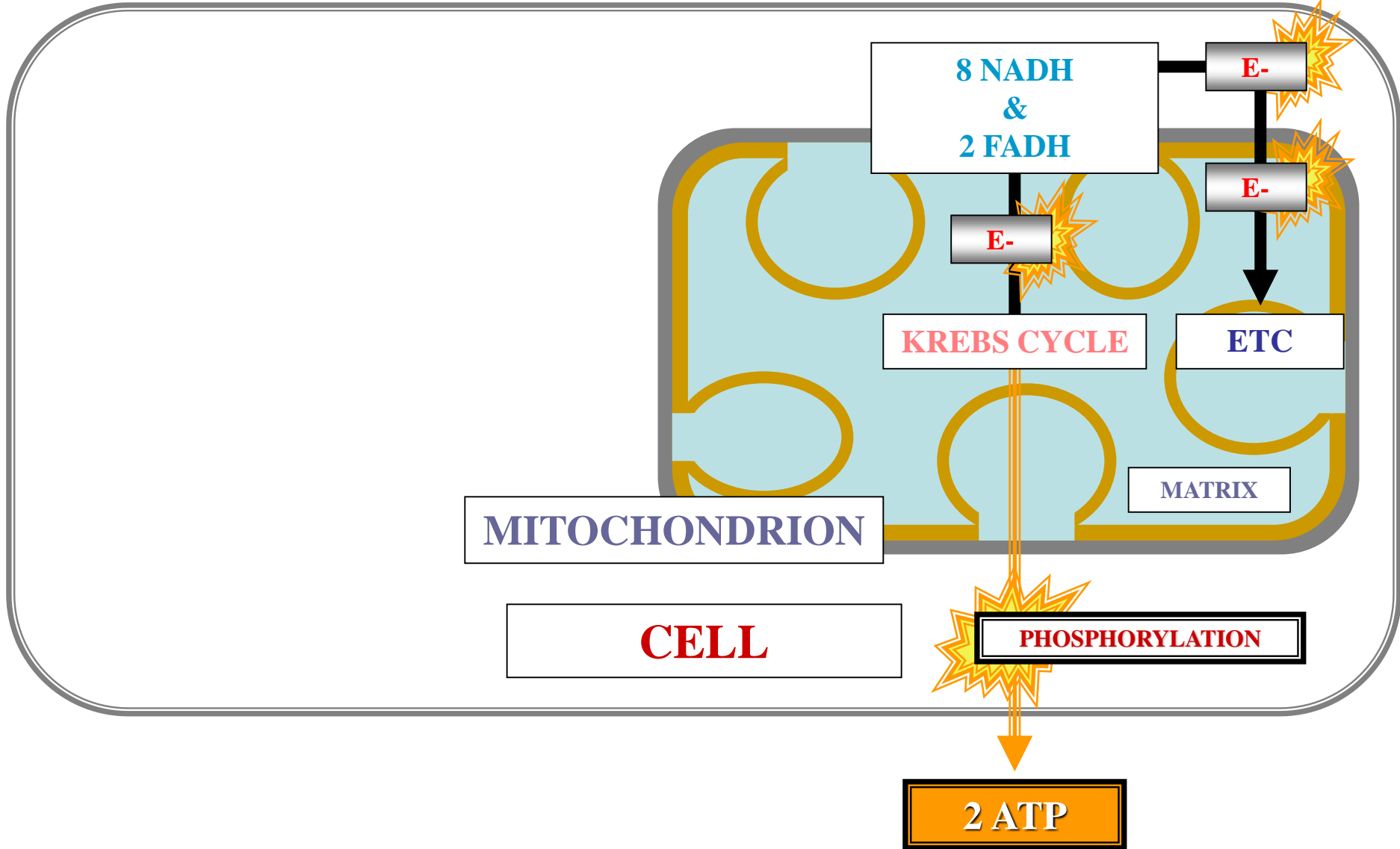
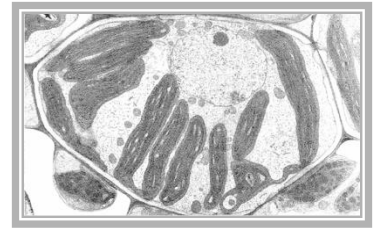


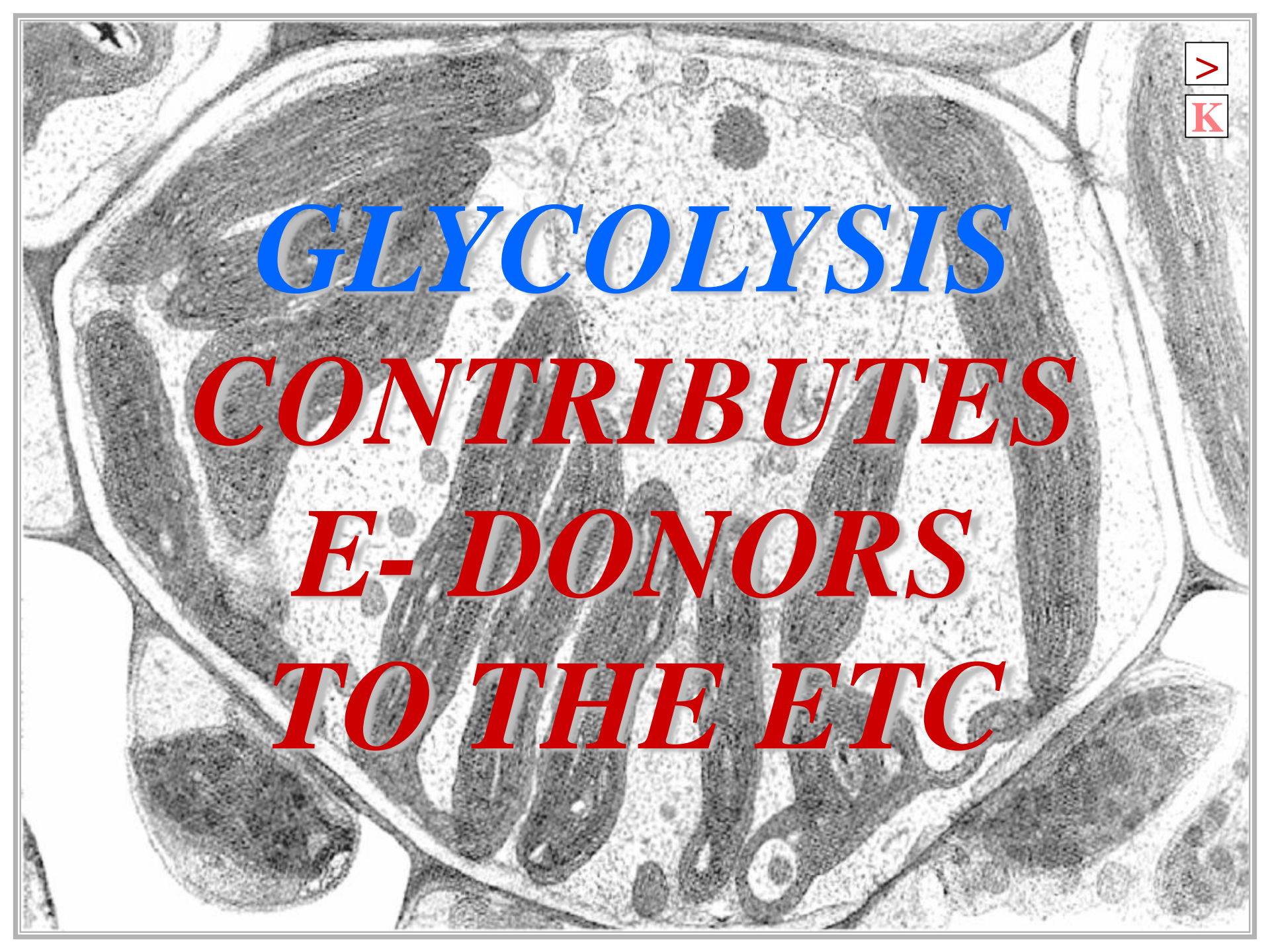
K





AEROBIC RESPIRATION



An electron micrograph showing a cross-section of a cell. The cell contains various organelles, including a large nucleus with a prominent nucleolus, several mitochondria with visible internal folds (cristae), and a network of endoplasmic reticulum. The text is overlaid on the central part of the image.

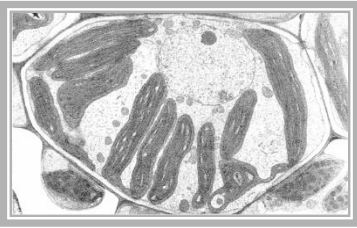
GLYCOLYSIS
CONTRIBUTES
E- DONORS
TO THE ETC



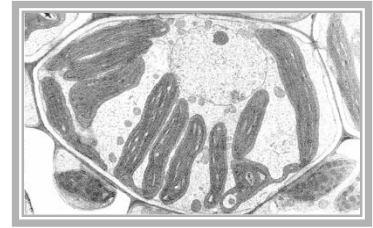
***KREBS CYCLE
CONTRIBUTES
E-DONORS
TO THE ETC***



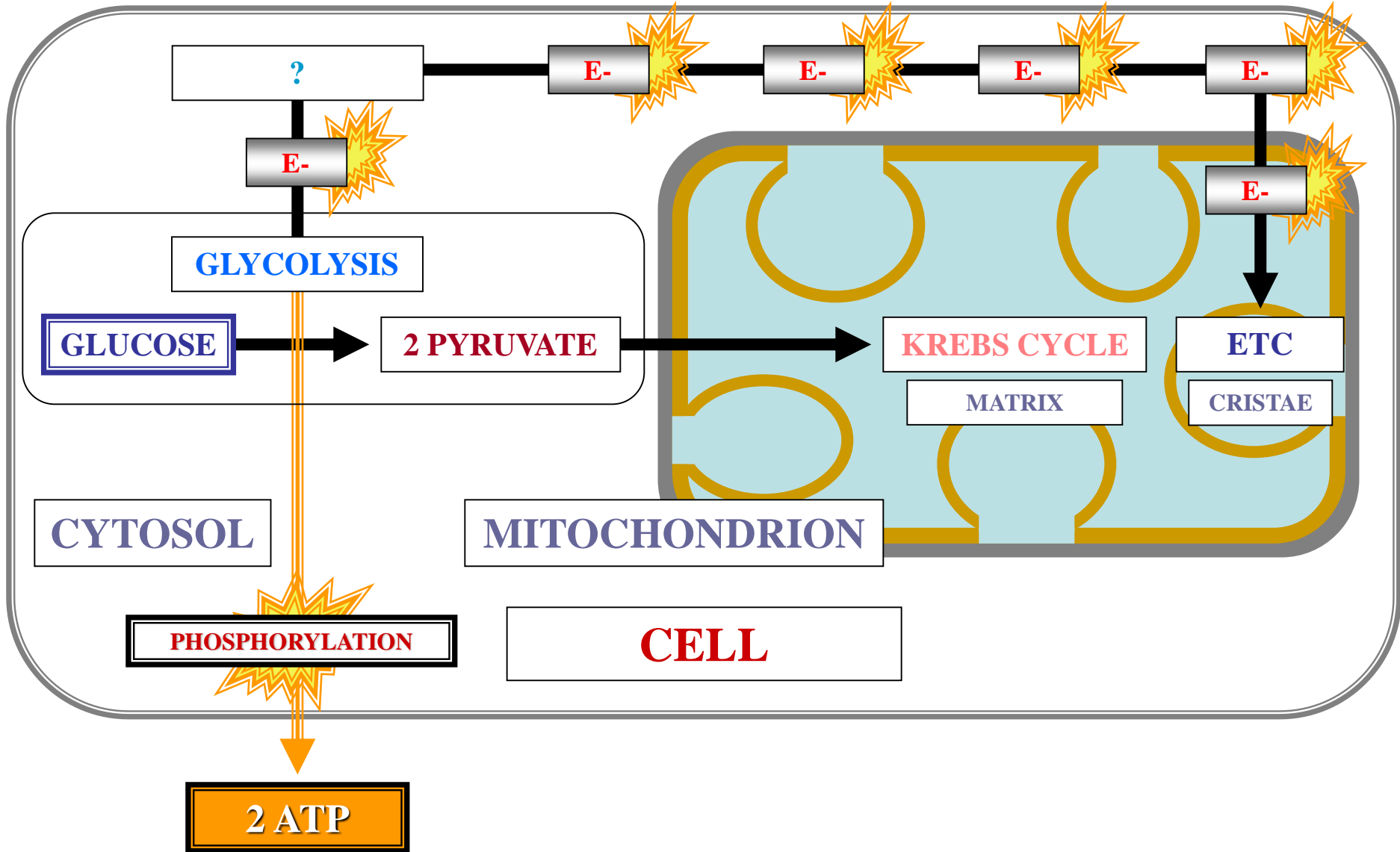
GLYCOLYSIS DERIVED E- DONORS

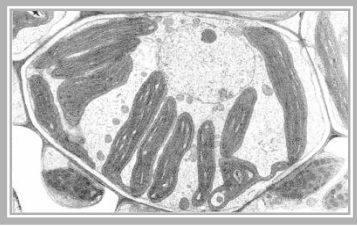


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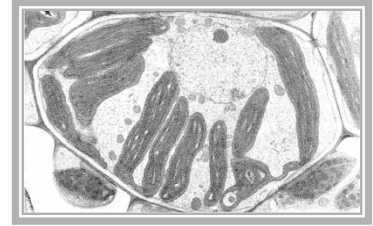


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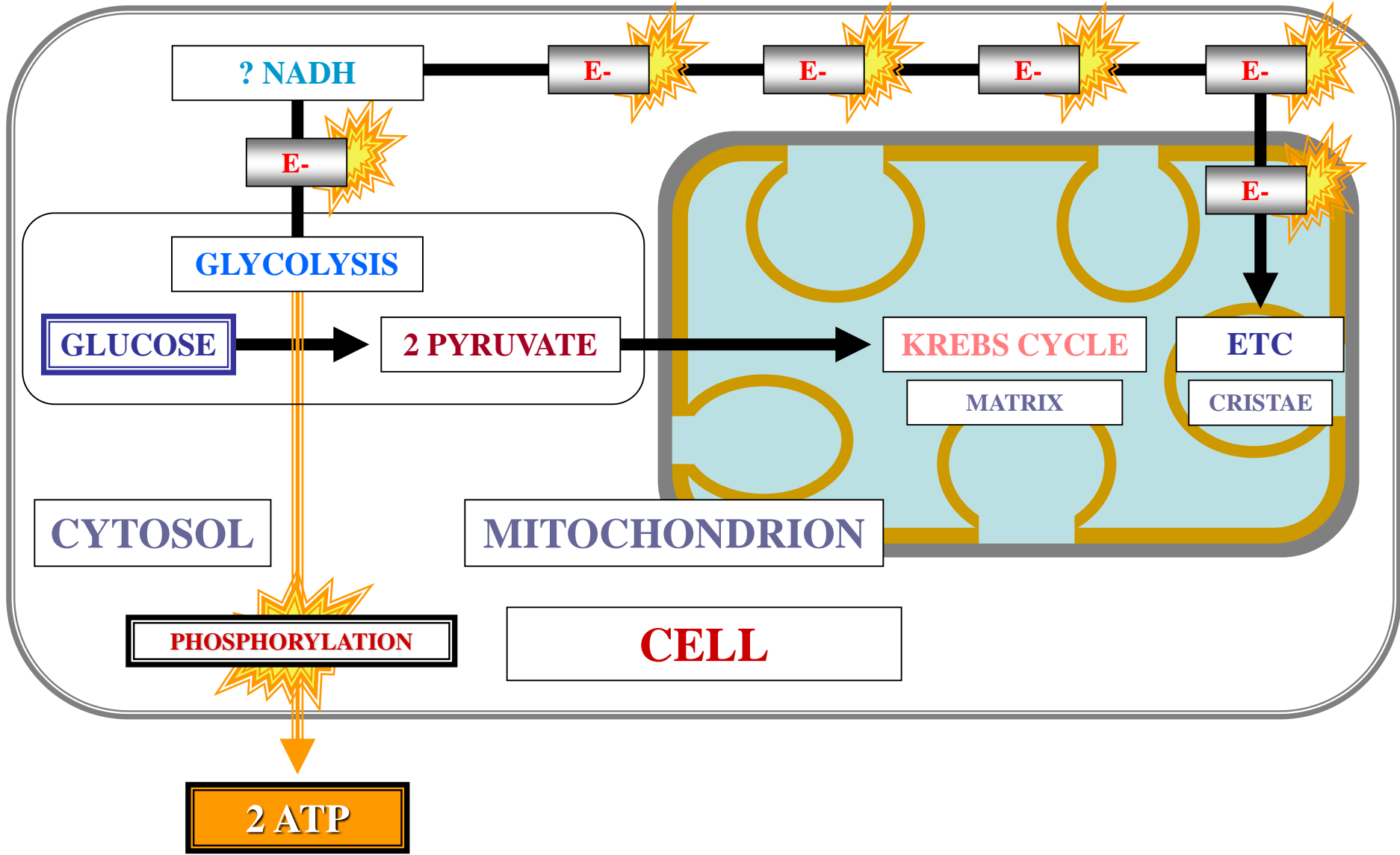




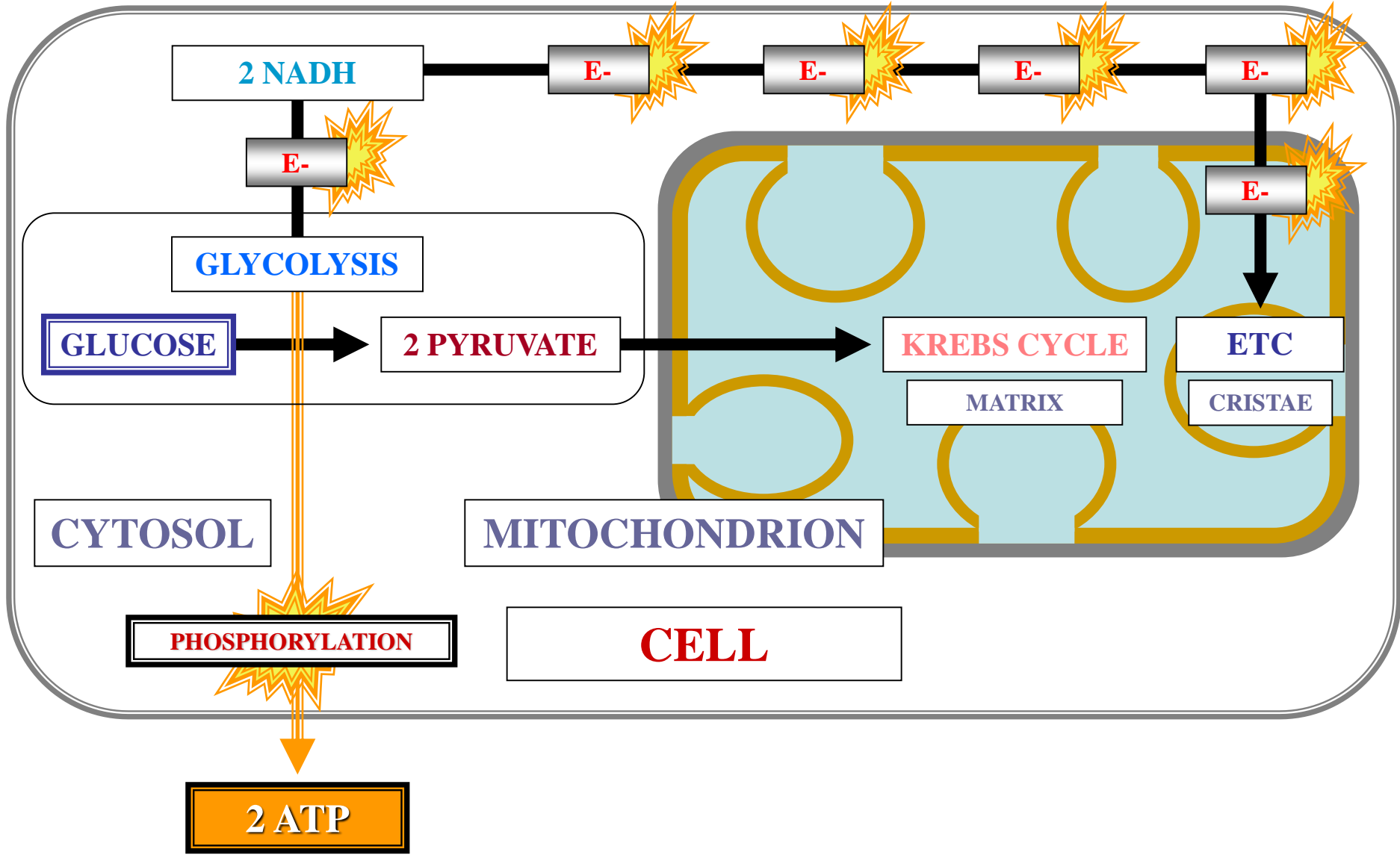
AEROBIC RESPIRATION



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AEROBIC RESPIRATION

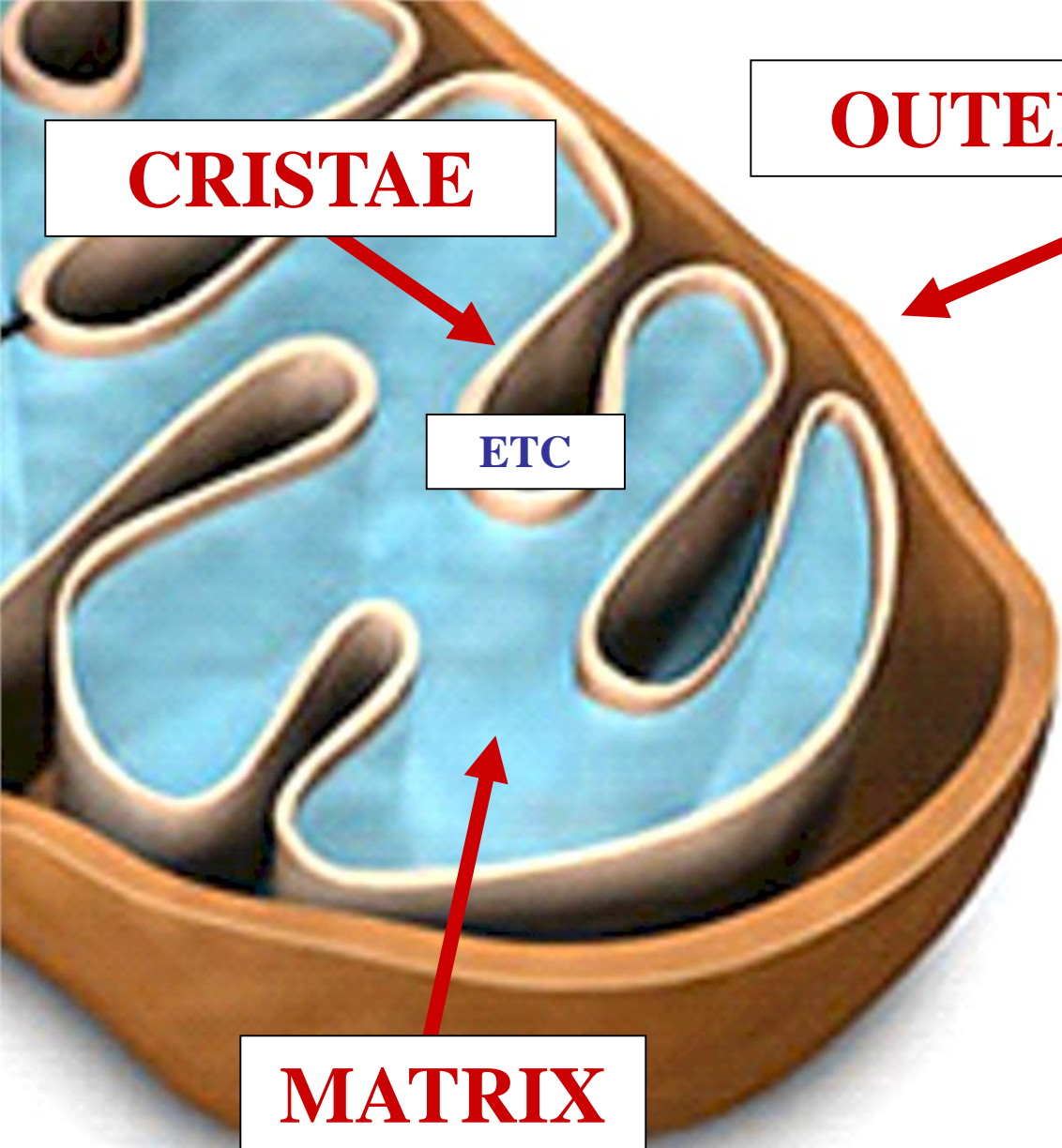




QUESTION

WHERE WITHIN THE
CELL DOES THE
GLYCOLYSIS TAKE PLACE?

QUESTION



CRISTAE

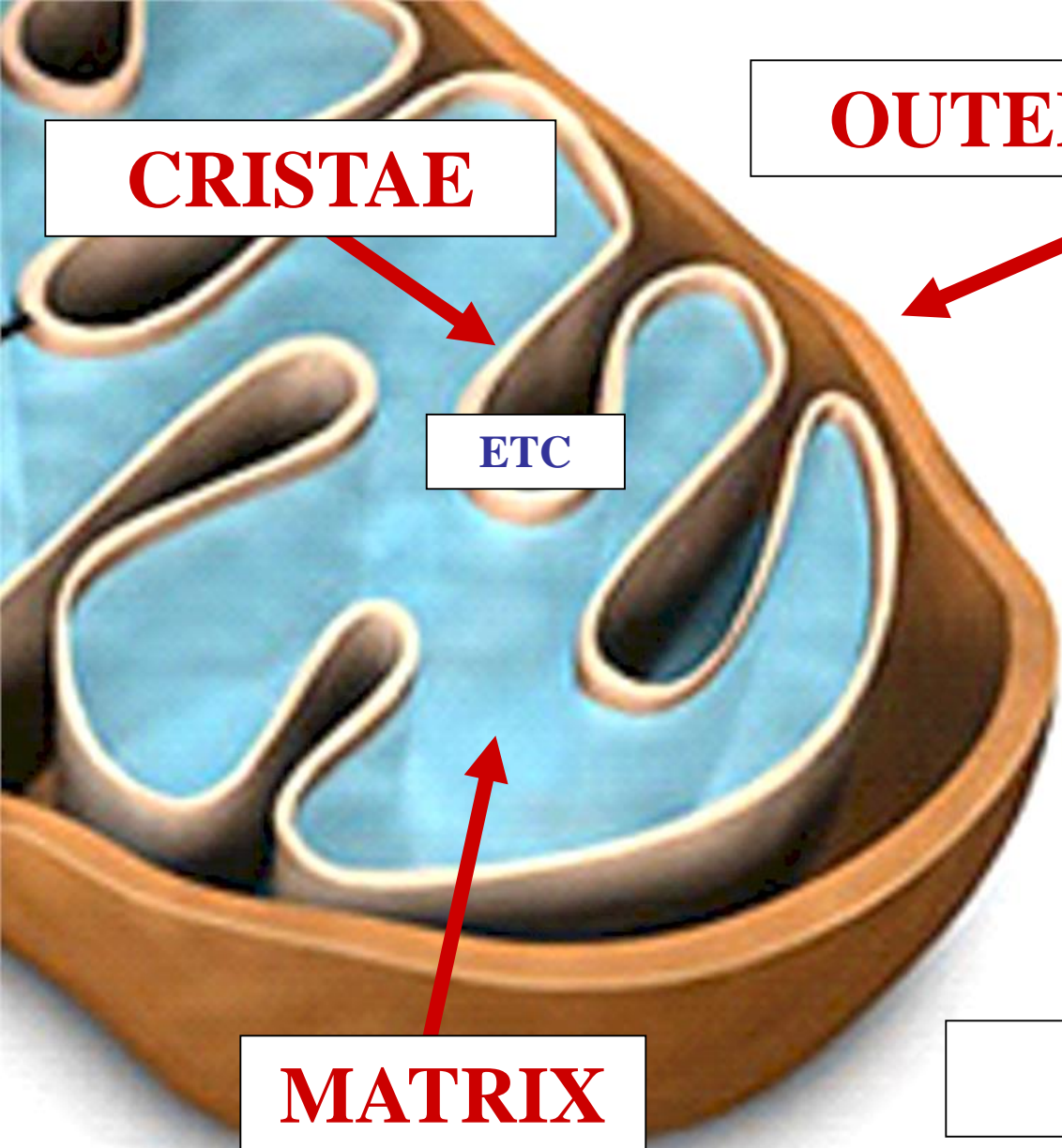
OUTER MEMBRANE

ETC

MATRIX

MITOCHONDRION

CYTOSOL



CRISTAE

OUTER MEMBRANE

ETC

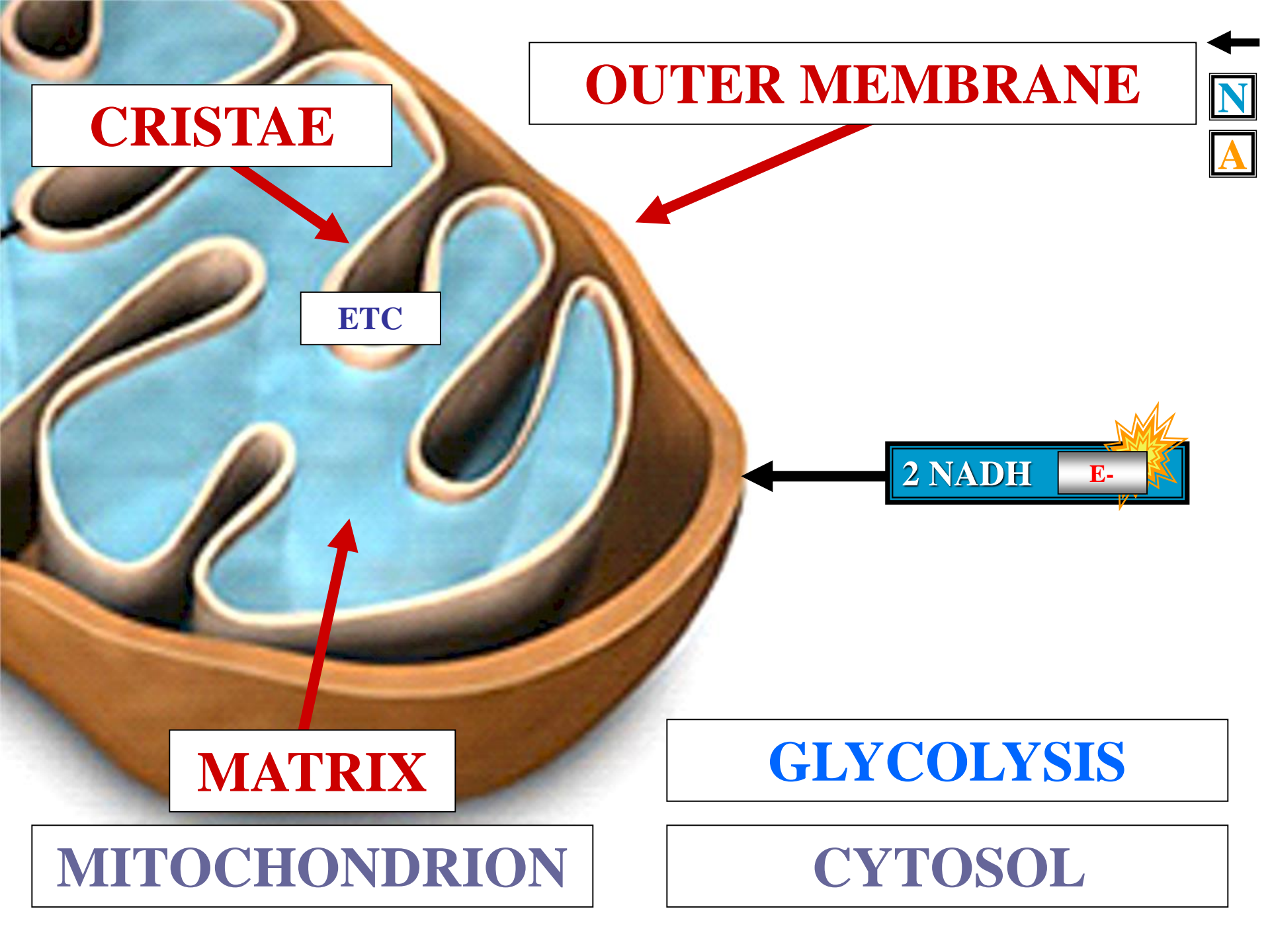
2 NADH **E-**

MATRIX

GLYCOLYSIS

MITOCHONDRION

CYTOSOL



CRISTAE

OUTER MEMBRANE

ETC

MATRIX

MITOCHONDRION

2 NADH **E-**

GLYCOLYSIS

CYTOSOL



OUTER MEMBRANE

CRISTAE

ETC

?

2 ATP

2 NADH **E-**

2 ADP

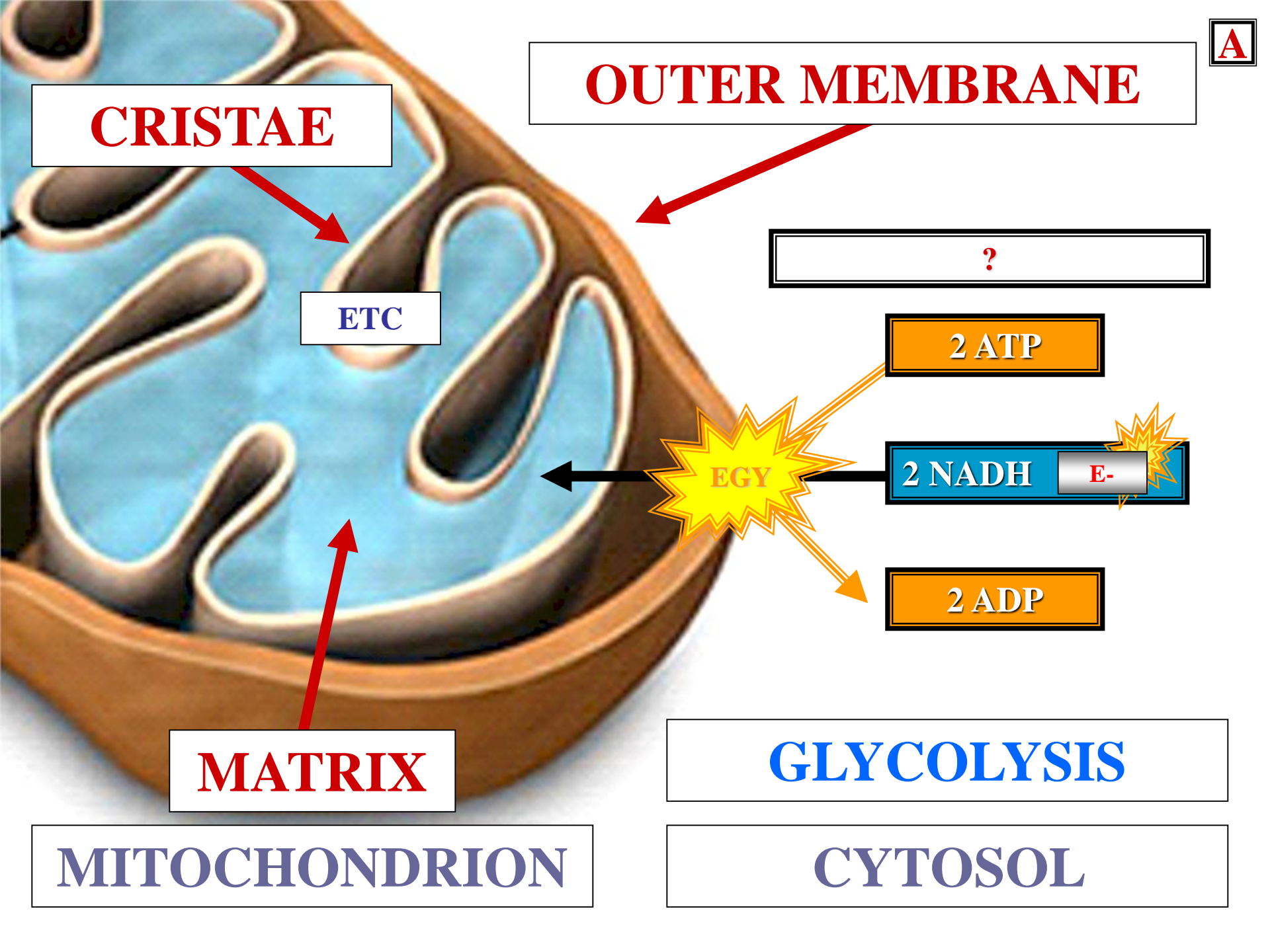
EGY

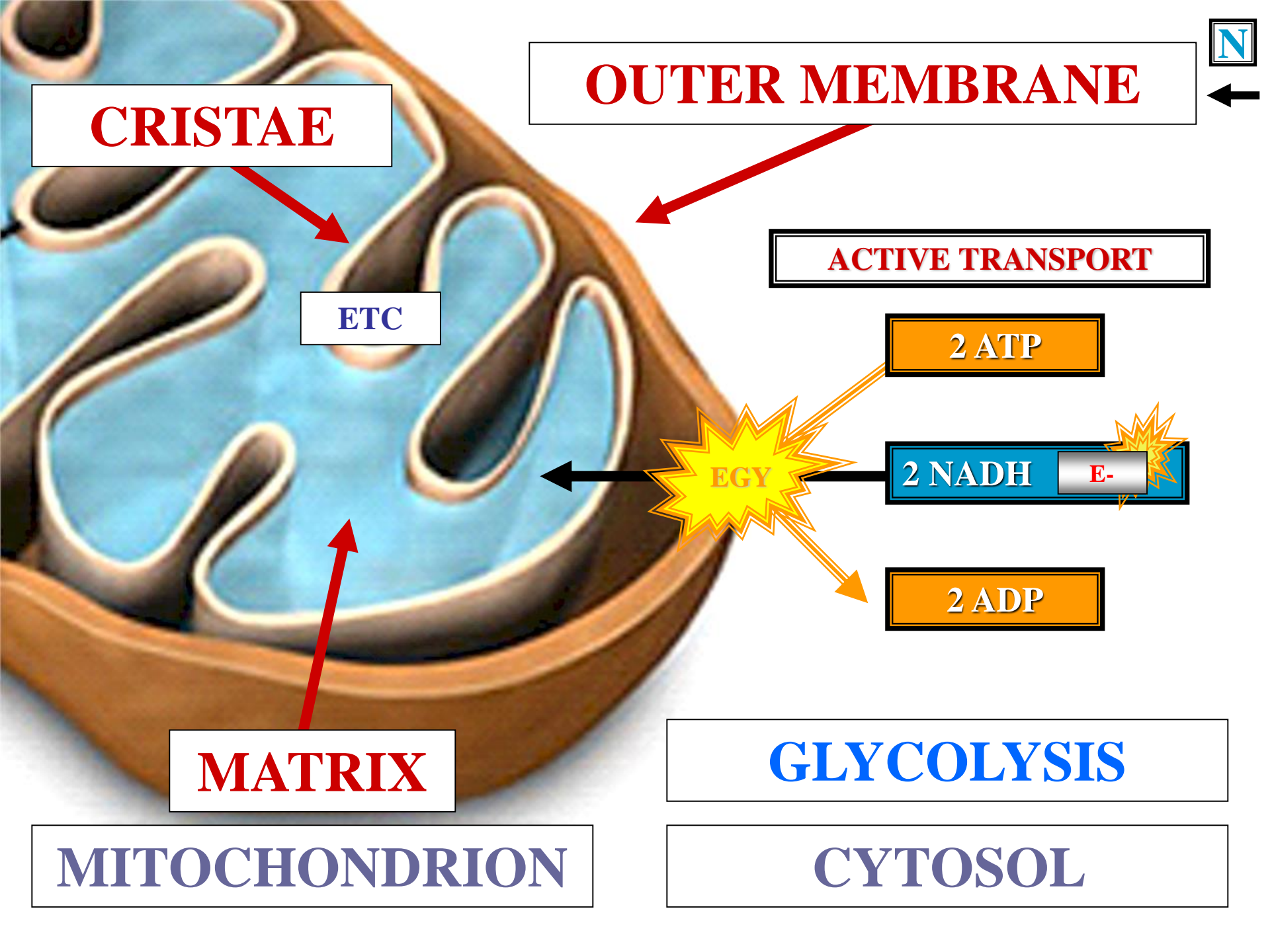
MATRIX

GLYCOLYSIS

MITOCHONDRION

CYTOSOL





N



OUTER MEMBRANE

CRISTAE

ACTIVE TRANSPORT

ETC

2 ATP

EGY

2 NADH

E-

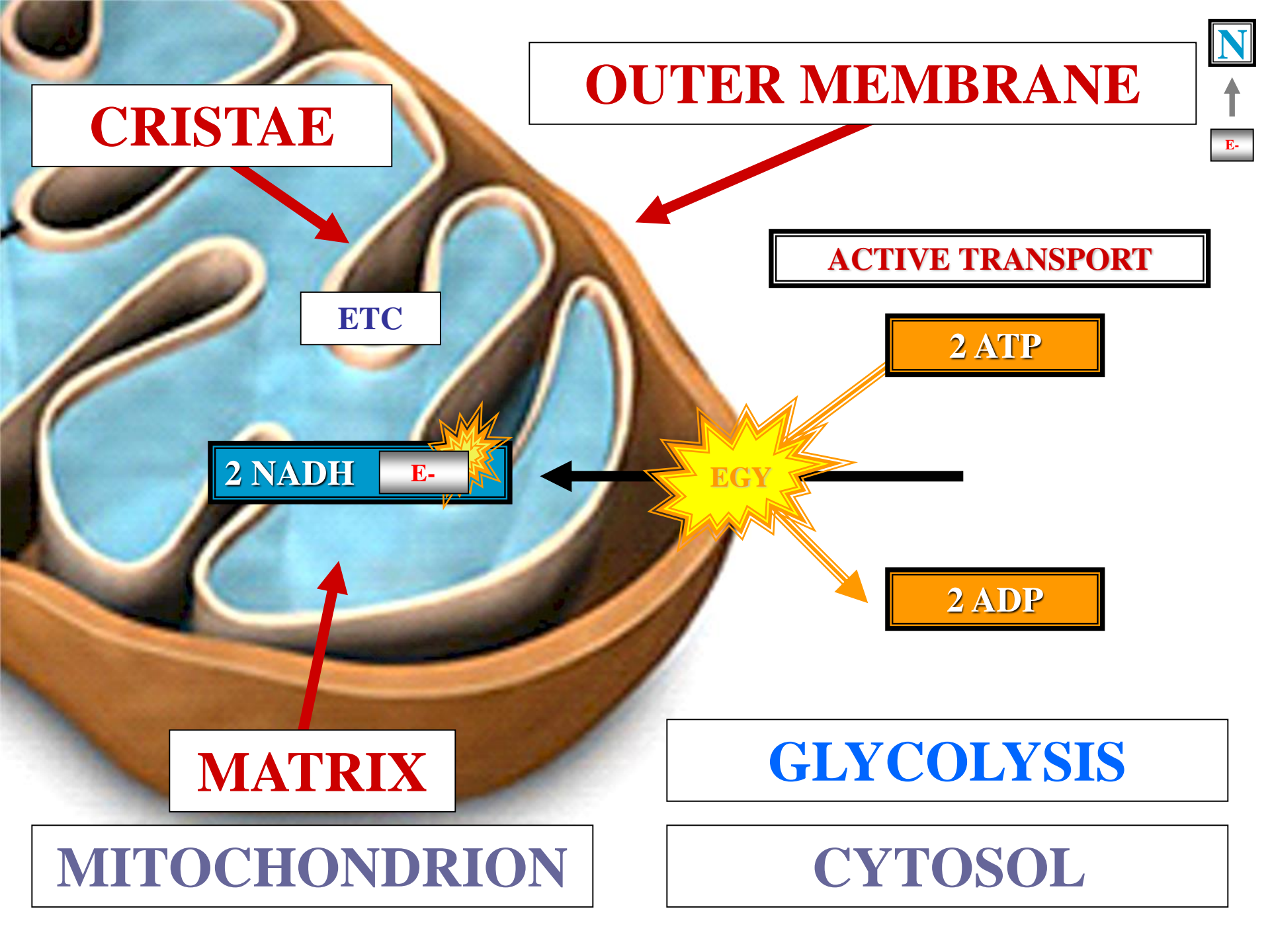
2 ADP

MATRIX

GLYCOLYSIS

MITOCHONDRION

CYTOSOL



N

↑

E-

OUTER MEMBRANE

CRISTAE

ACTIVE TRANSPORT

ETC

2 ATP

2 NADH

E-

EGY

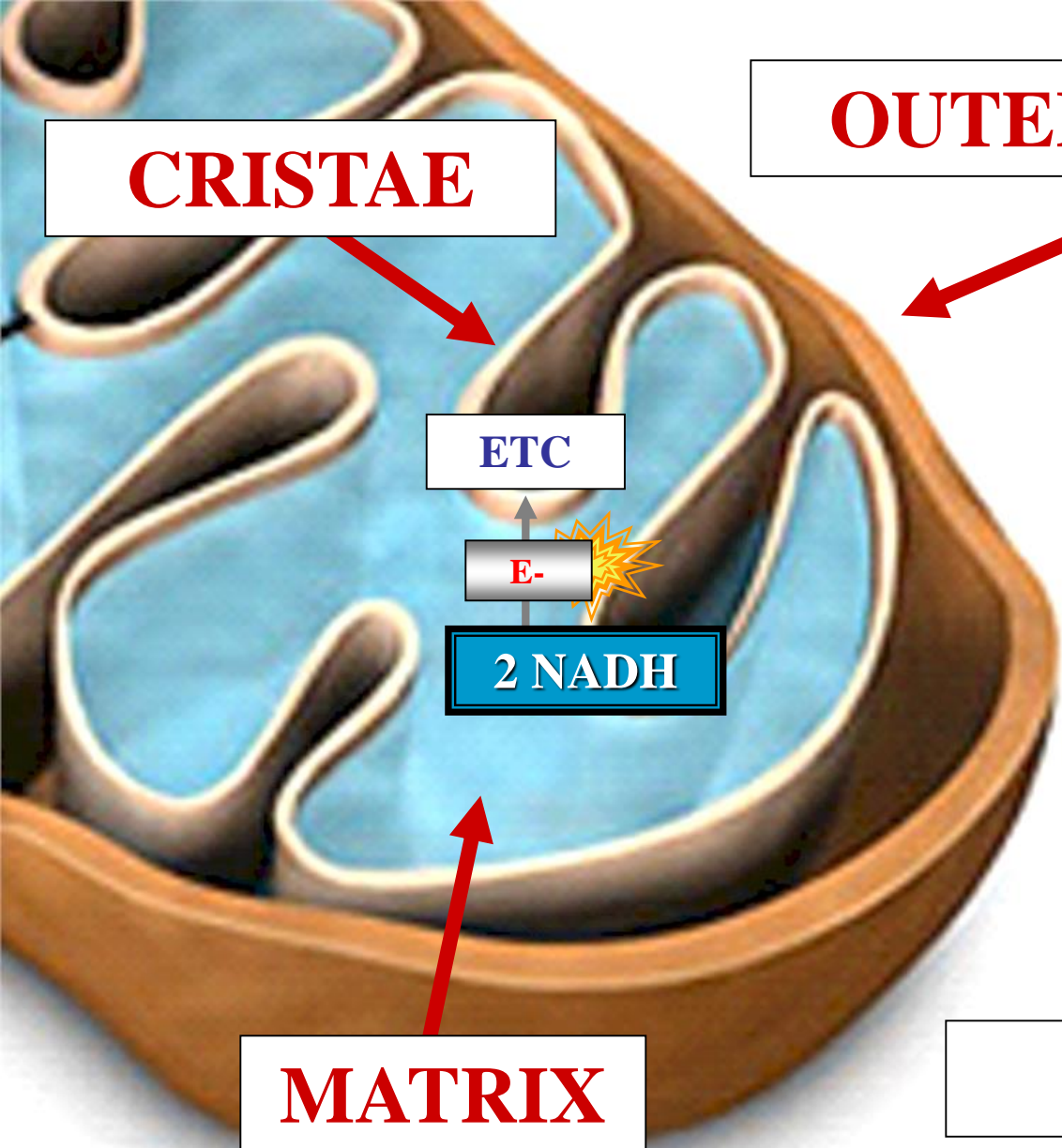
2 ADP

MATRIX

GLYCOLYSIS

MITOCHONDRION

CYTOSOL



OUTER MEMBRANE

CRISTAE

ETC

E-

2 NADH

MATRIX

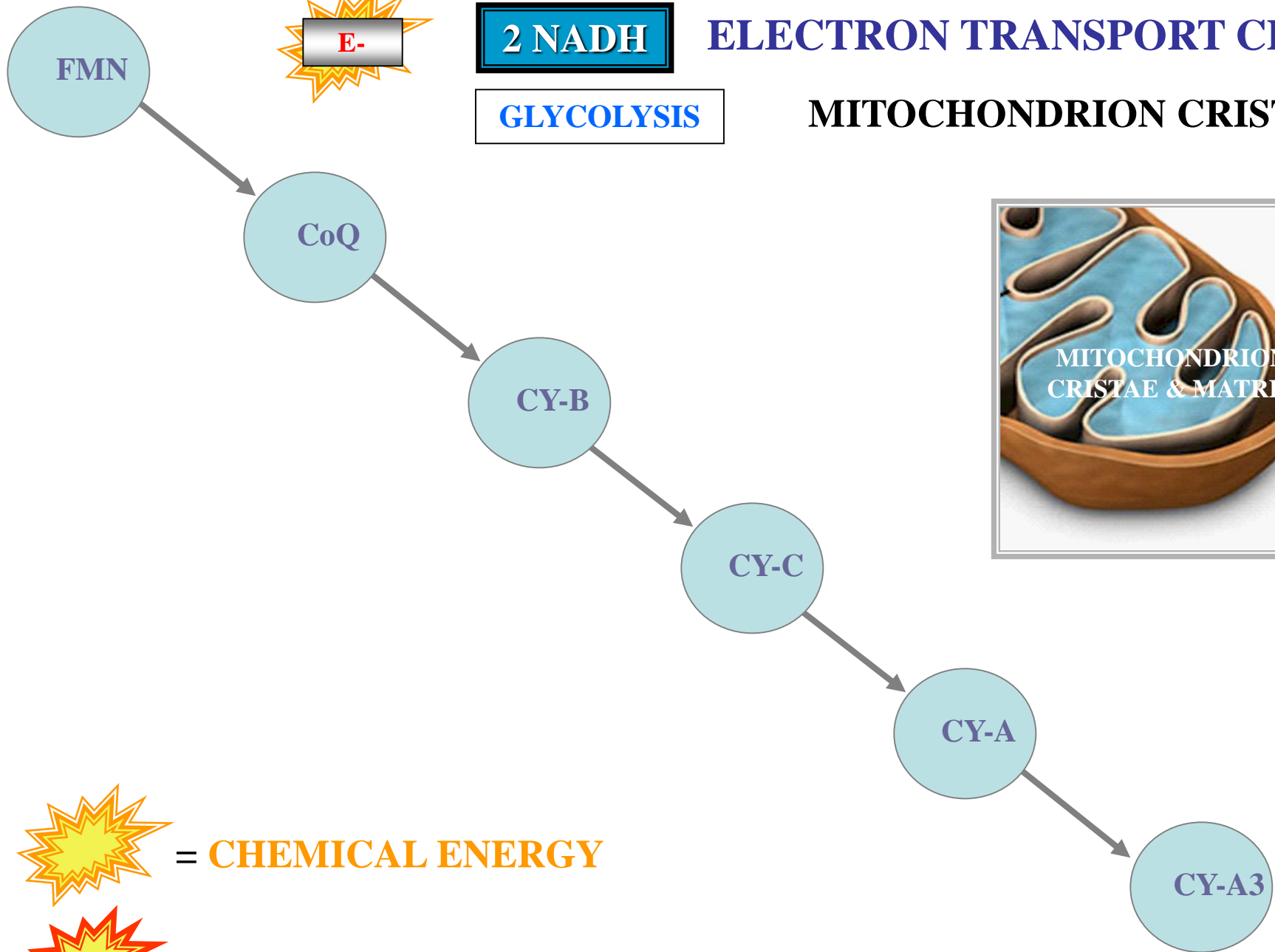
MITOCHONDRION

GLYCOLYSIS

CELL CYTOSOL

ELECTRON TRANSPORT CHAIN

MITOCHONDRION CRISTAE



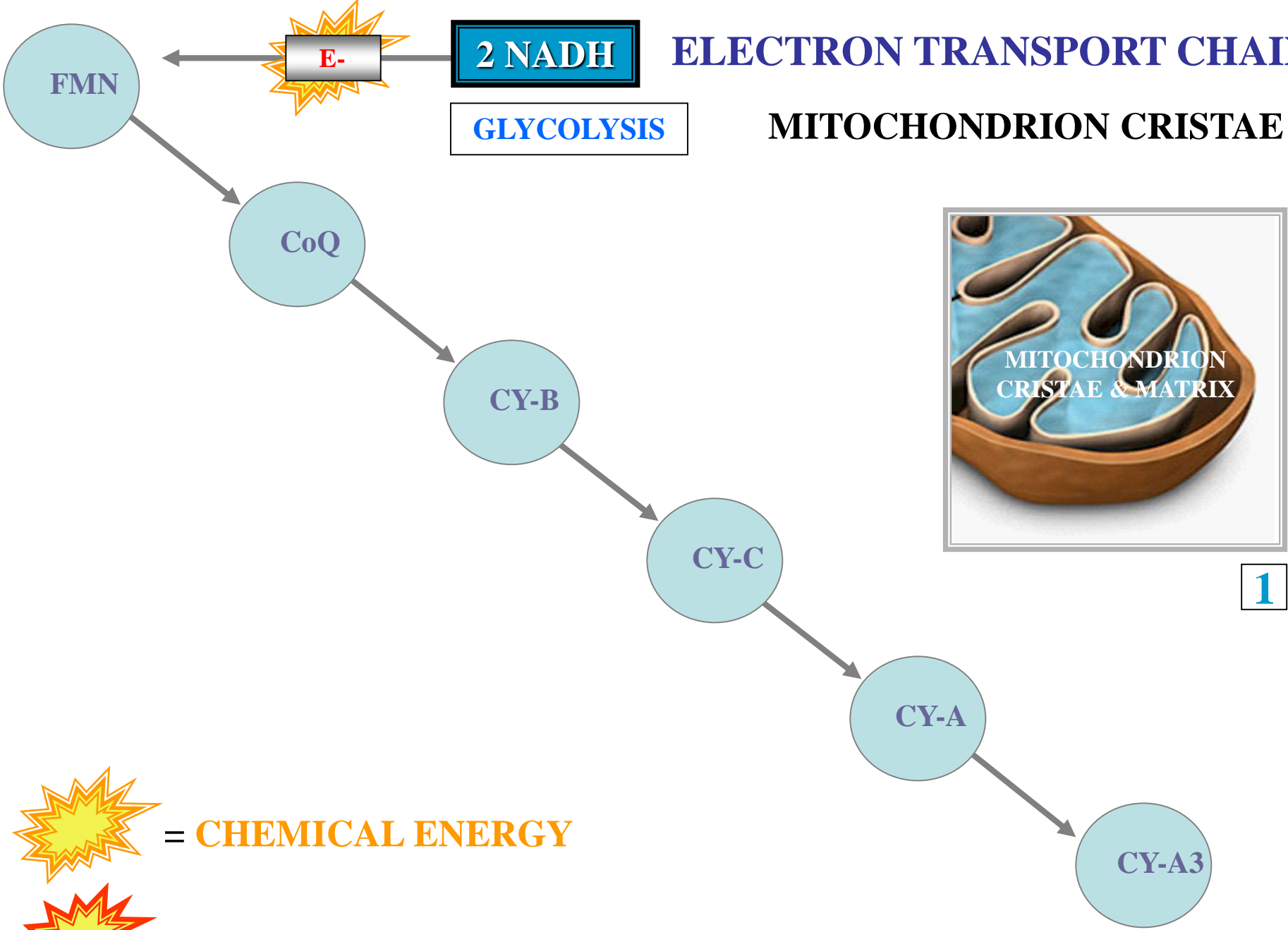
= CHEMICAL ENERGY



= DISSIPATED HEAT ENERGY

ELECTRON TRANSPORT CHAIN

MITOCHONDRION CRISTAE

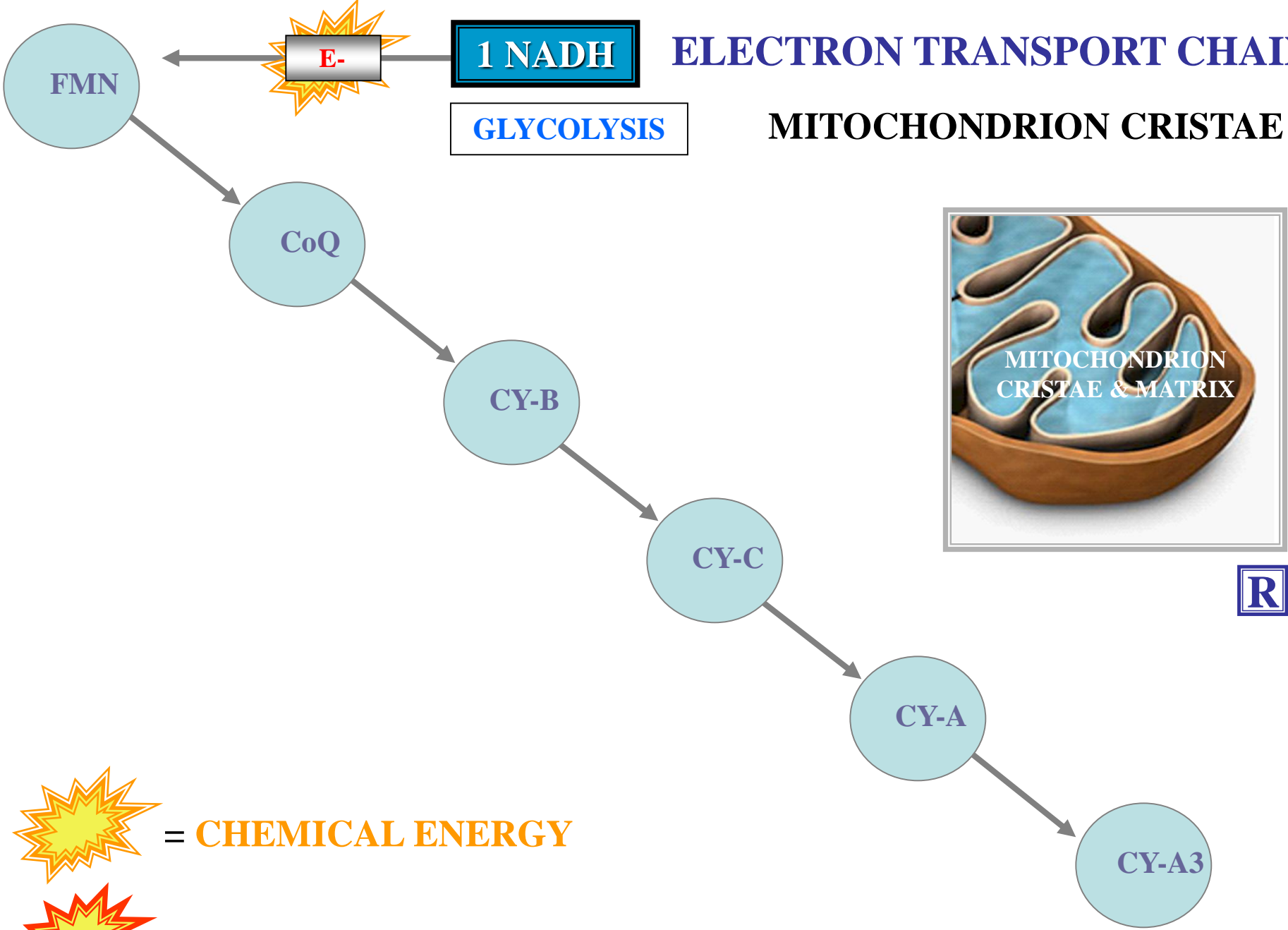


 = **CHEMICAL ENERGY**

 = **DISSIPATED HEAT ENERGY**

ELECTRON TRANSPORT CHAIN

MITOCHONDRION CRISTAE



E-

1 NADH

GLYCOLYSIS

FMN

CoQ

CY-B

CY-C

CY-A

CY-A3

MITOCHONDRION CRISTAE & MATRIX

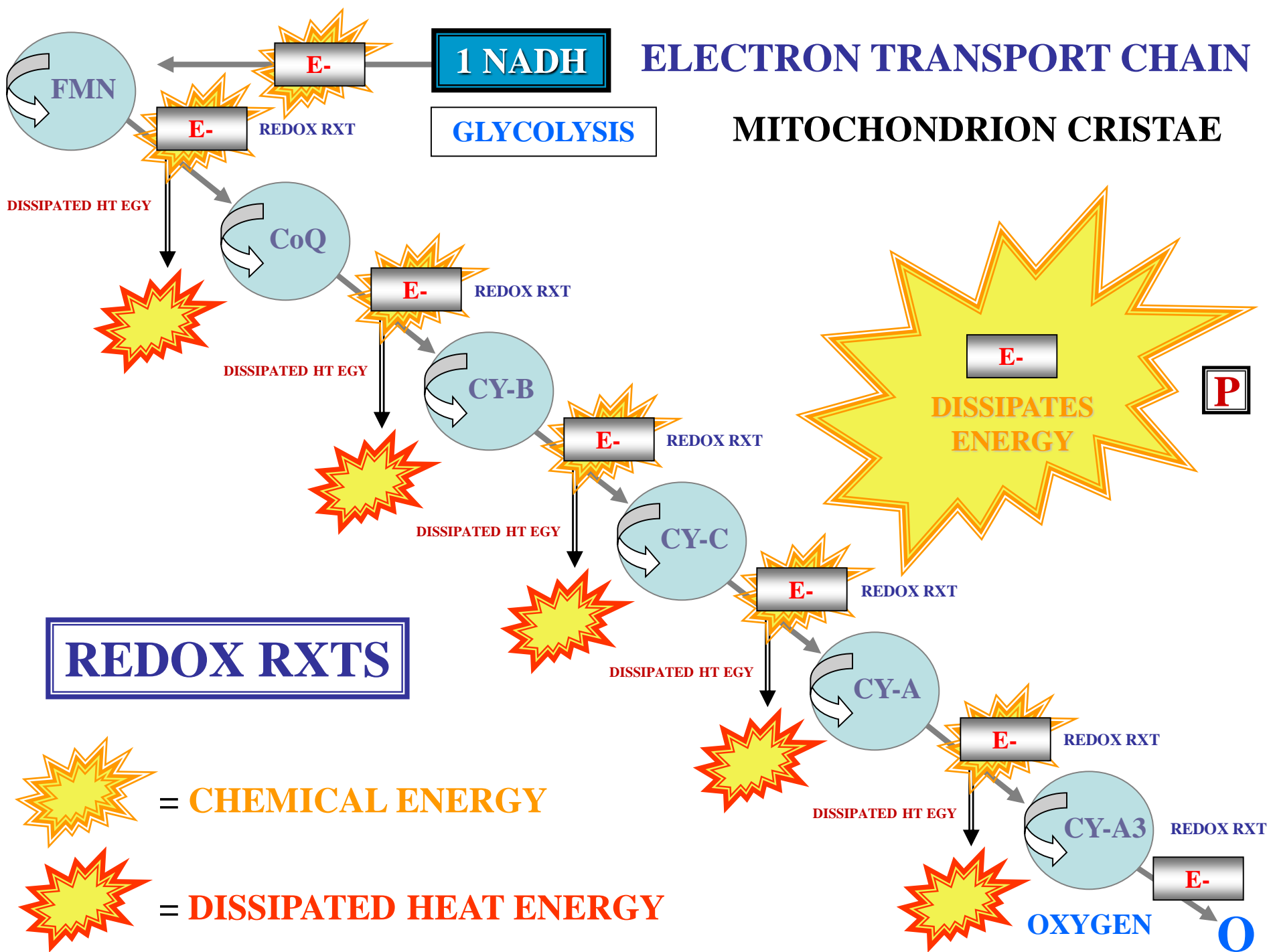
R

= CHEMICAL ENERGY

= DISSIPATED HEAT ENERGY

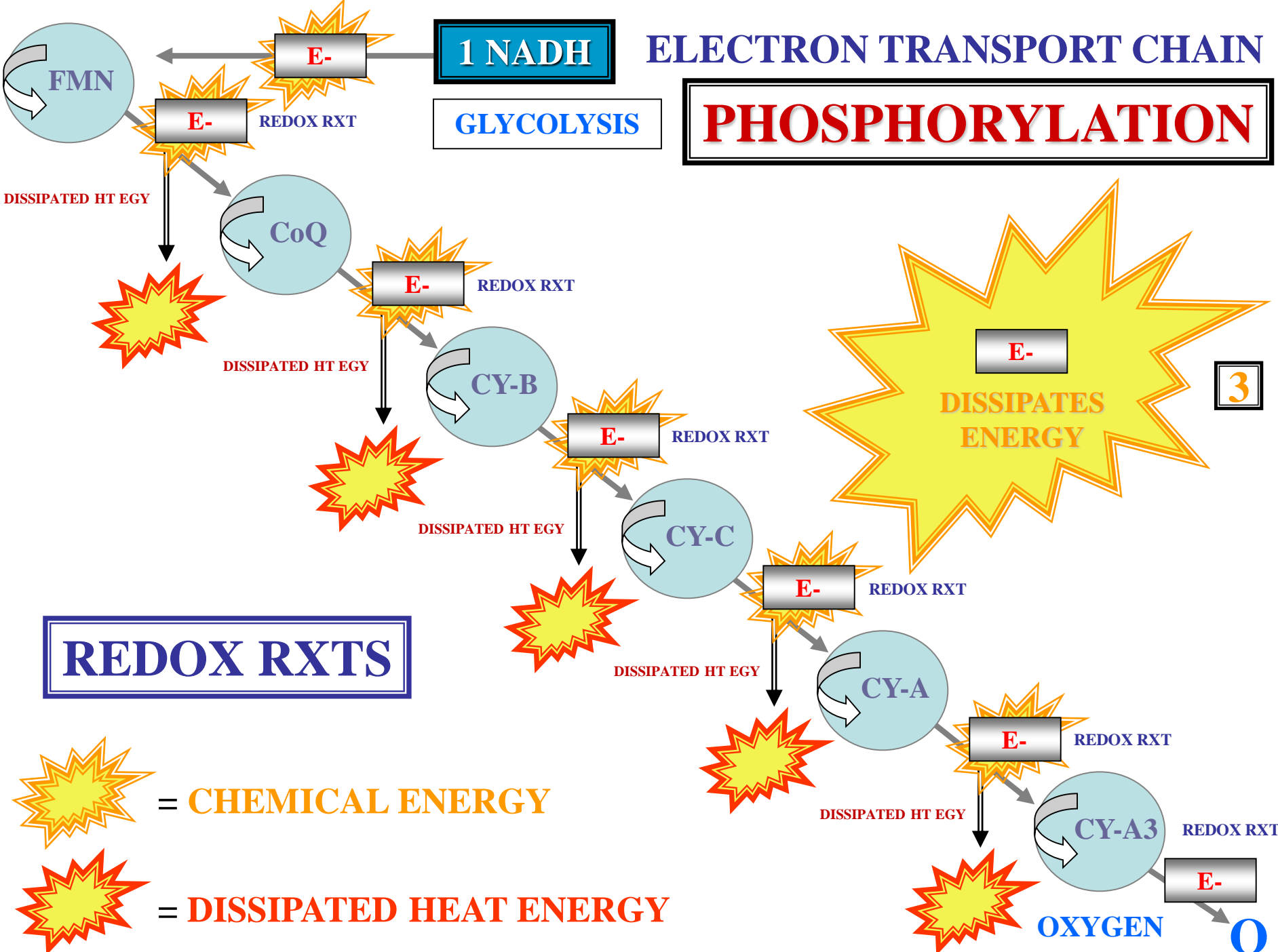
ELECTRON TRANSPORT CHAIN

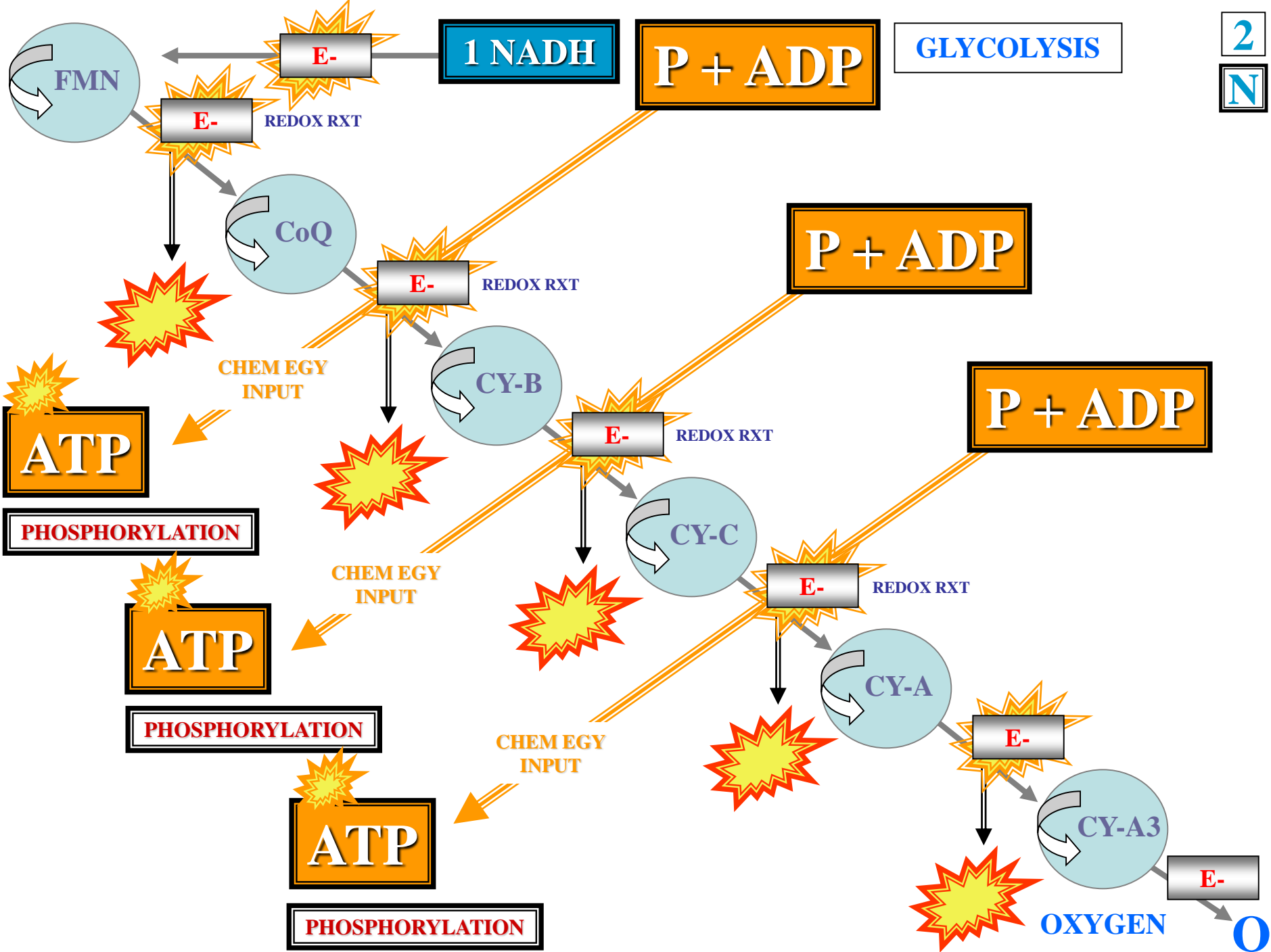
MITOCHONDRION CRISTAE



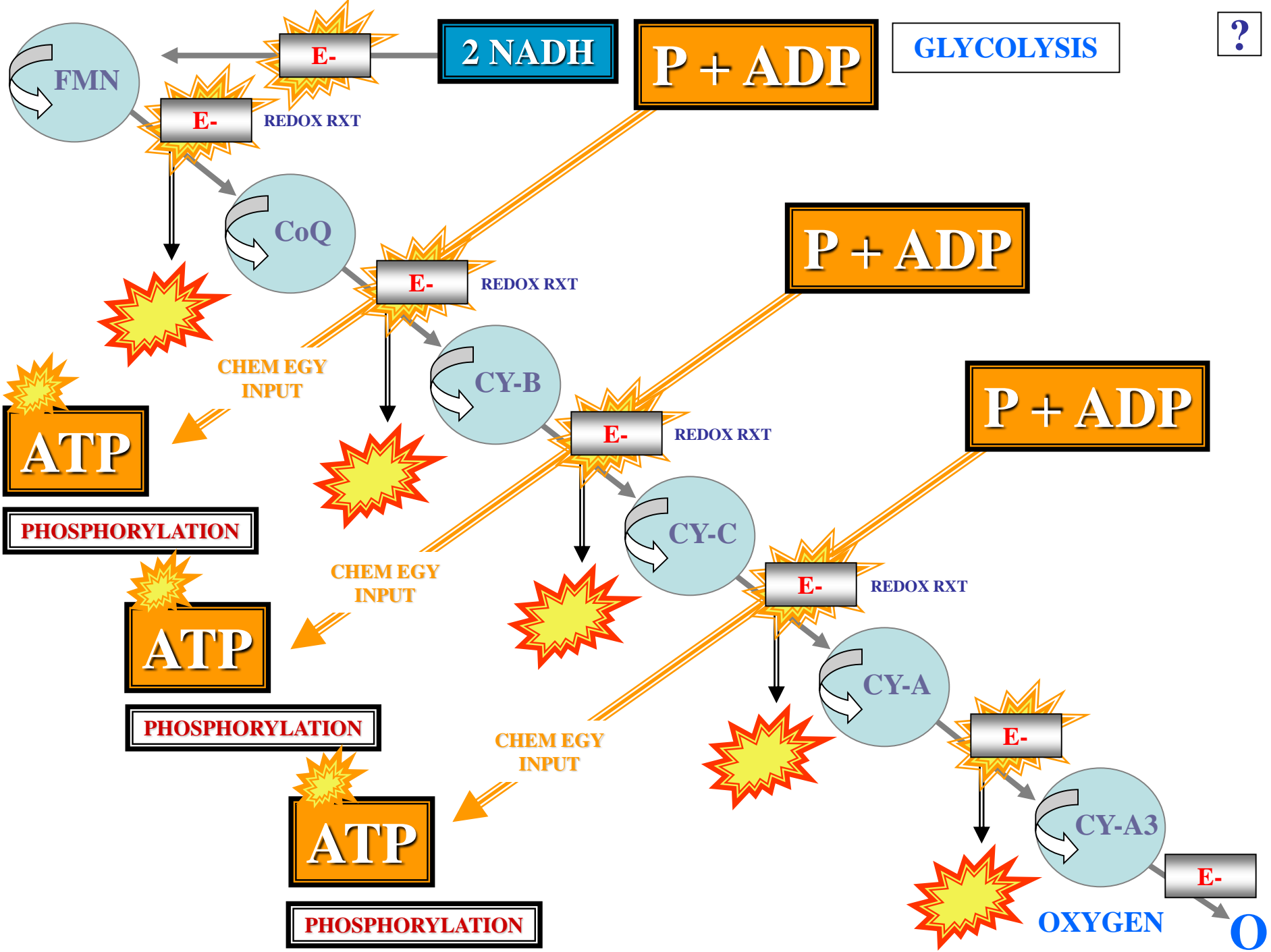
ELECTRON TRANSPORT CHAIN

PHOSPHORYLATION





?





QUESTION

HOW MANY GROSS ATP
PHOSPHORLATIONS
VIA GLYCOLYSIS
NADH?

QUESTION



6 ATP

PHOSPHORYLATIONS

VIA GLYCOLYSIS

NADH

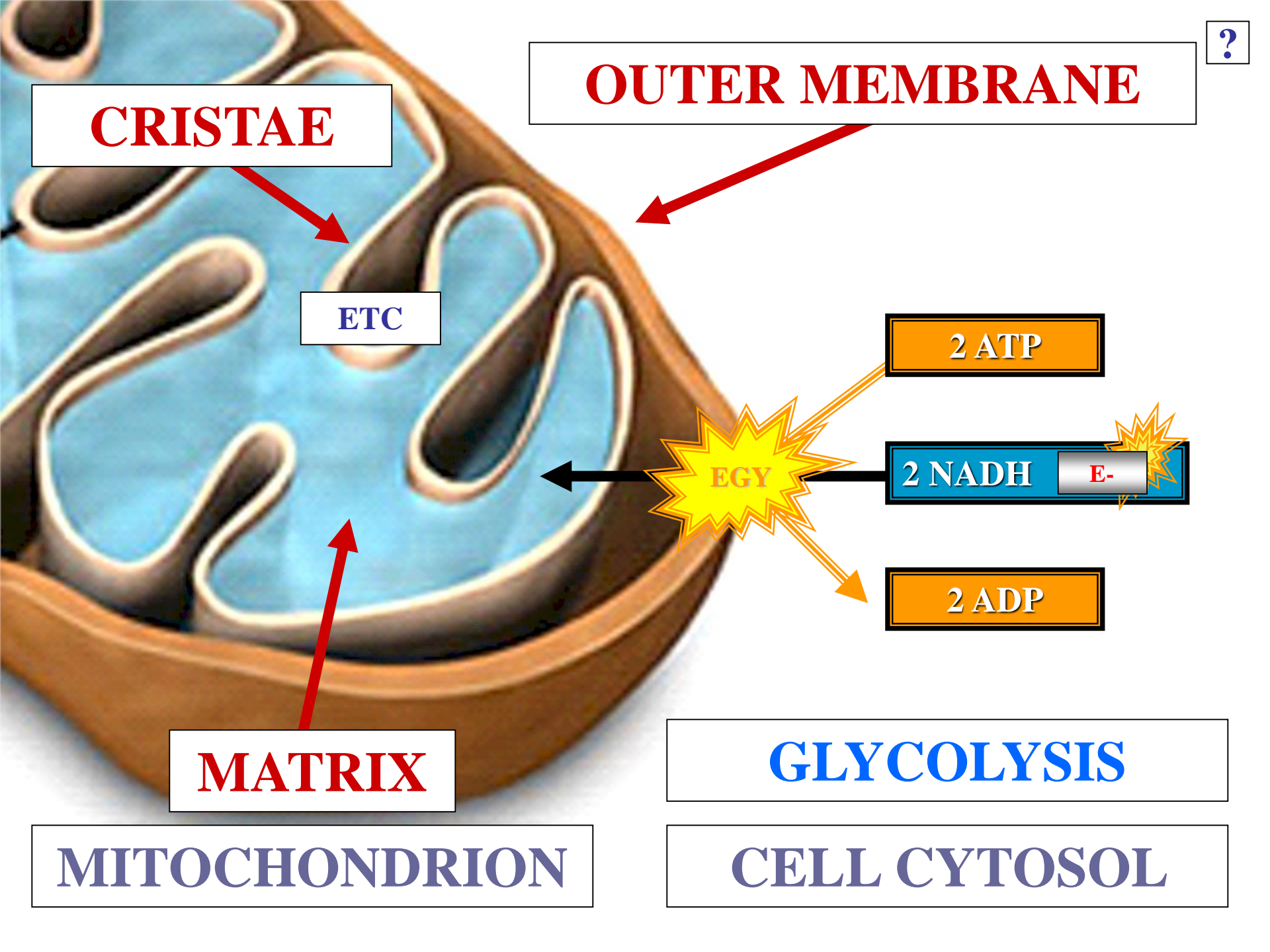
E- DONORS



QUESTION

HOW MANY NET ATP
PHOSPHORLATIONS
VIA GLYCOLYSIS
NADH?

QUESTION



?

OUTER MEMBRANE

CRISTAE

ETC

2 ATP

2 NADH **E^-**

2 ADP

MATRIX

GLYCOLYSIS

MITOCHONDRION

CELL CYTOSOL

QUESTION

HOW MANY NET ATP
PHOSPHORYLATIONS
VIA GLYCOLYSIS
NADH?

QUESTION

4 ATP

PHOSPHORYLATIONS

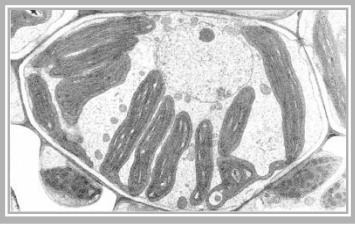
VIA GLYCOLYSIS

NADH

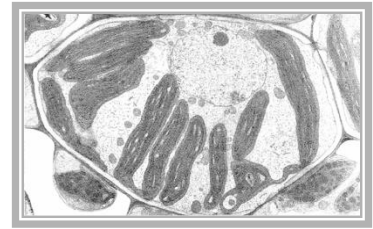
E- DONORS



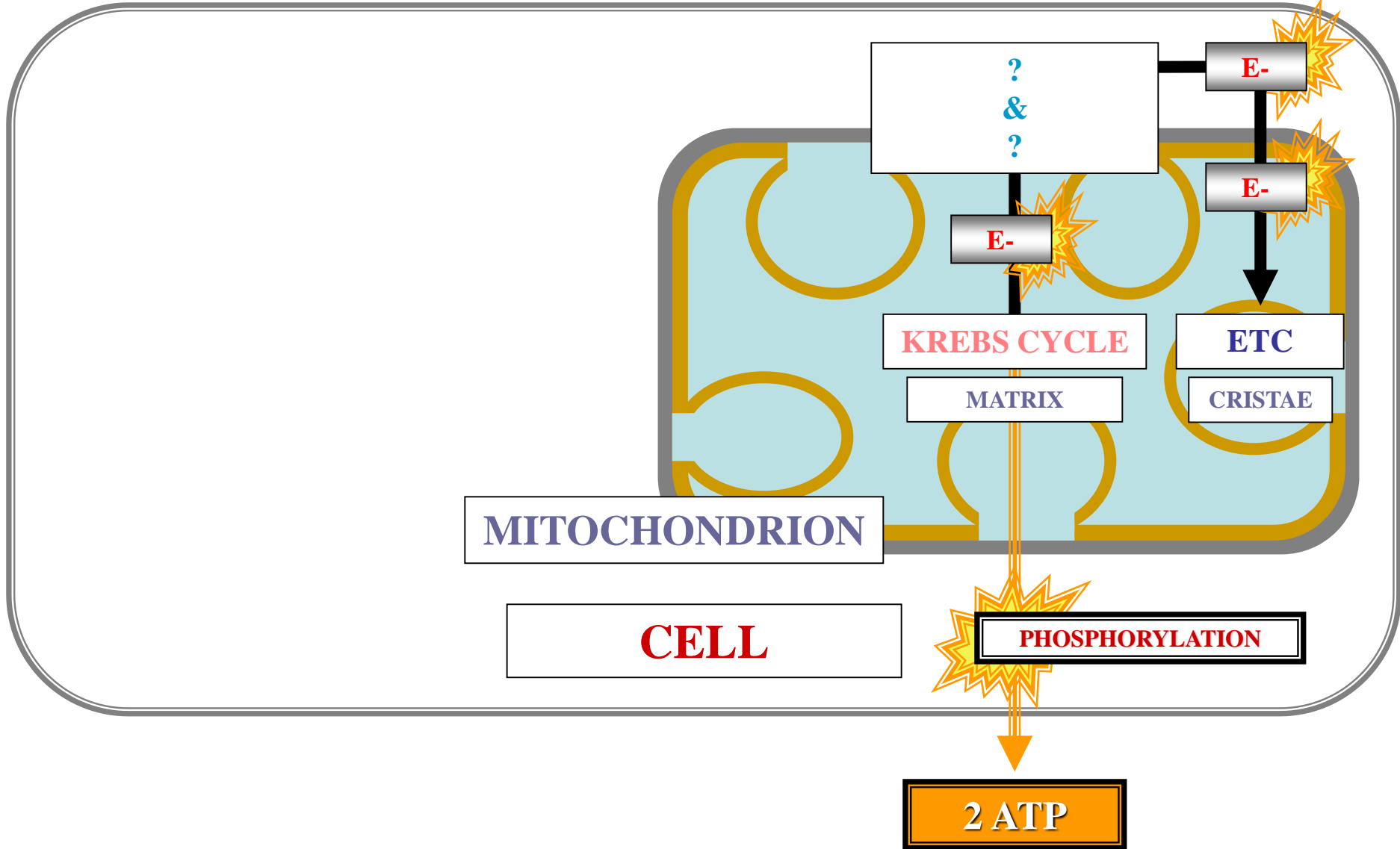
KREBS CYCLE DERIVED E- DONORS

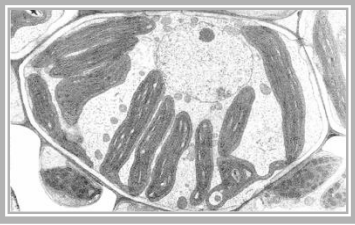


AEROBIC RESPIRATION

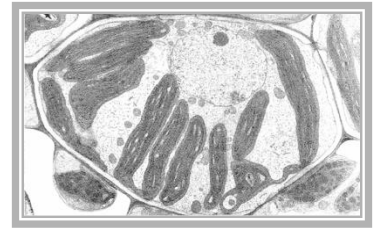


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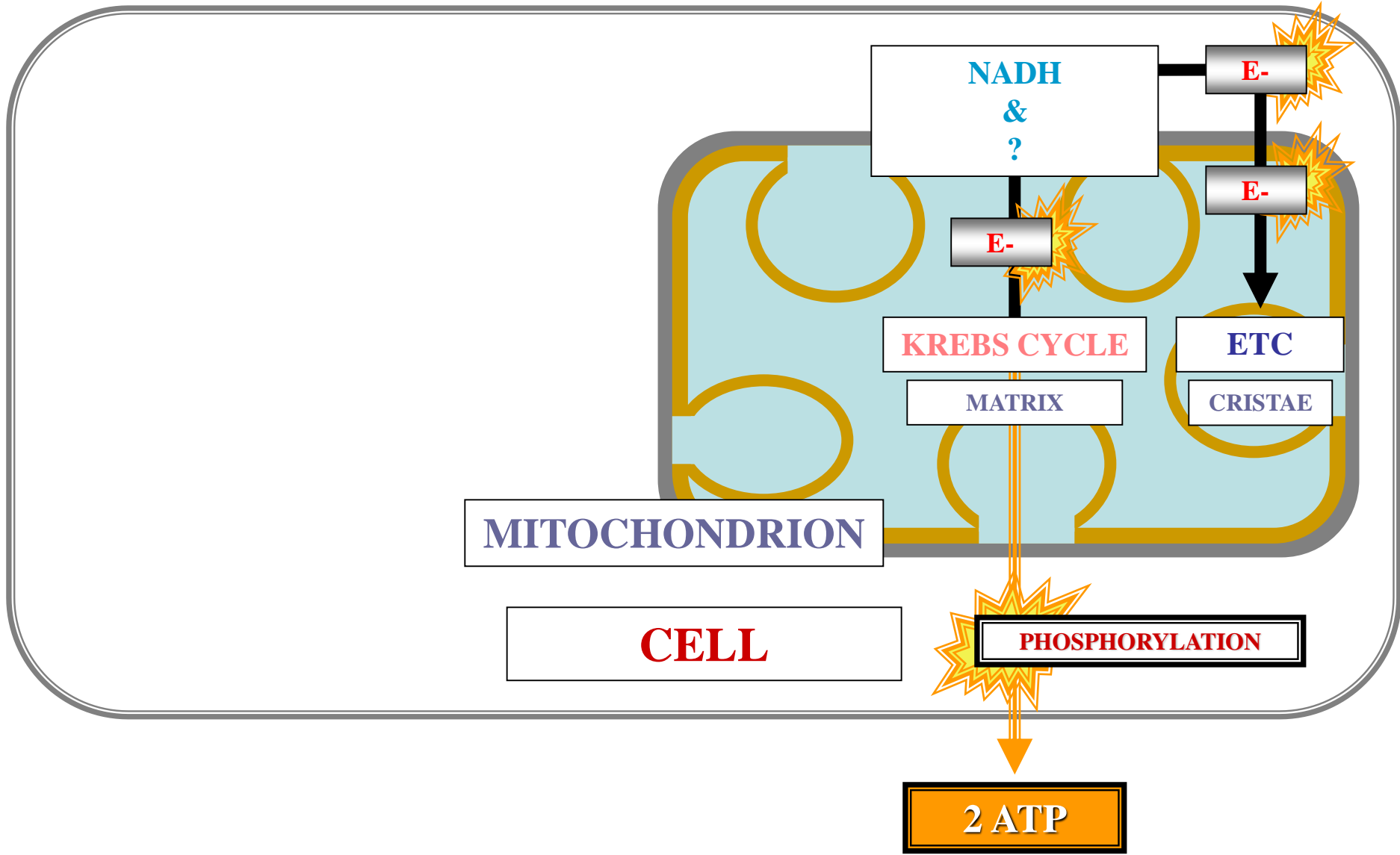




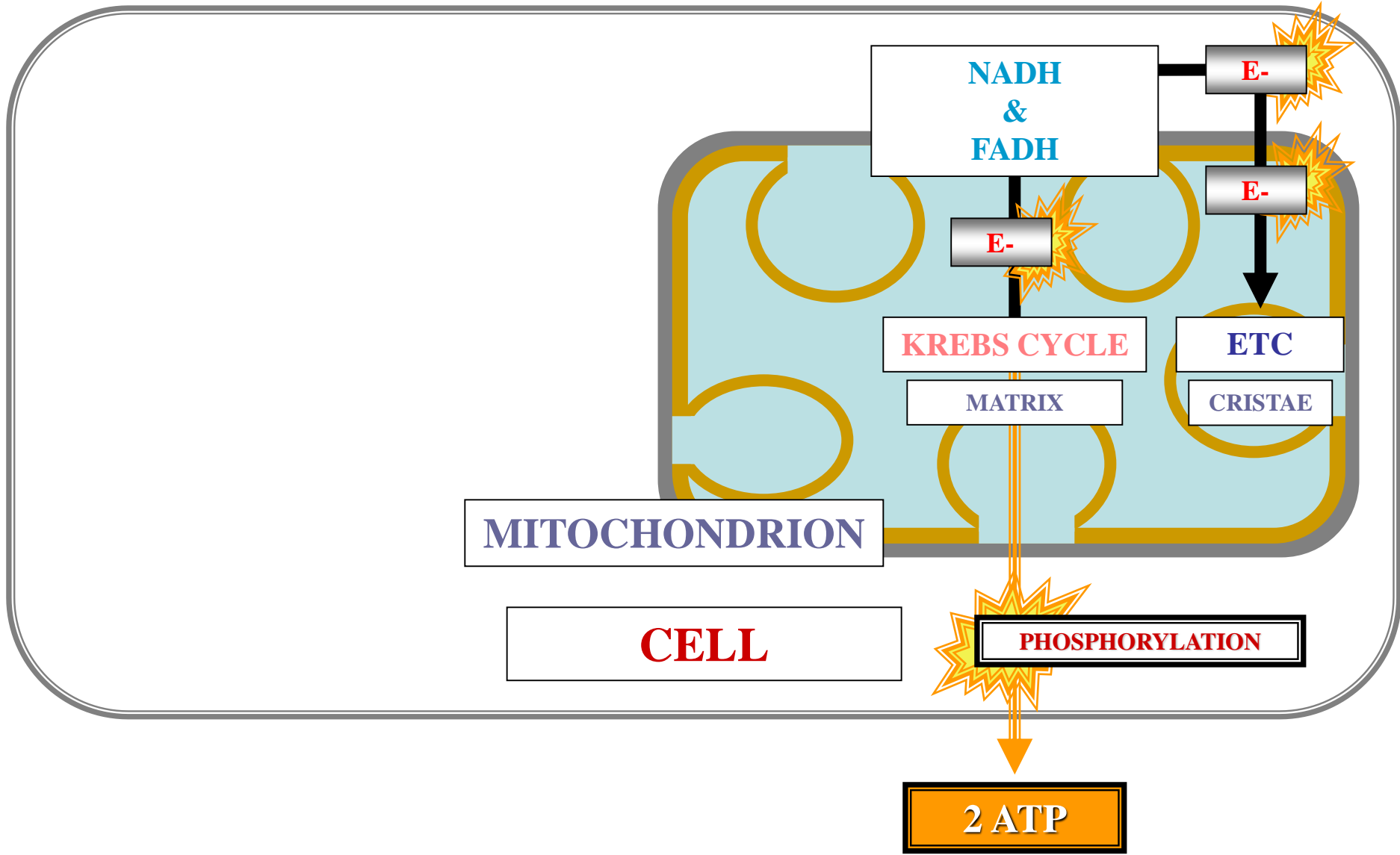
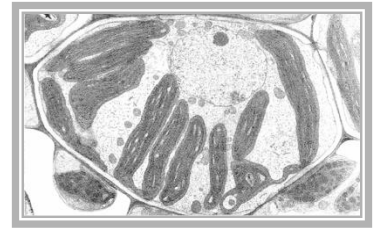
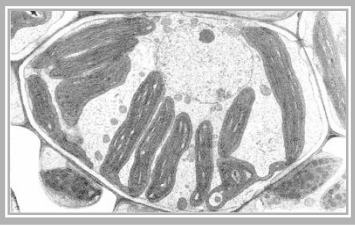
AEROBIC RESPIRATION

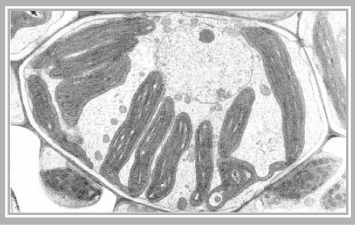


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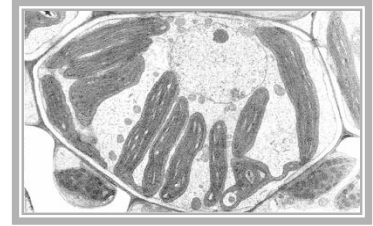


AEROBIC RESPIRATION

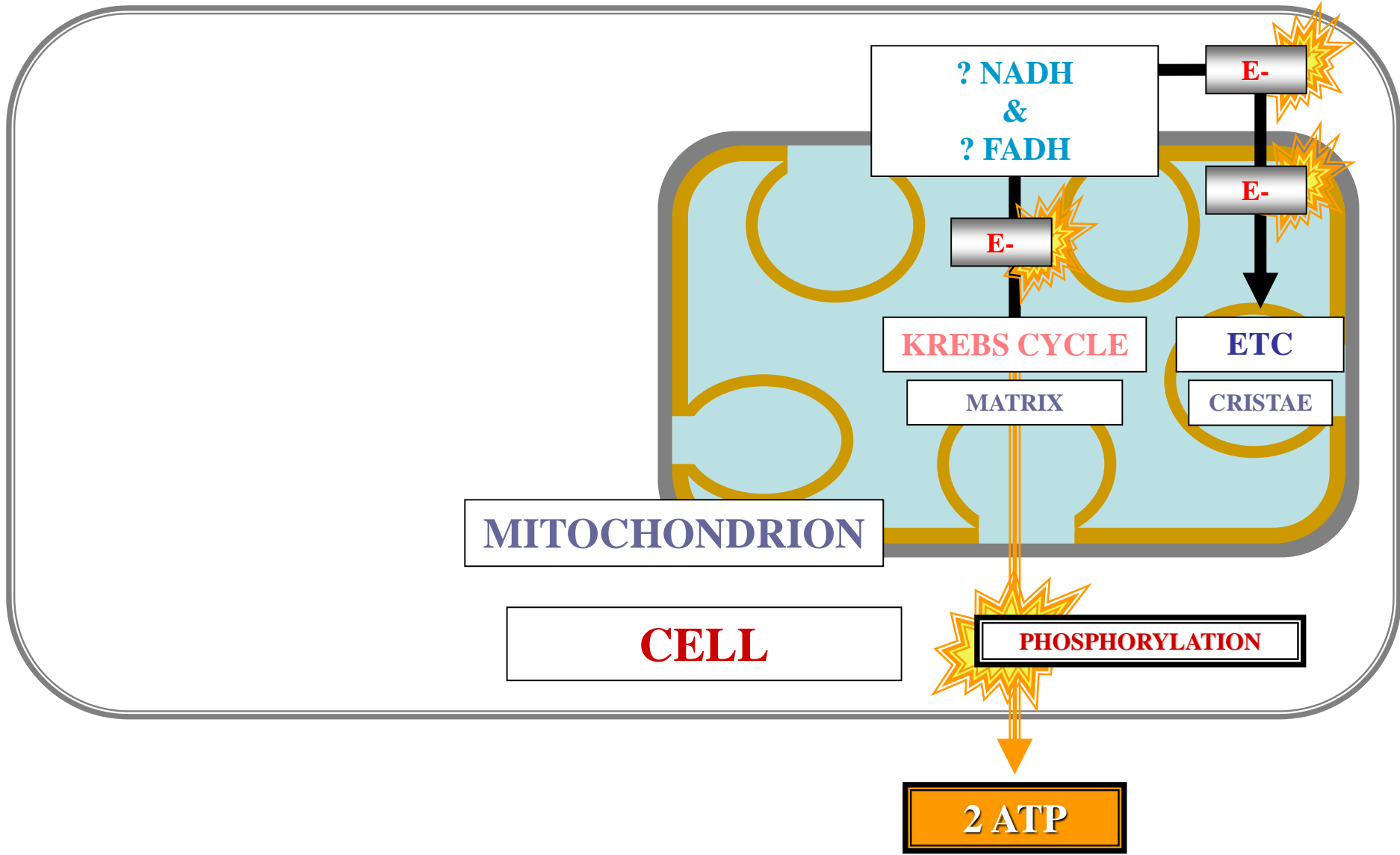


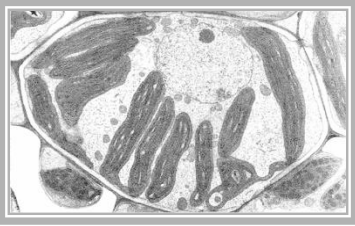


AEROBIC RESPIRATION

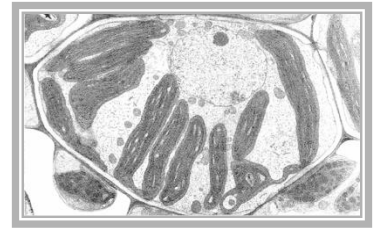


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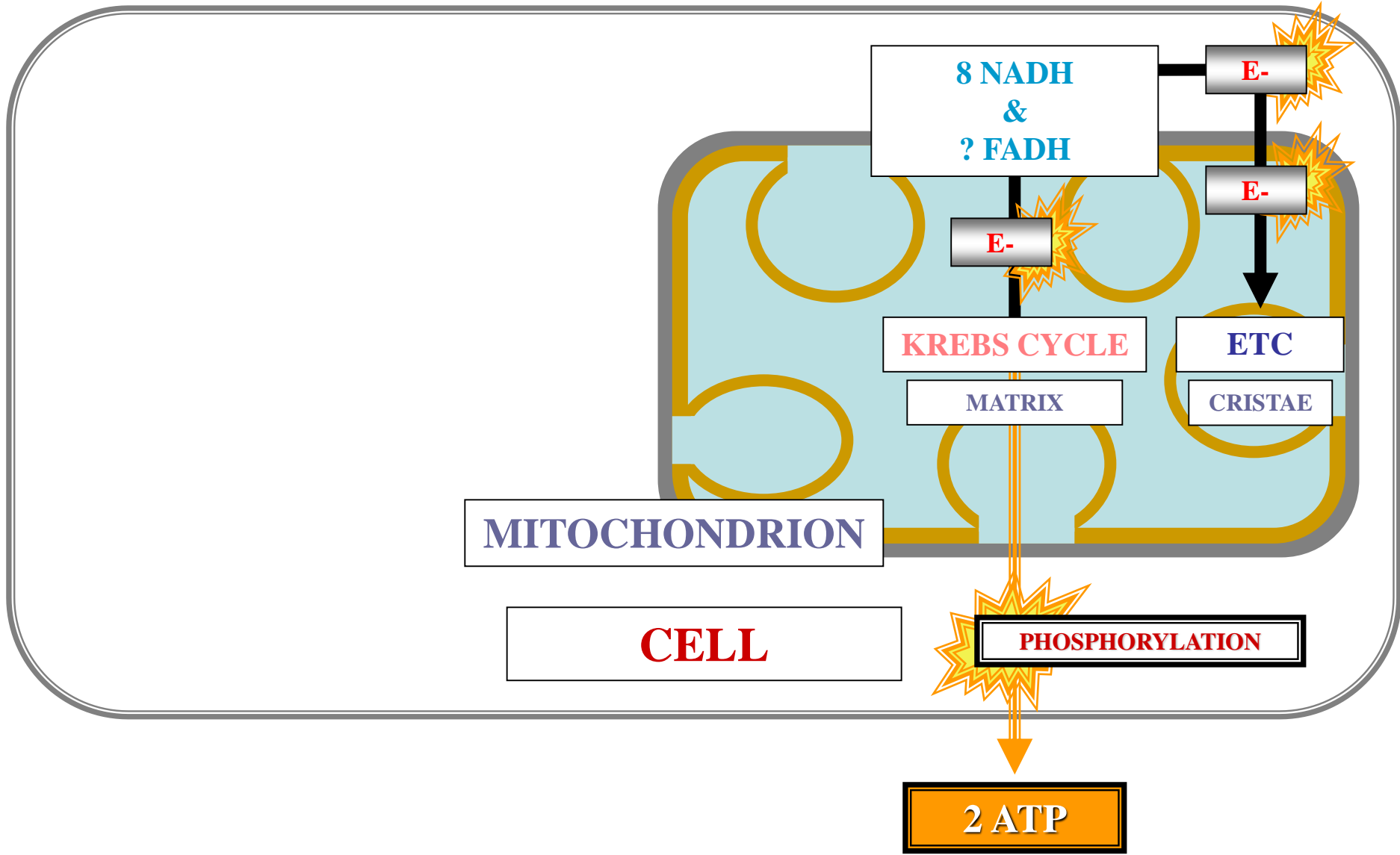




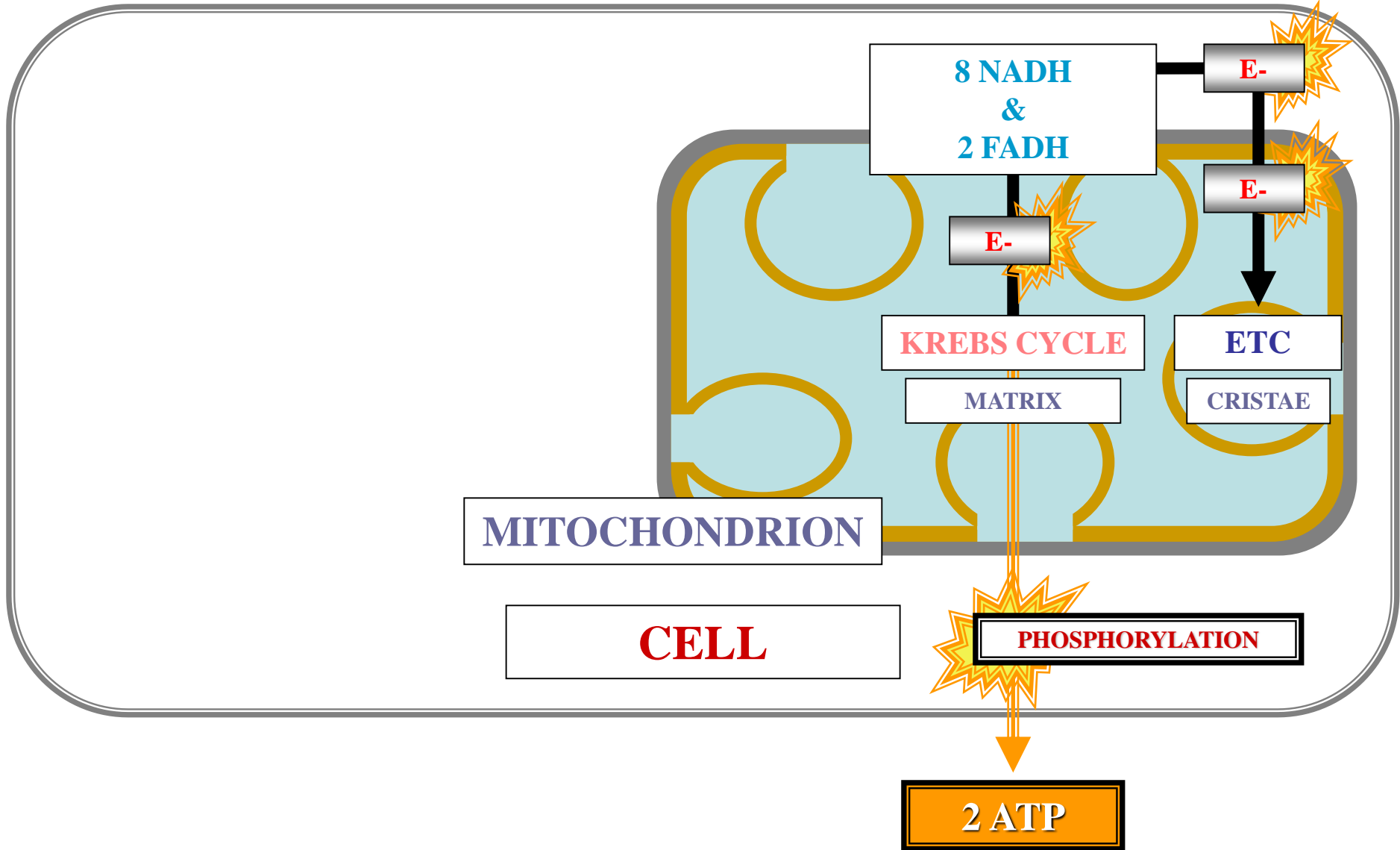
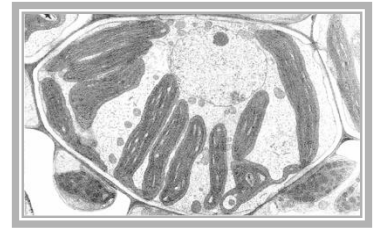
AEROBIC RESPIRATION



#



AEROBIC RESPIRATION

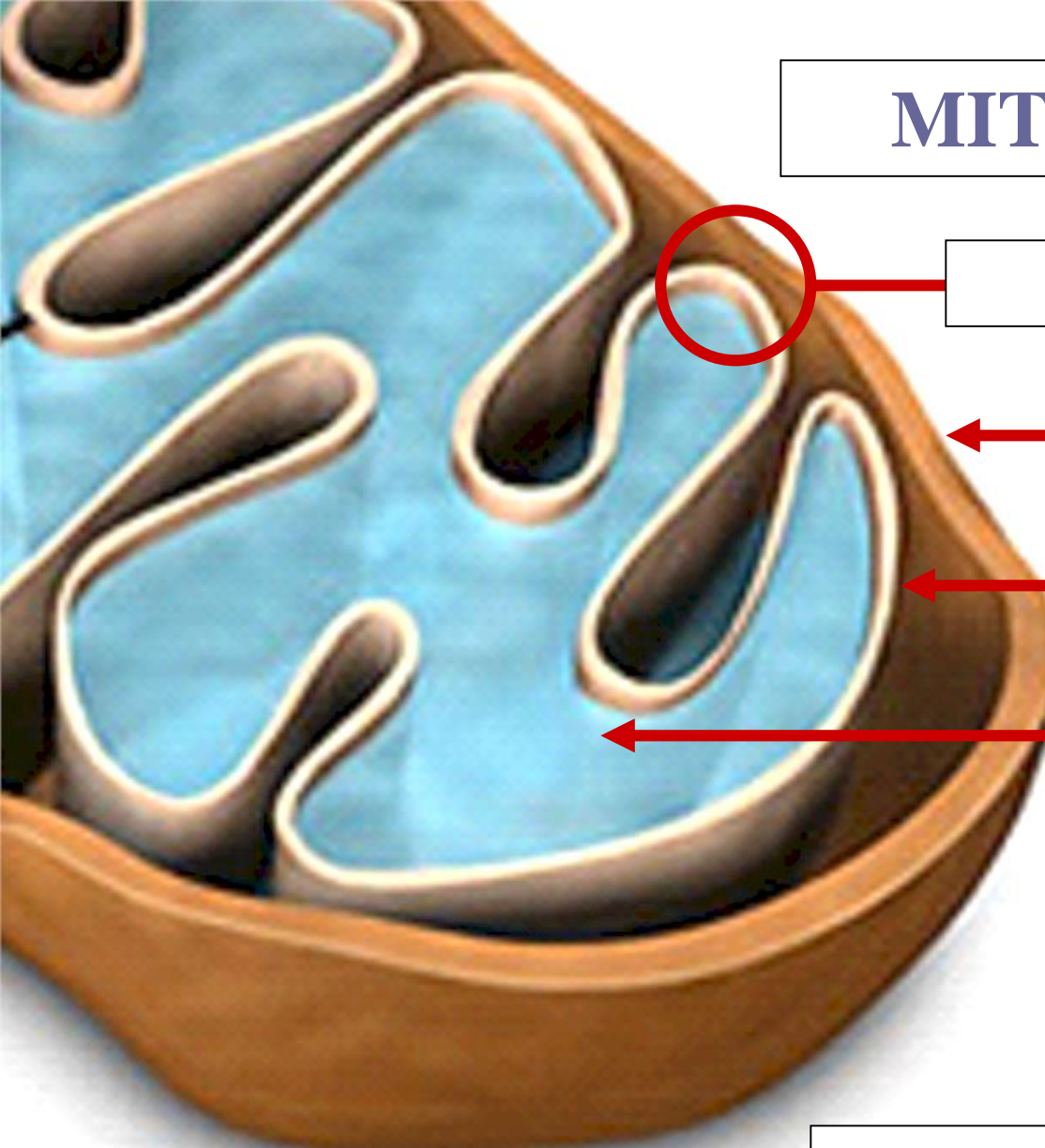




QUESTION

WHERE WITHIN THE
CELL DOES THE KREBS
CYCLE TAKE PLACE?

QUESTION



MITOCHONDRION

DOUBLE MEMBRANE

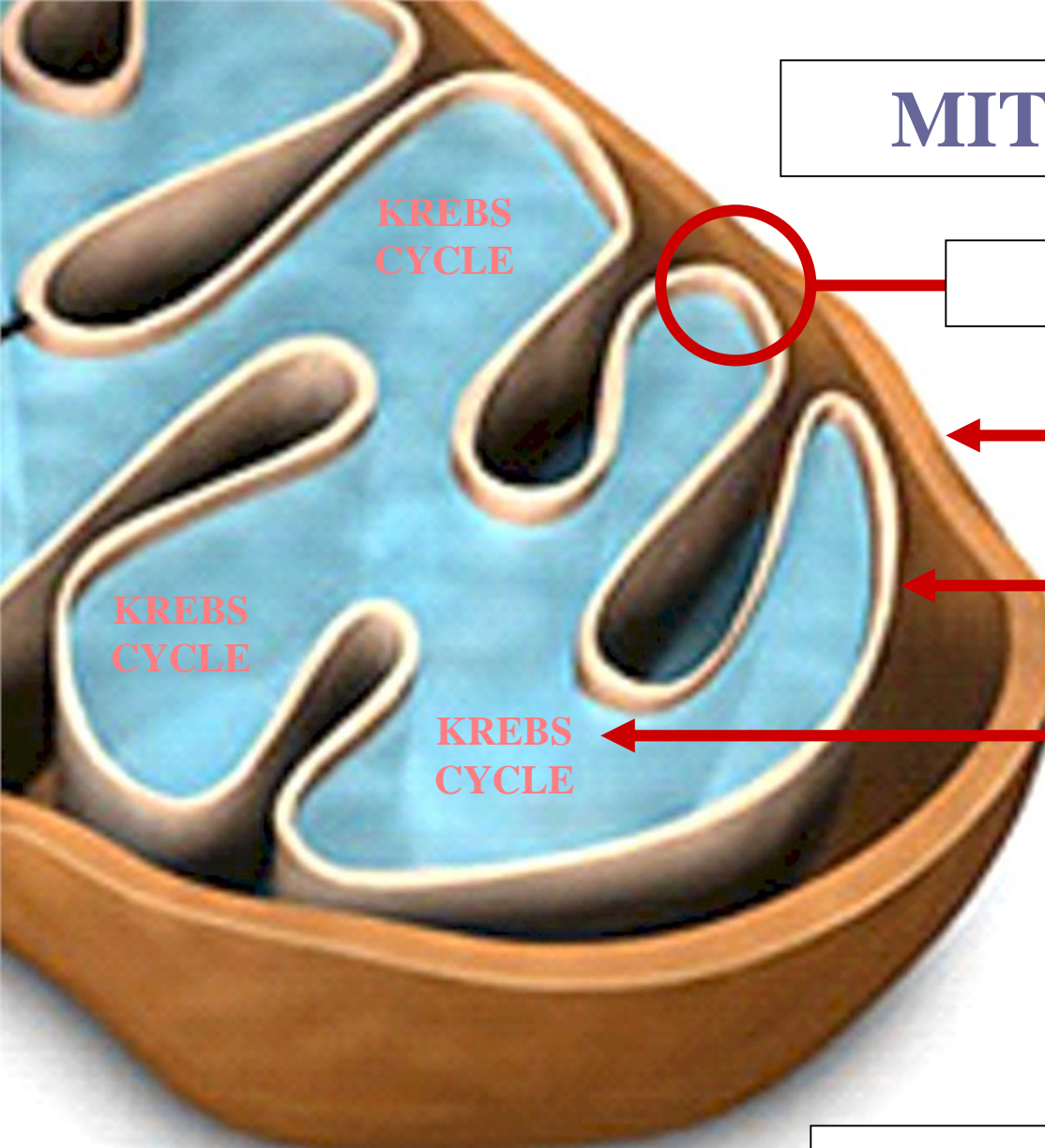
OUTER MEMBRANE

CRISTAE MEMBRANE

MATRIX

K

CELL CYTOSOL



MITOCHONDRION

DOUBLE MEMBRANE

OUTER MEMBRANE

CRISTAE MEMBRANE

MATRIX

**KREBS
CYCLE**

**KREBS
CYCLE**

**KREBS
CYCLE**

CELL CYTOSOL



MITOCHONDRION

KREBS
CYCLE

DOUBLE MEMBRANE

OUTER MEMBRANE

CRISTAE MEMBRANE

MATRIX

8 NADH & 2 FADH
DERIVED W/IN
MITOCHONDRION
MATRIX

CELL CYTOSOL

8 NADH

E-

ETC

2 FADH

E-

MITOCHONDRION

KREBS
CYCLE

DOUBLE MEMBRANE

OUTER MEMBRANE

CRISTAE MEMBRANE

MATRIX

NO **ATP** EXPENDED
ENTERING
MITOCHONDRION

CELL CYTOSOL

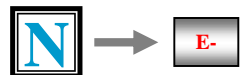
8 NADH

E-

ETC

2 FADH

E-



MITOCHONDRION

KREBS
CYCLE

DOUBLE MEMBRANE

OUTER MEMBRANE

CRISTAE MEMBRANE

MATRIX

8 NADH

E-

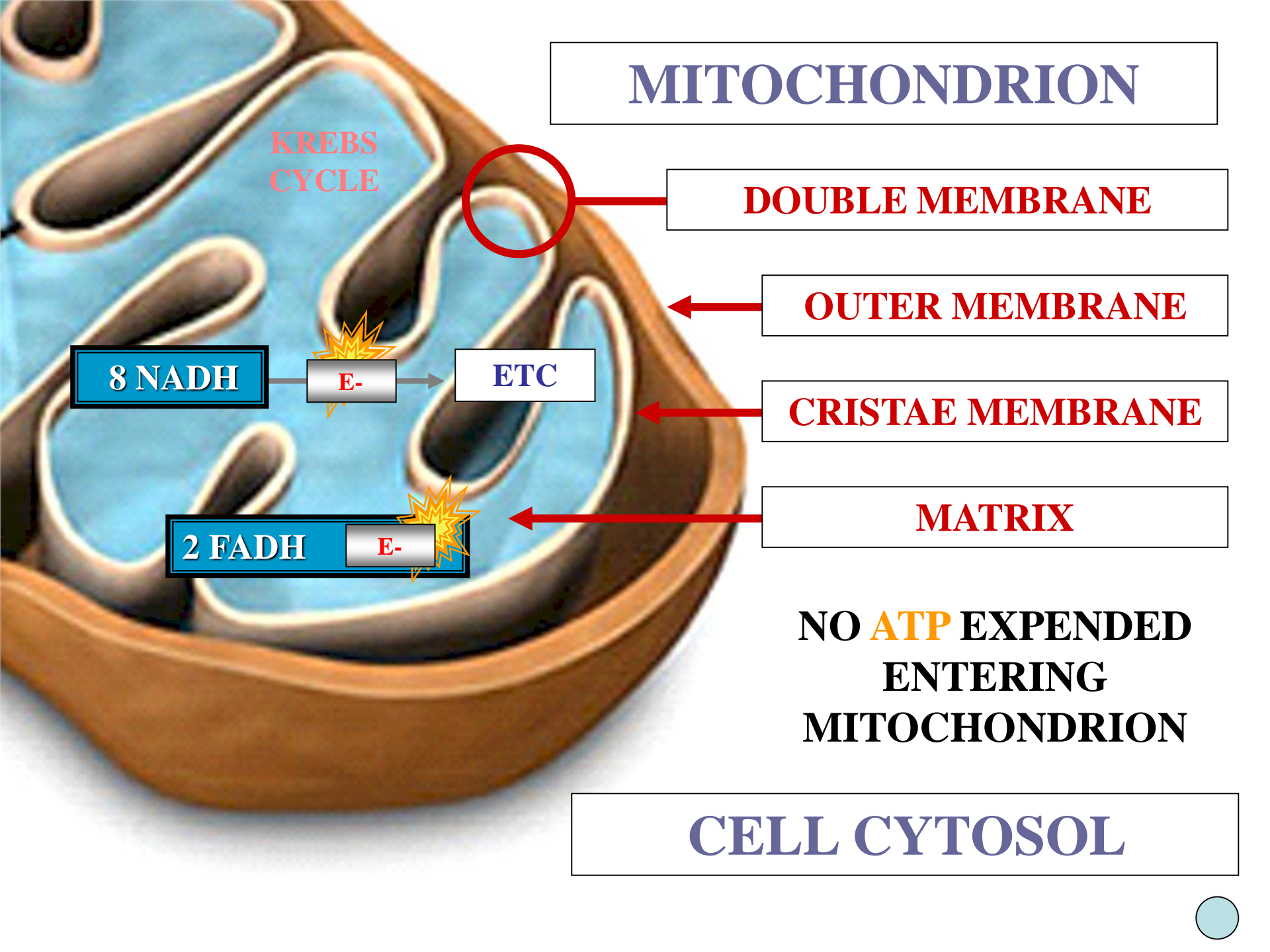
ETC

2 FADH

E-

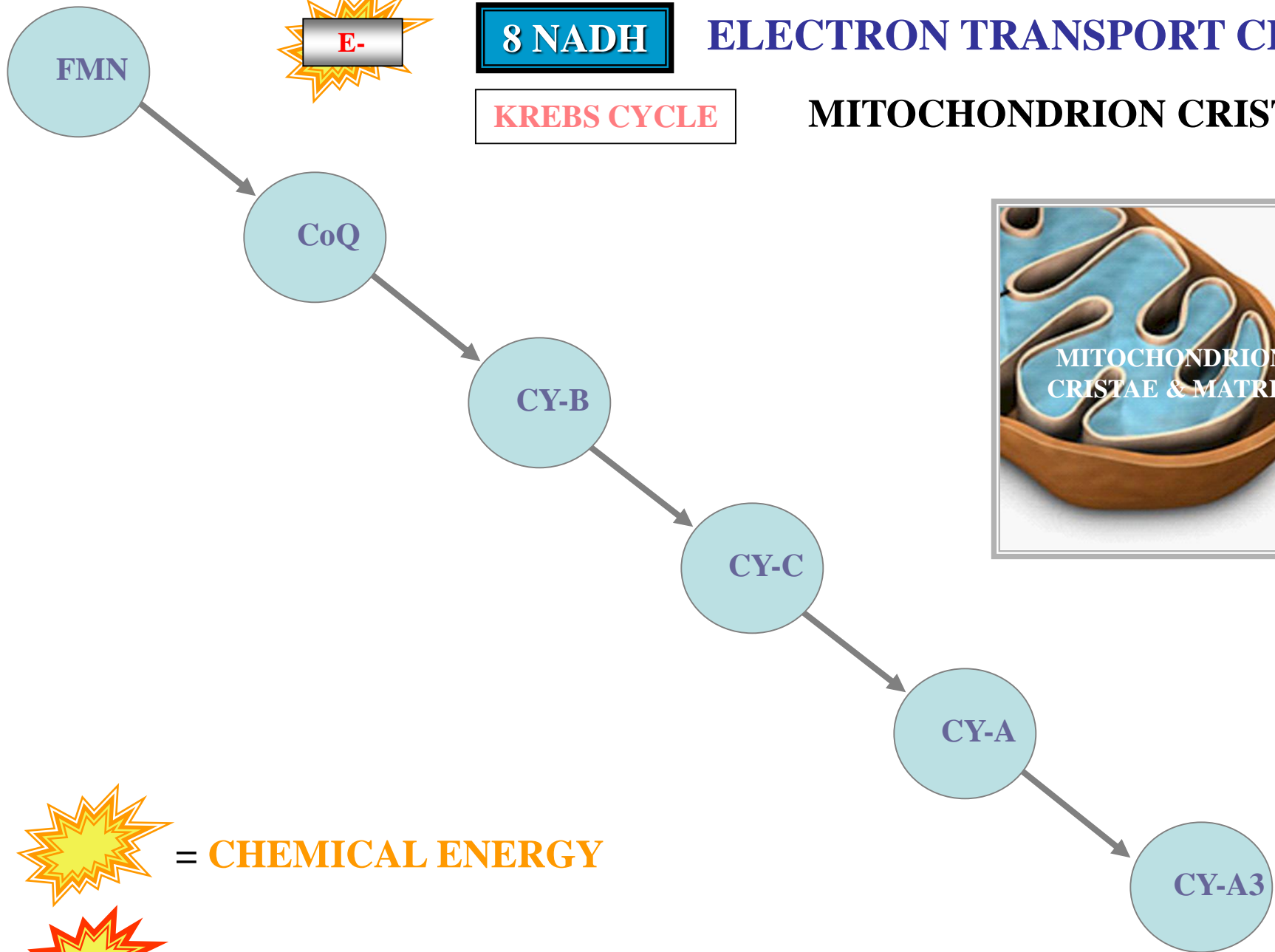
NO **ATP** EXPENDED
ENTERING
MITOCHONDRION

CELL CYTOSOL



ELECTRON TRANSPORT CHAIN

MITOCHONDRION CRISTAE



8 NADH

KREBS CYCLE



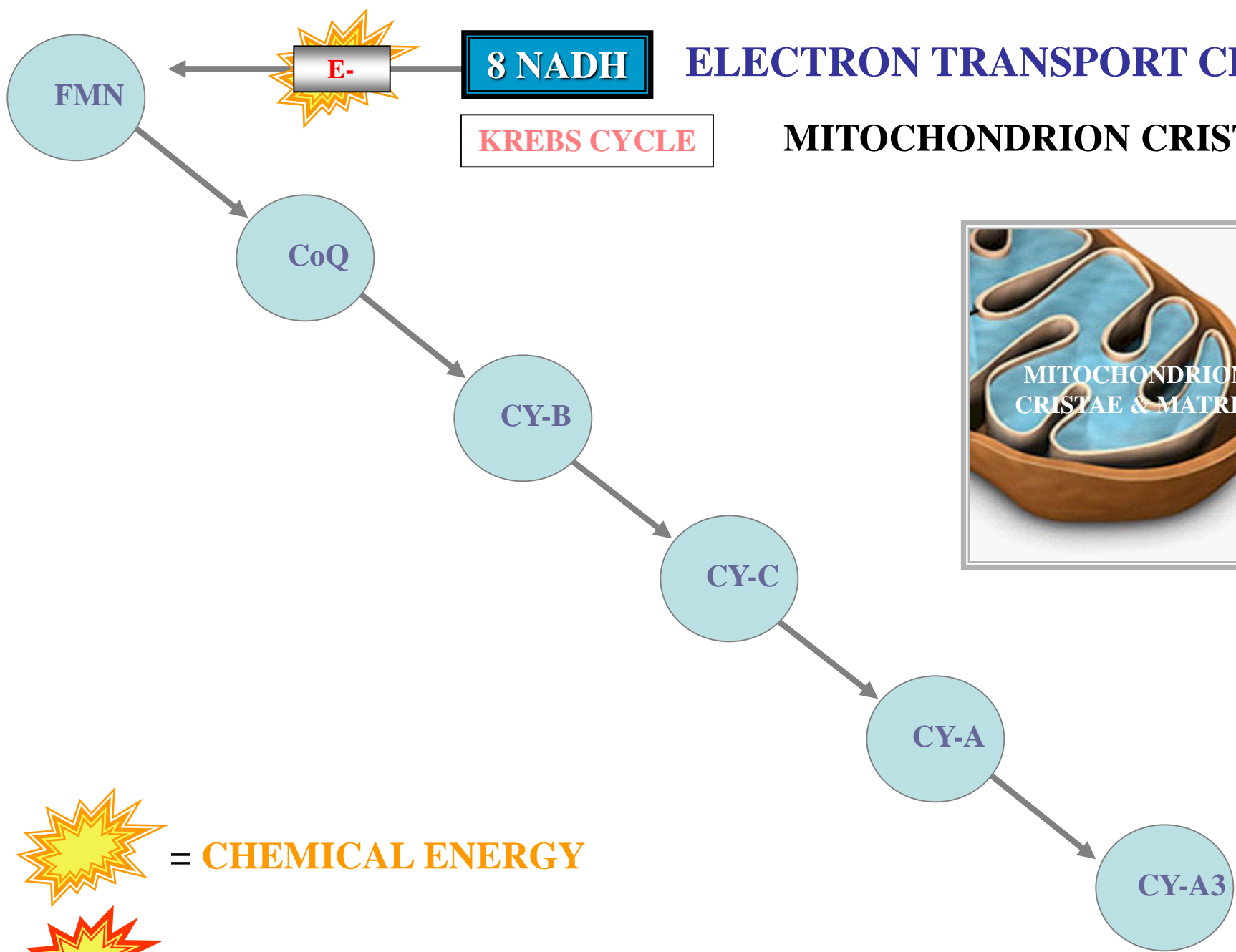
= **CHEMICAL ENERGY**



= **DISSIPATED HEAT ENERGY**

ELECTRON TRANSPORT CHAIN

MITOCHONDRION CRISTAE

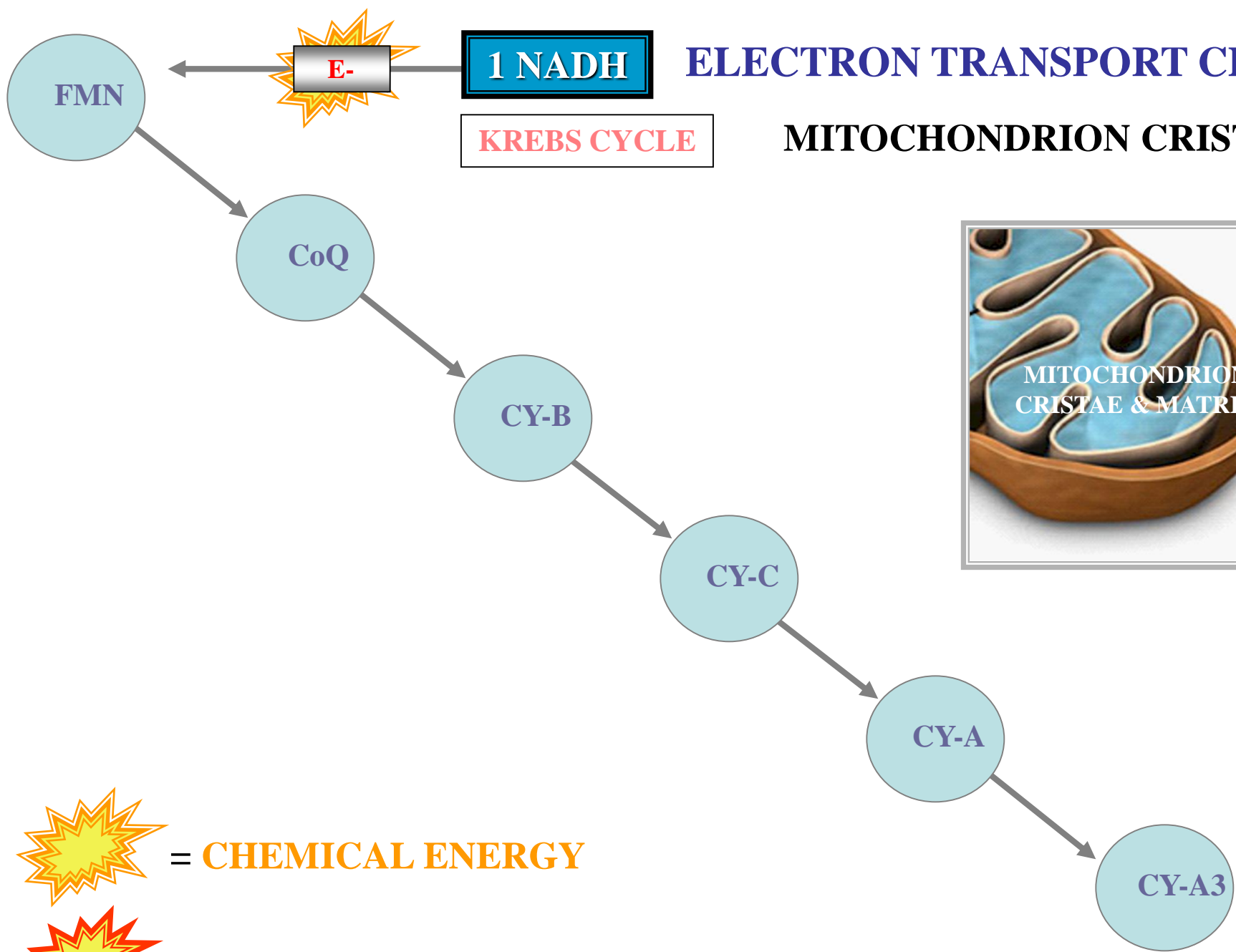


 = **CHEMICAL ENERGY**

 = **DISSIPATED HEAT ENERGY**

ELECTRON TRANSPORT CHAIN

MITOCHONDRION CRISTAE

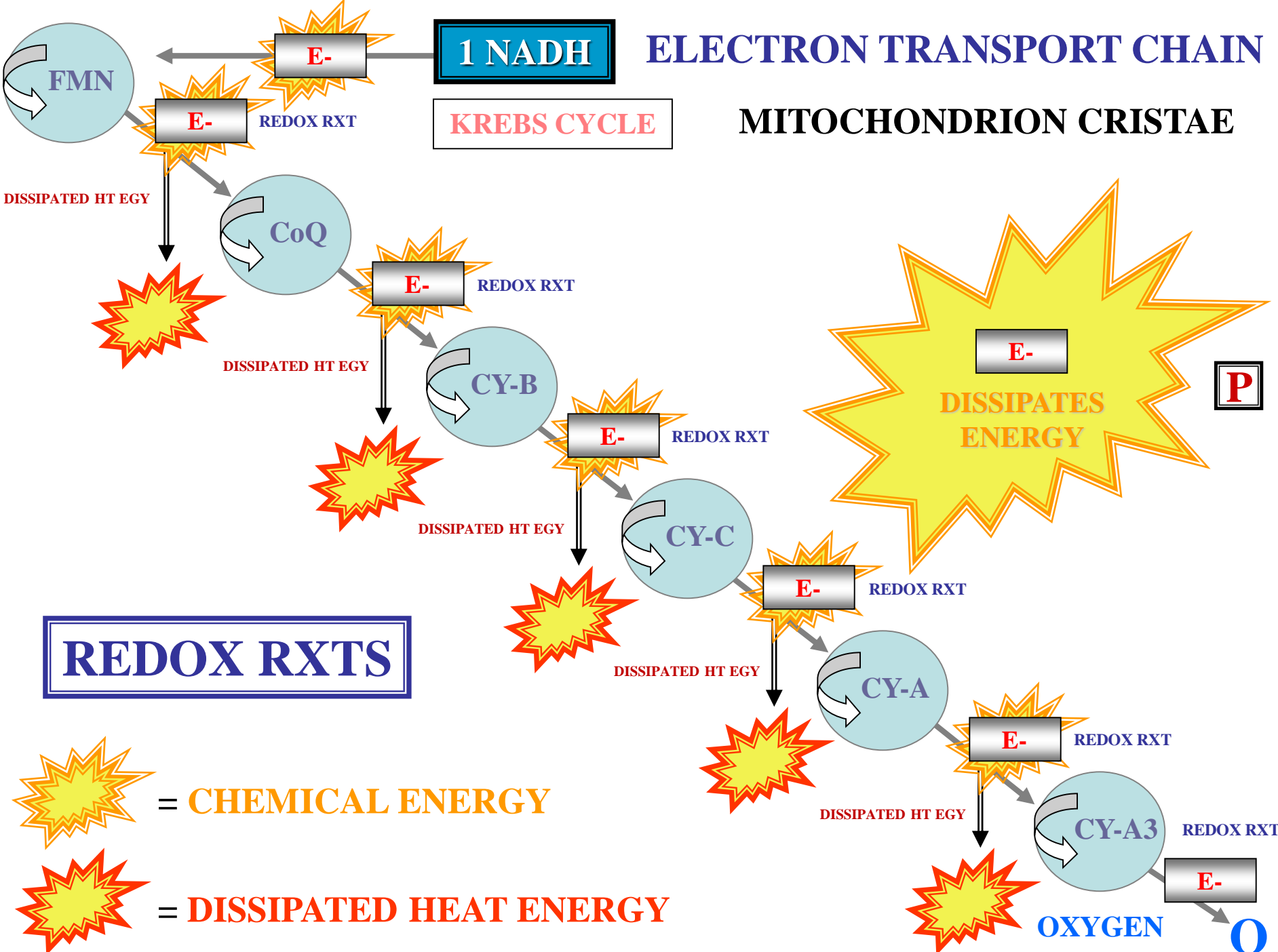


 = **CHEMICAL ENERGY**

 = **DISSIPATED HEAT ENERGY**

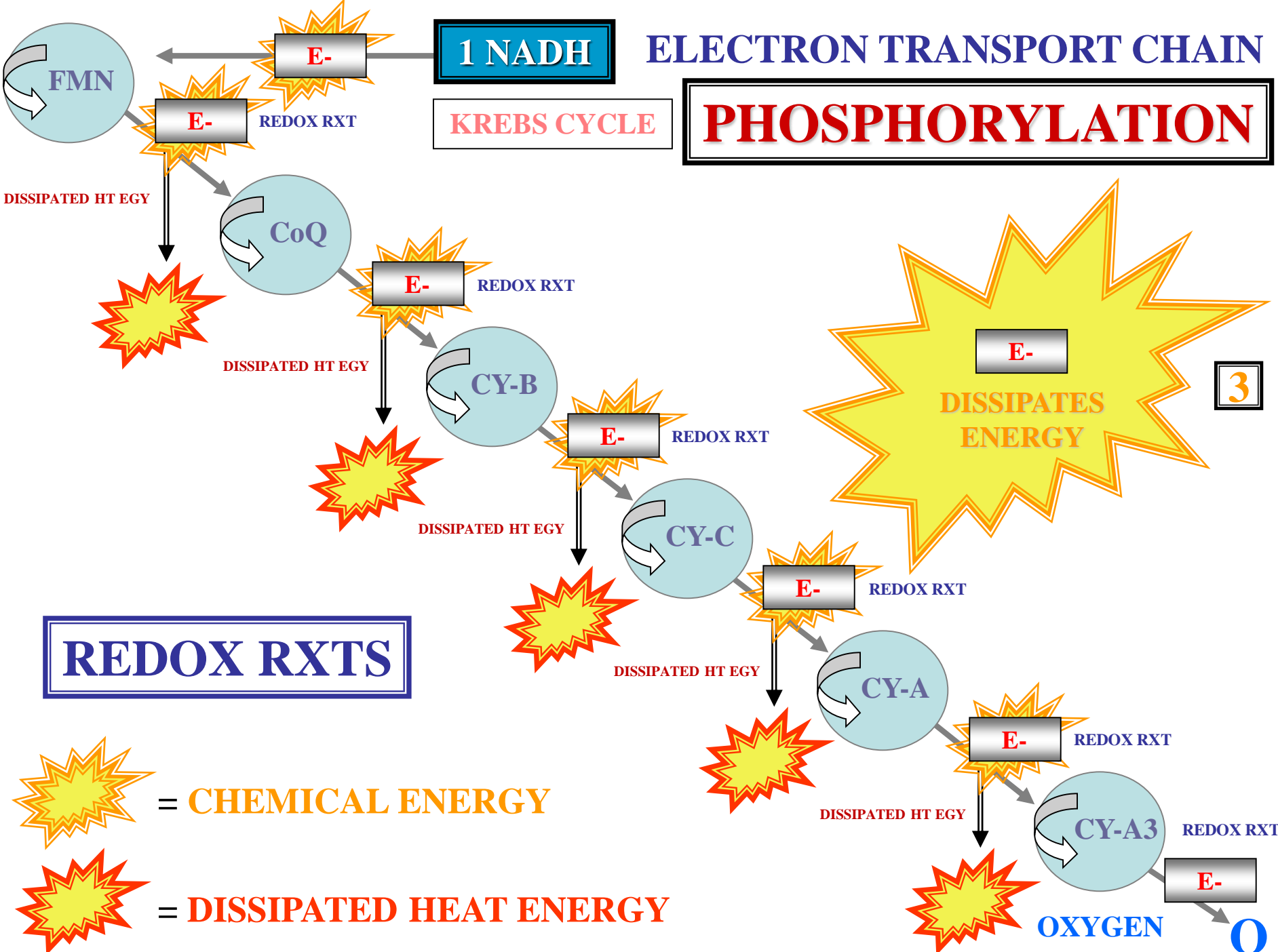
ELECTRON TRANSPORT CHAIN

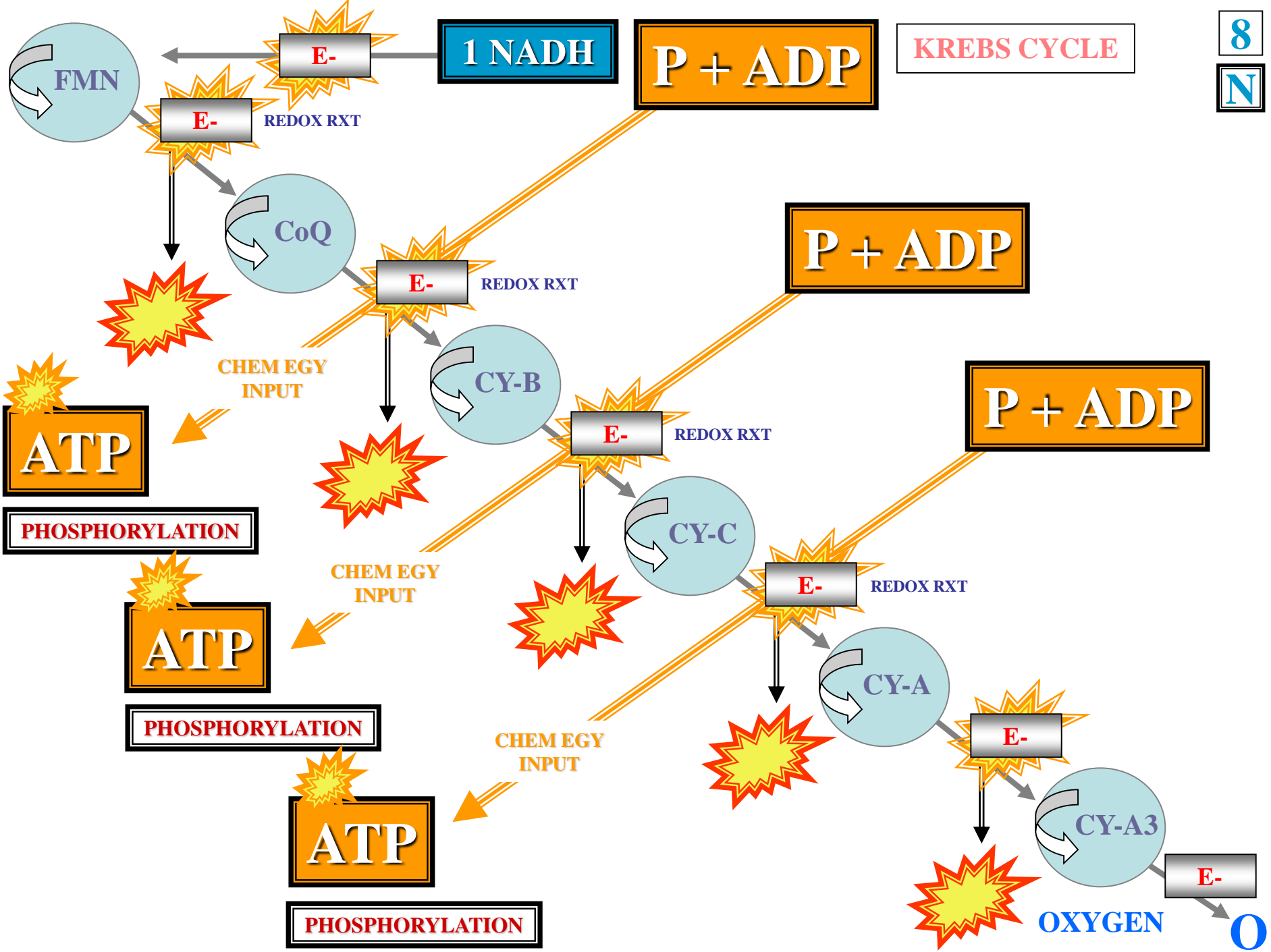
MITOCHONDRION CRISTAE



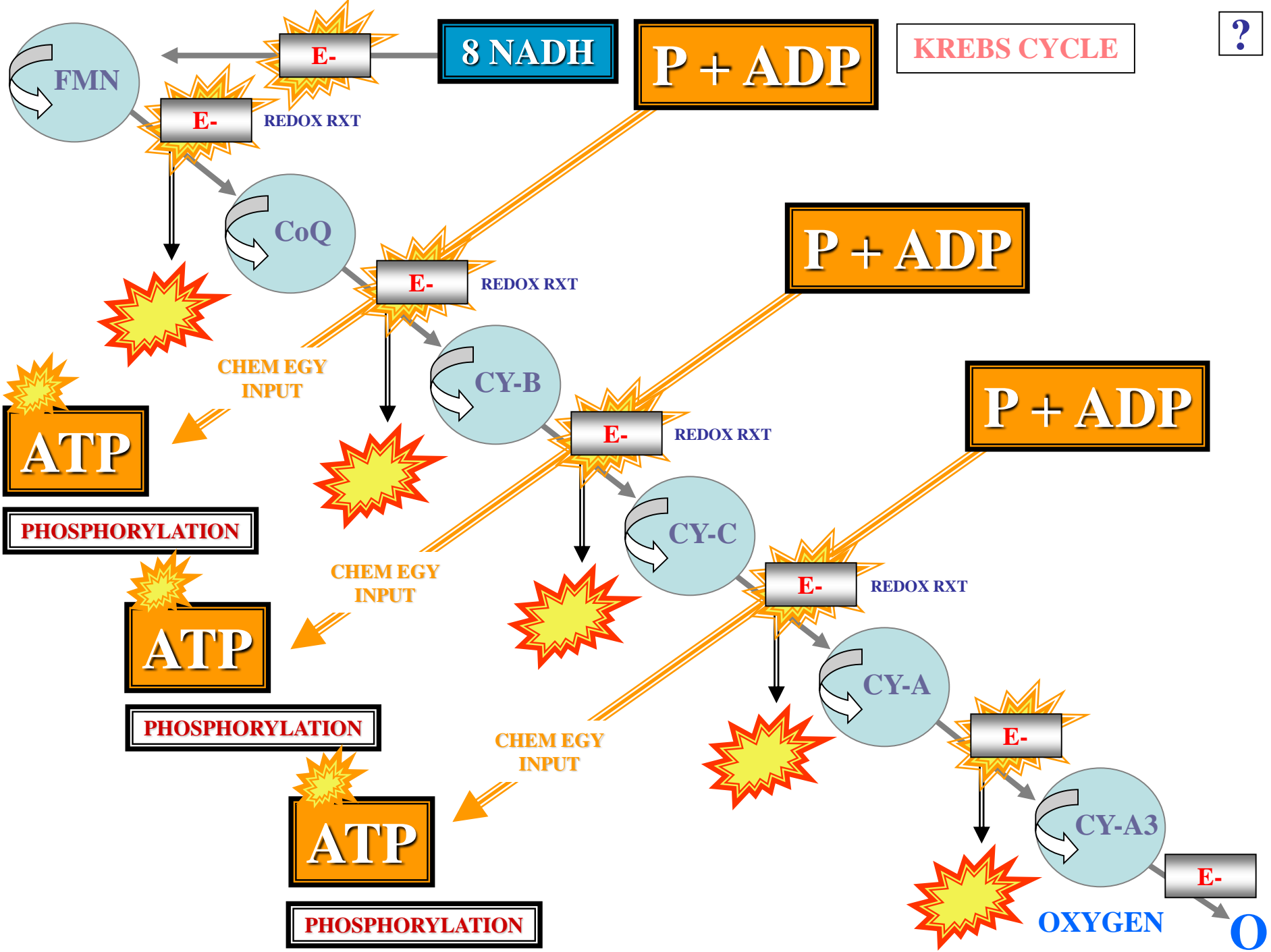
ELECTRON TRANSPORT CHAIN

PHOSPHORYLATION





?



QUESTION

HOW MANY NET ATP
PHOSPHORYLATIONS
VIA KREBS CYCLE
NADH?

QUESTION



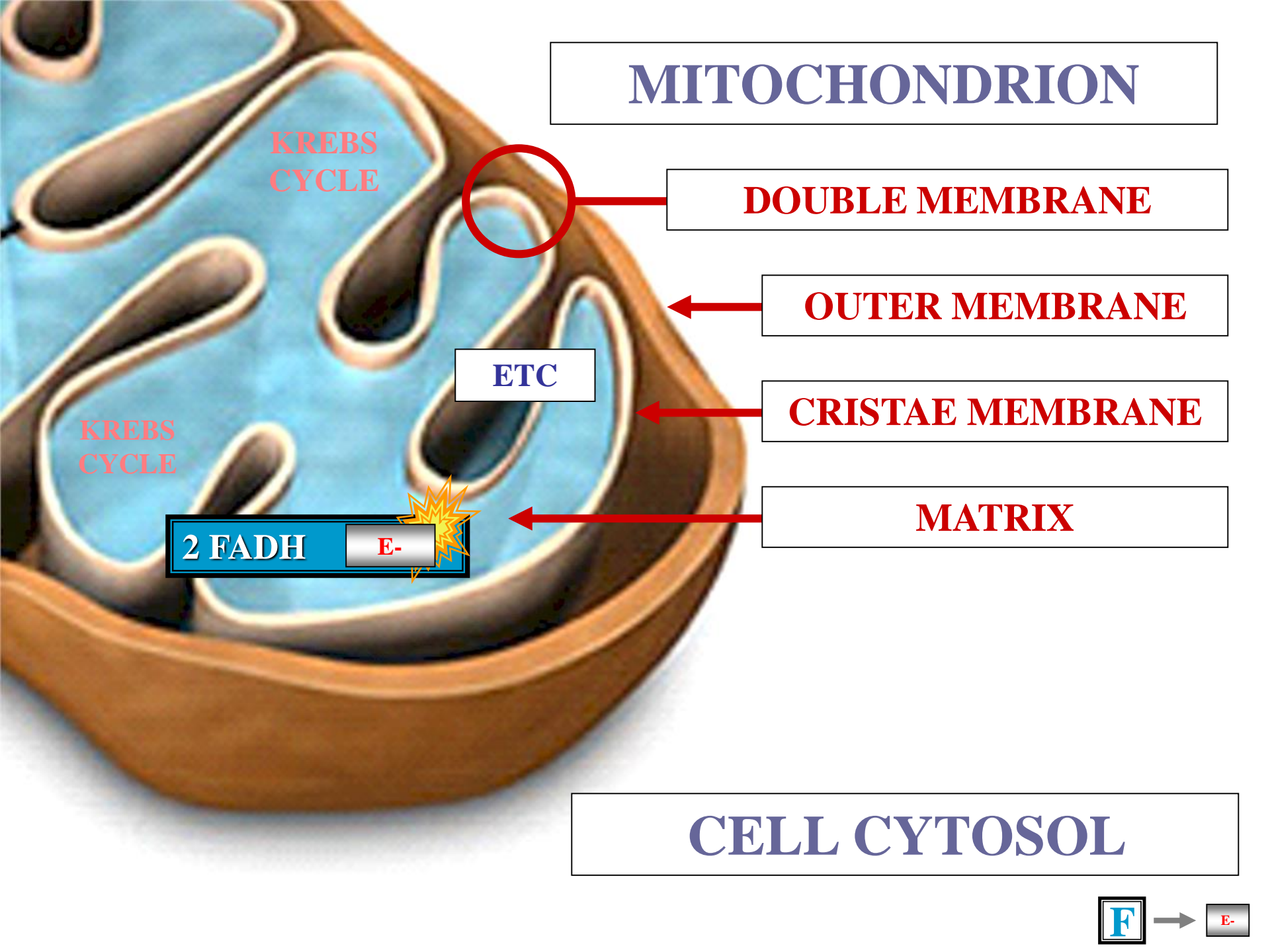
24 ATP

PHOSPHORYLATIONS

VIA KREBS CYCLE

NADH

E- DONORS



MITOCHONDRION

DOUBLE MEMBRANE

OUTER MEMBRANE

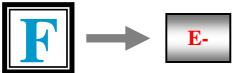
ETC

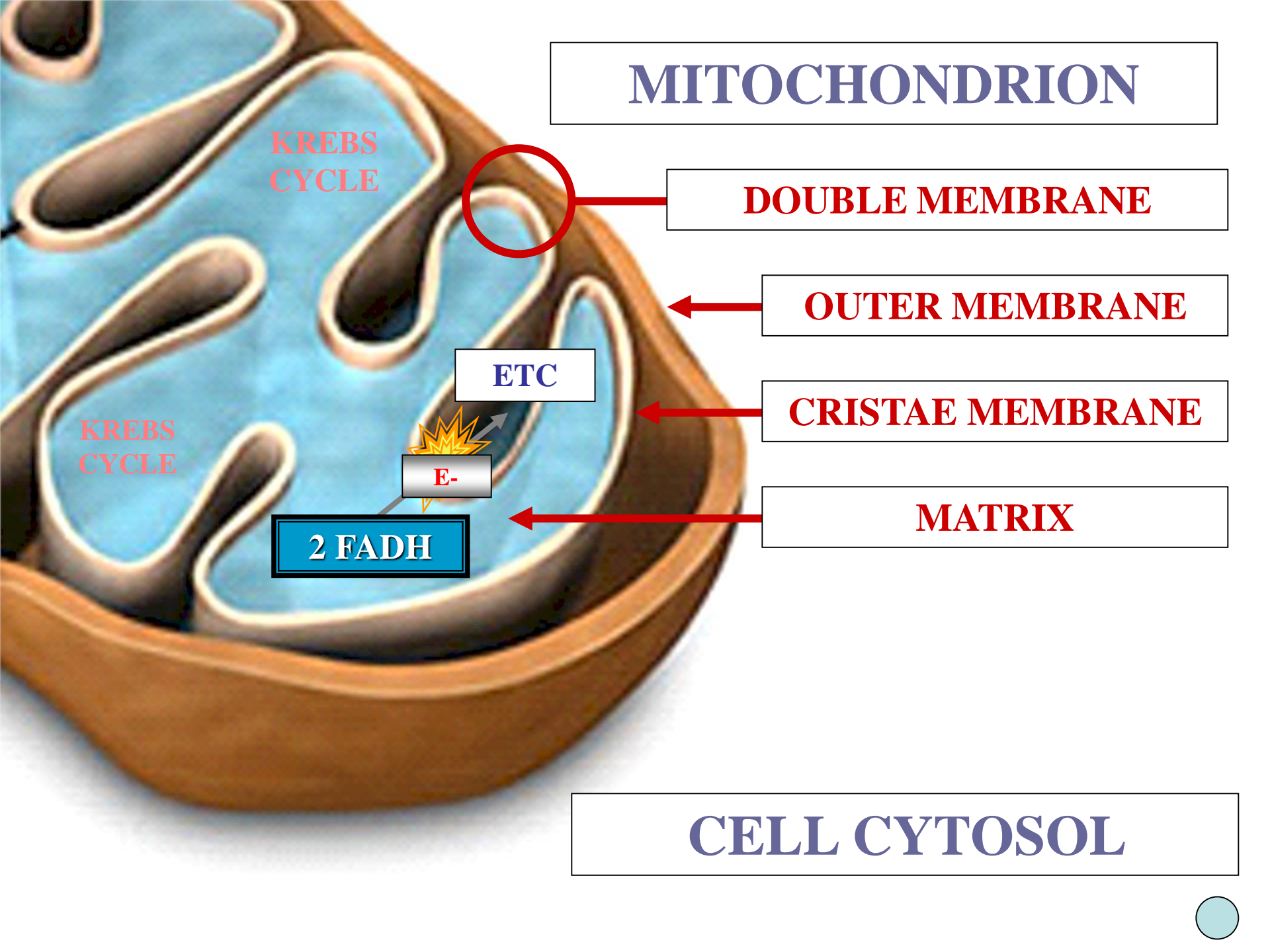
CRISTAE MEMBRANE

MATRIX

2 FADH E-

CELL CYTOSOL





MITOCHONDRION

DOUBLE MEMBRANE

OUTER MEMBRANE

CRISTAE MEMBRANE

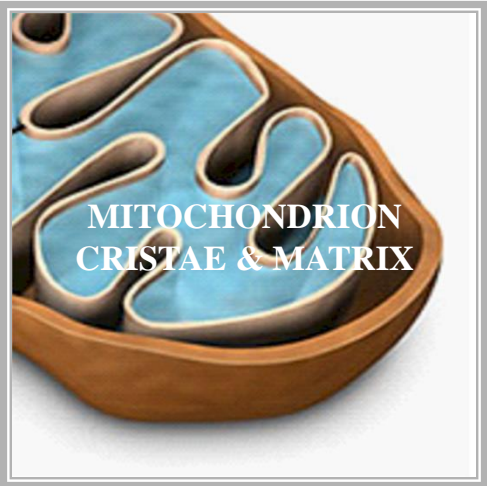
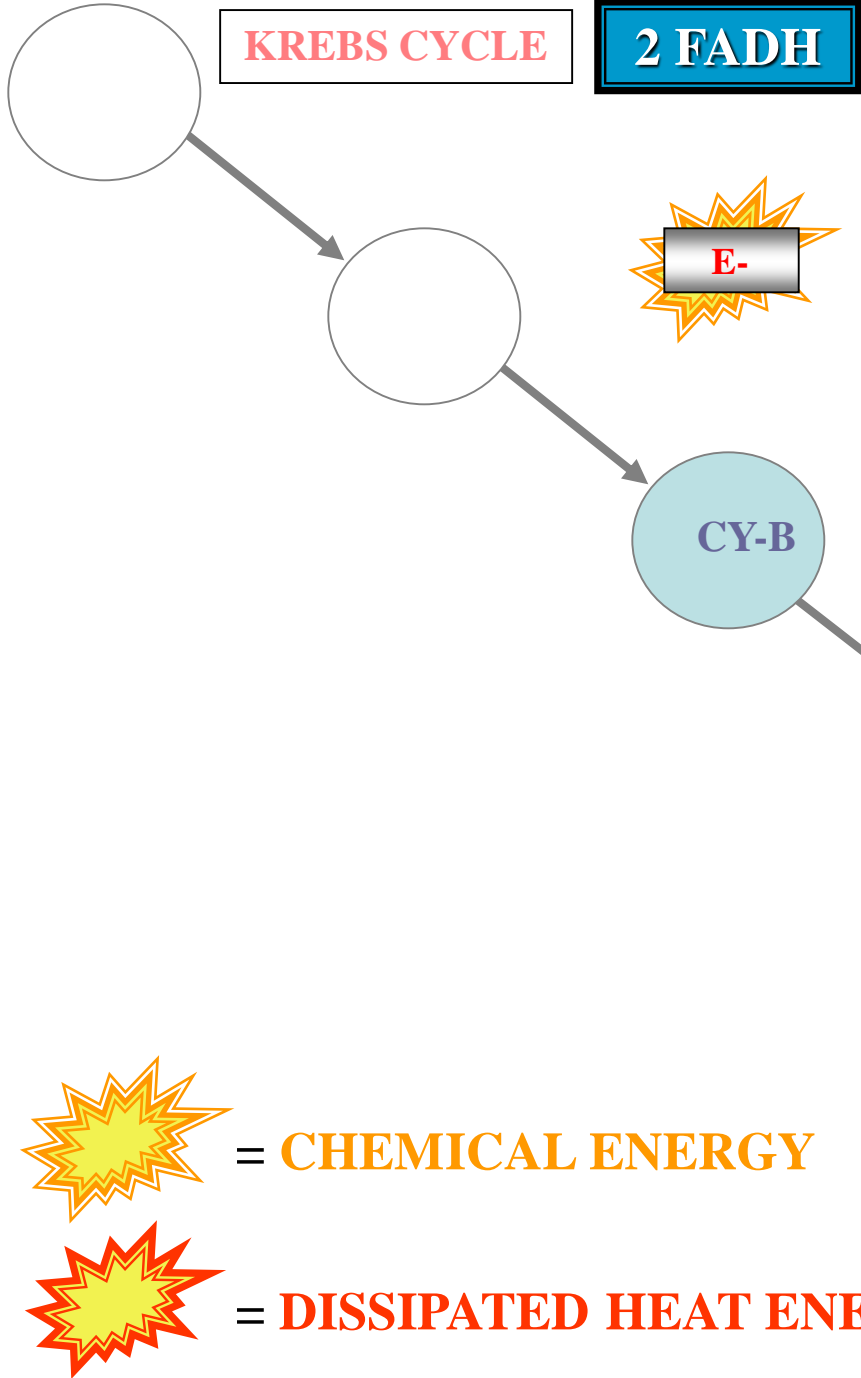
MATRIX

CELL CYTOSOL



ELECTRON TRANSPORT CHAIN

MITOCHONDRION CRISTAE

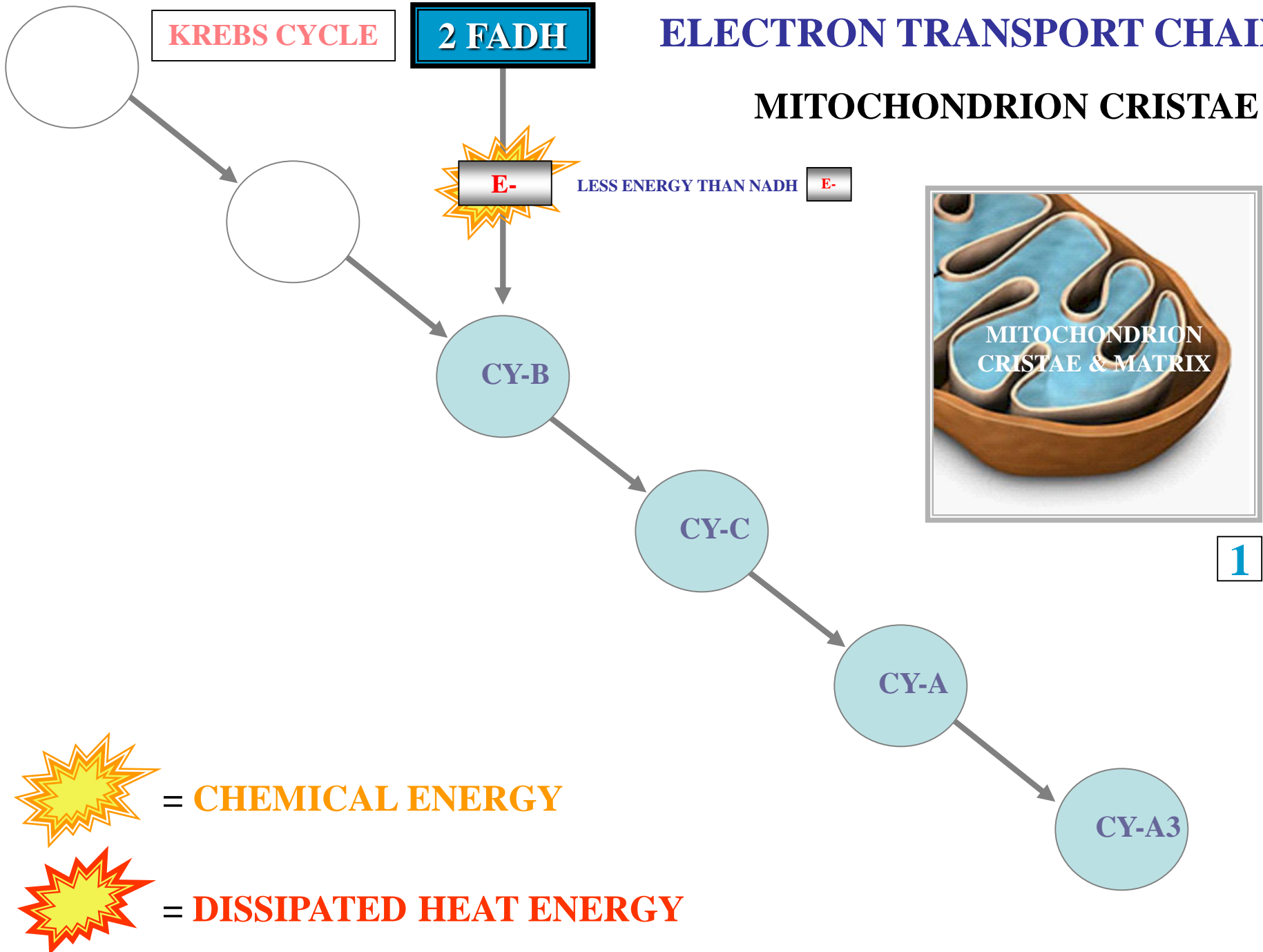


 = CHEMICAL ENERGY

 = DISSIPATED HEAT ENERGY

ELECTRON TRANSPORT CHAIN

MITOCHONDRION CRISTAE



KREBS CYCLE

2 FADH

E-

LESS ENERGY THAN NADH

E-

CY-B

CY-C

CY-A

CY-A3



1



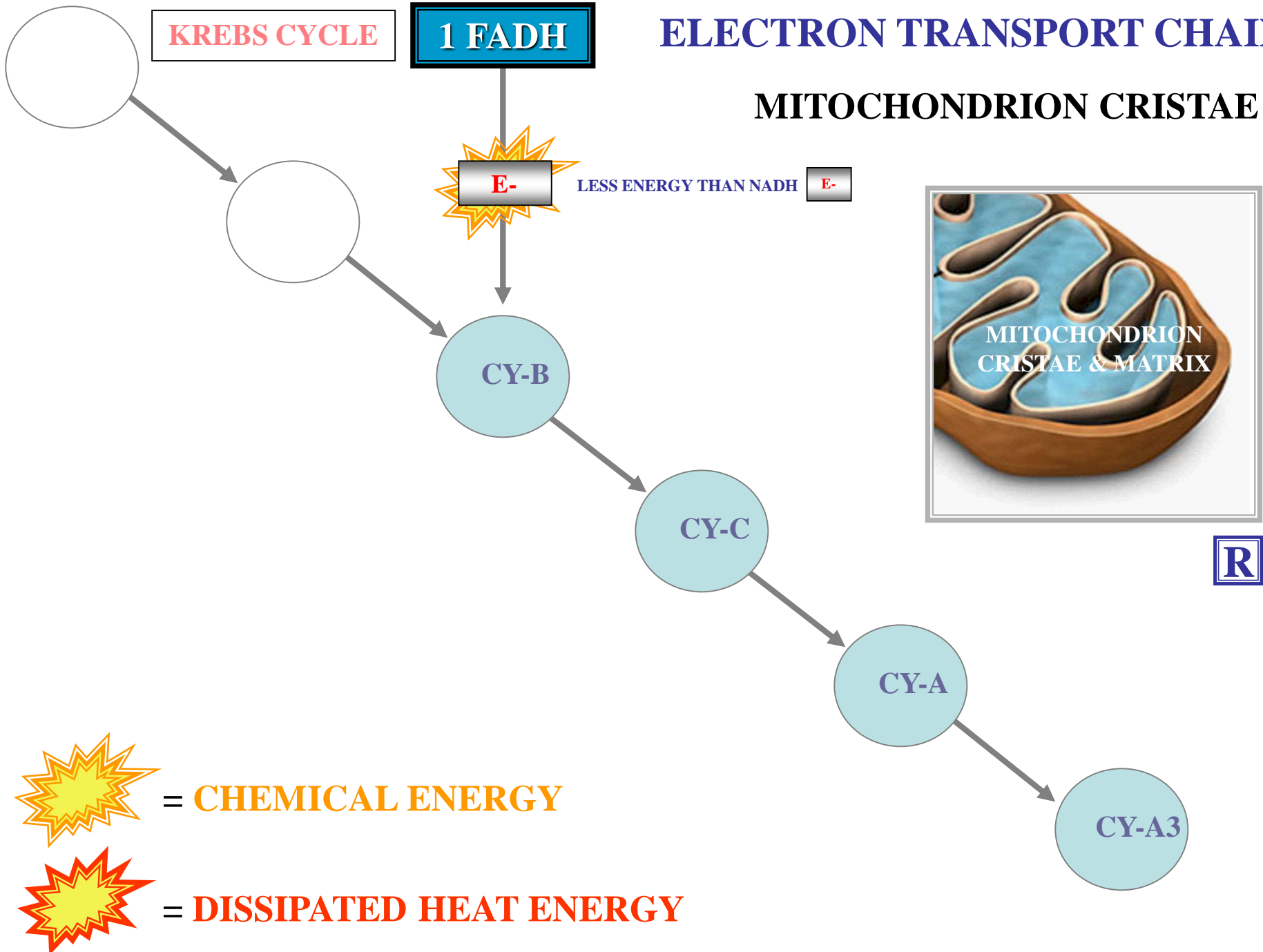
= **CHEMICAL ENERGY**



= **DISSIPATED HEAT ENERGY**

ELECTRON TRANSPORT CHAIN

MITOCHONDRION CRISTAE



 = **CHEMICAL ENERGY**

 = **DISSIPATED HEAT ENERGY**

ELECTRON TRANSPORT CHAIN

MITOCHONDRION CRISTAE



KREBS CYCLE

1 FADH

E-

LESS ENERGY THAN NADH

E-

CY-B

E-

REDOX RXT

DISSIPATED HT EGY

CY-C

E-

REDOX RXT

DISSIPATED HT EGY

CY-A

E-

REDOX RXT

DISSIPATED HT EGY

CY-A3

REDOX RXT

E-

OXYGEN

O

REDOX RXTS



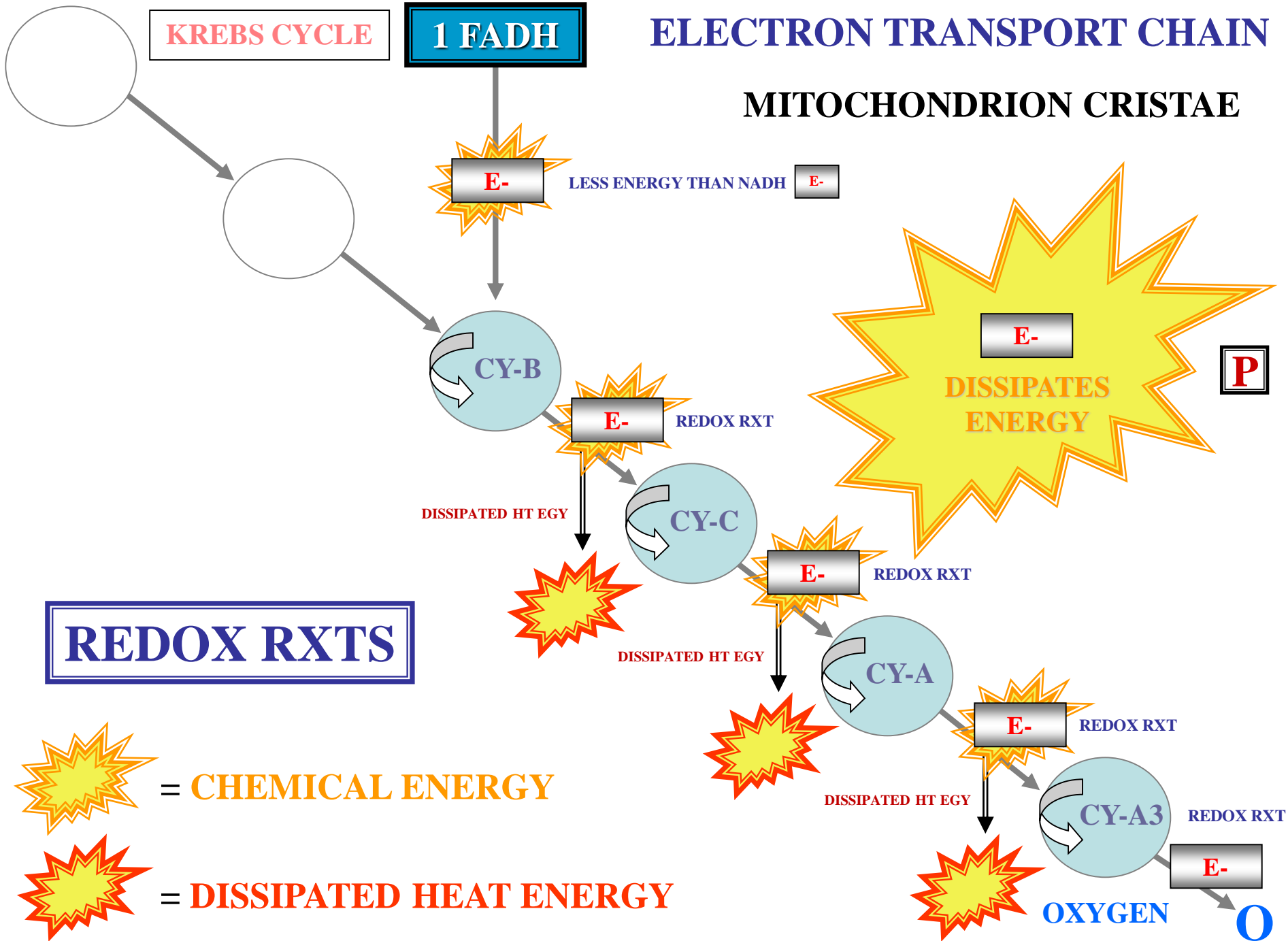
= CHEMICAL ENERGY



= DISSIPATED HEAT ENERGY

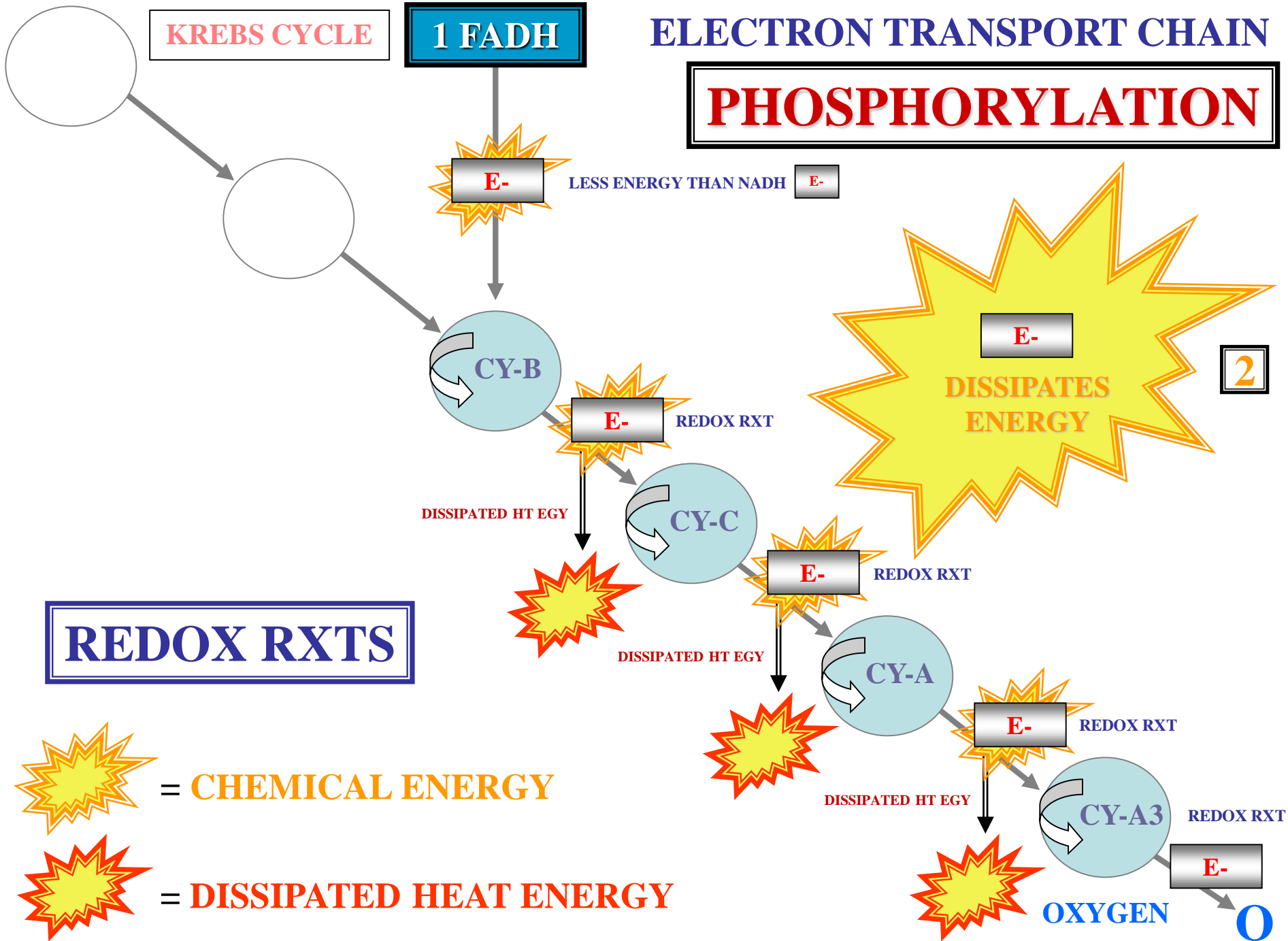
ELECTRON TRANSPORT CHAIN

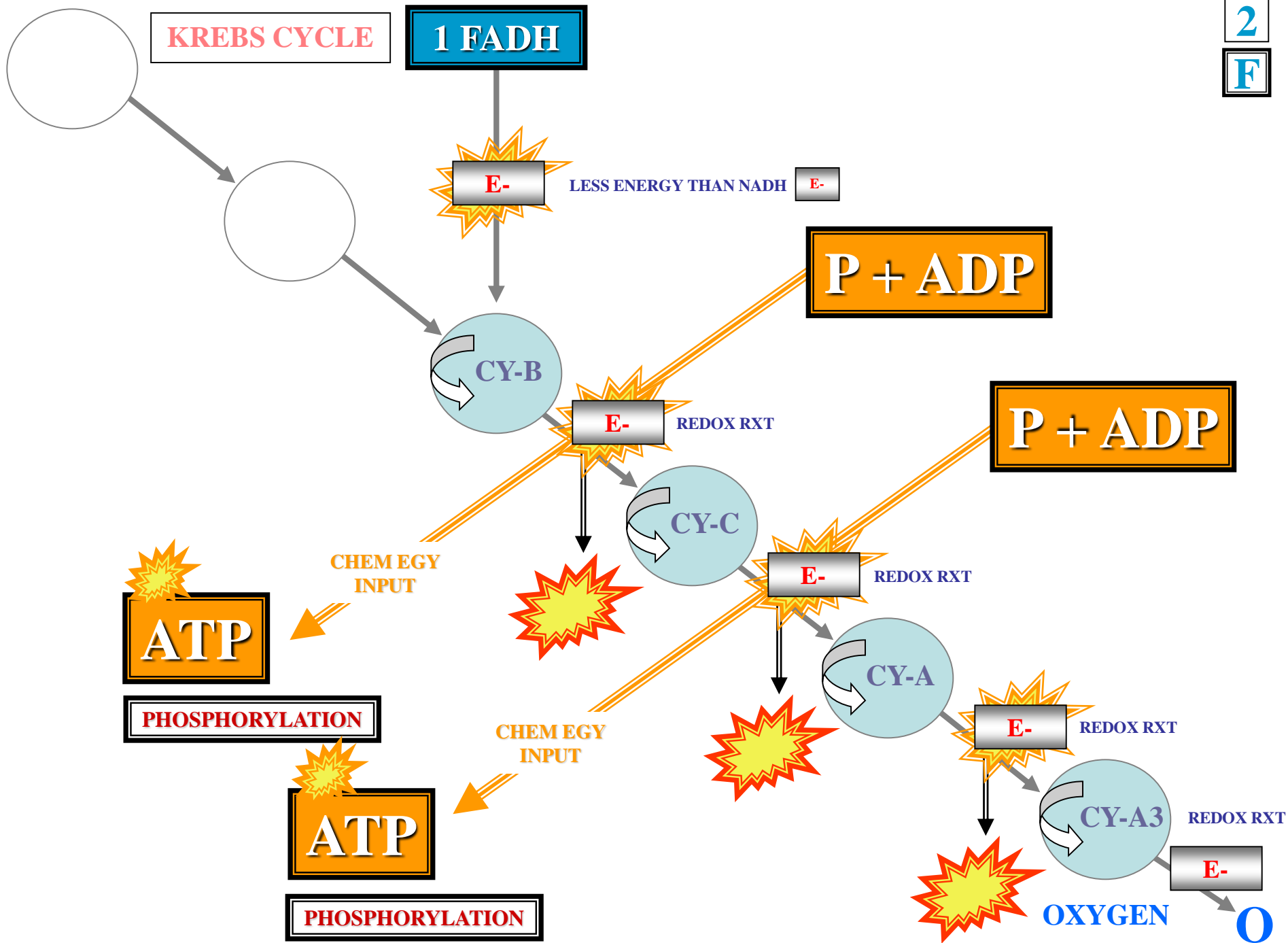
MITOCHONDRION CRISTAE

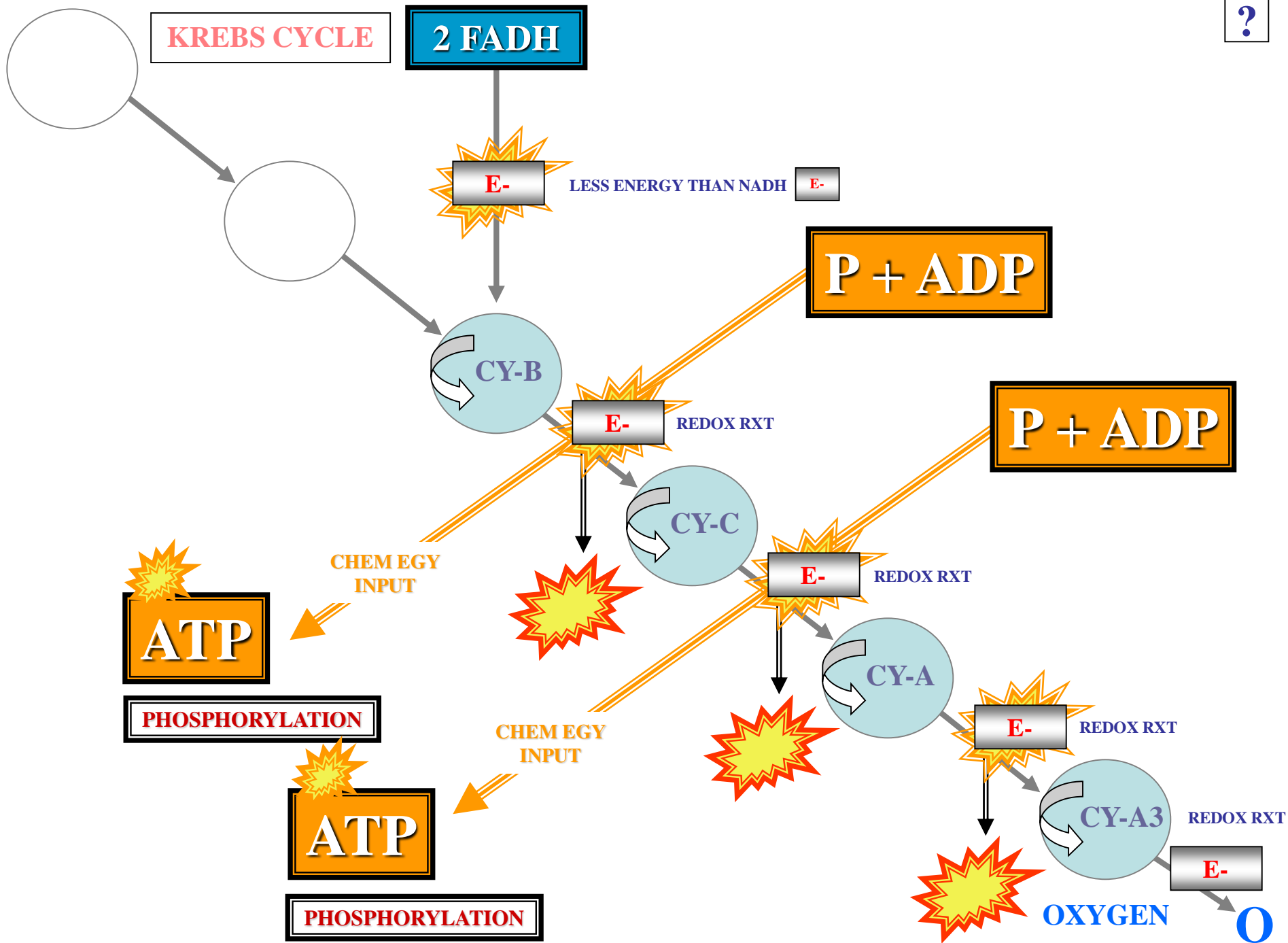


ELECTRON TRANSPORT CHAIN

PHOSPHORYLATION









QUESTION

HOW MANY NET ATP
PHOSPHORYLATIONS
VIA KREBS CYCLE
FADH?

QUESTION



4 ATP

PHOSPHORYLATIONS

VIA KREBS CYCLE

FADH

E- DONORS

QUESTION

HOW MANY NET ATP
PHOSPHORYLATIONS

VIA THE ENTIRE

KREBS CYCLE E- DONORS?

QUESTION

24 ATP

PHOSPHORYLATIONS

VIA KREBS CYCLE

NADH

E- DONORS

4 ATP

PHOSPHORYLATIONS

VIA KREBS CYCLE

FADH

E- DONORS



28 ATP

**PHOSPHORLATIONS
VIA KREBS CYCLE
E- DONORS**



ETC
ATP NET

QUESTION

HOW MANY NET ATP
PHOSPHORYLATIONS
VIA GLYCOLYSIS
E- DONORS?

QUESTION



4 ATP

**PHOSPHORLATIONS
VIA GLYCOLYSIS
E- DONORS**



QUESTION

HOW MANY NET ATP
PHOSPHORYLATIONS
VIA KREBS CYCLE
E- DONORS?

QUESTION



28 ATP

**PHOSPHORLATIONS
VIA KREBS CYCLE
E- DONORS**

QUESTION

HOW MANY NET ATP
PHOSPHORYLATIONS
VIA THE ENTIRE ETC?

QUESTION

4 ATP

**PHOSPHORYLATIONS
VIA GLYCOLYSIS
E- DONORS**

28 ATP

**PHOSPHORLATIONS
VIA KREBS CYCLE
E- DONORS**



ETC
ATP NET
32 ATP

METABOLISM

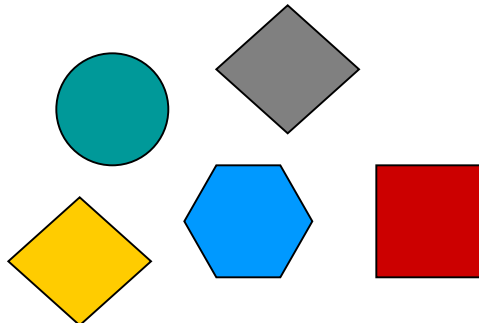
GLUCOSE



**CATABOLIC
METABOLISM**

**AEROBIC
RESPIRATION**

ETC



BUILDING BLOCKS



METABOLISM

GLUCOSE



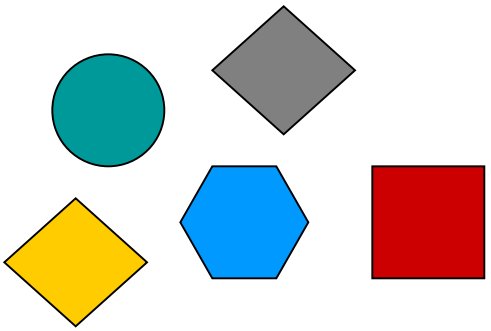
CATABOLIC METABOLISM

AEROBIC RESPIRATION

ETC



ANABOLIC METABOLISM

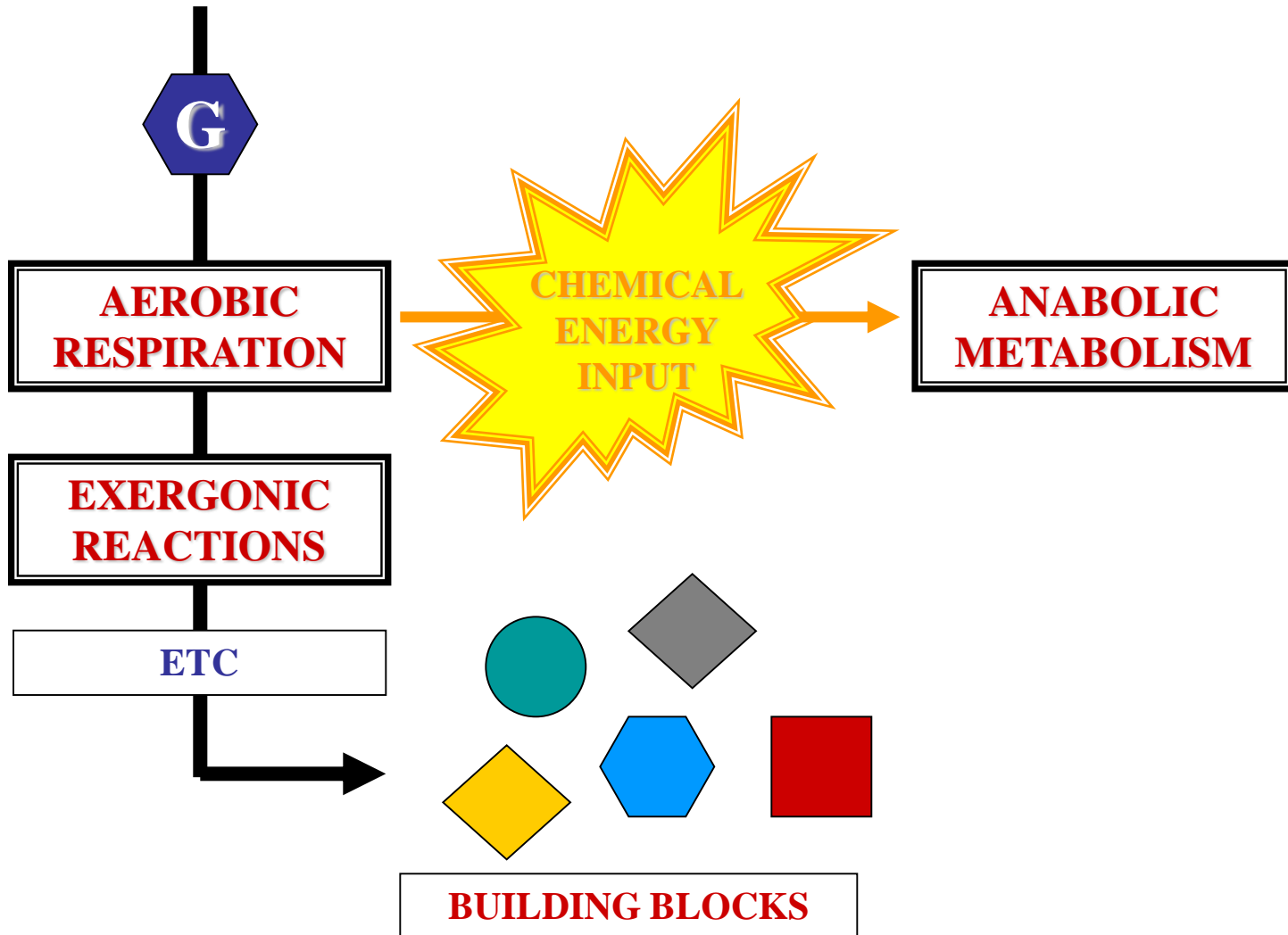


BUILDING BLOCKS

METABOLISM

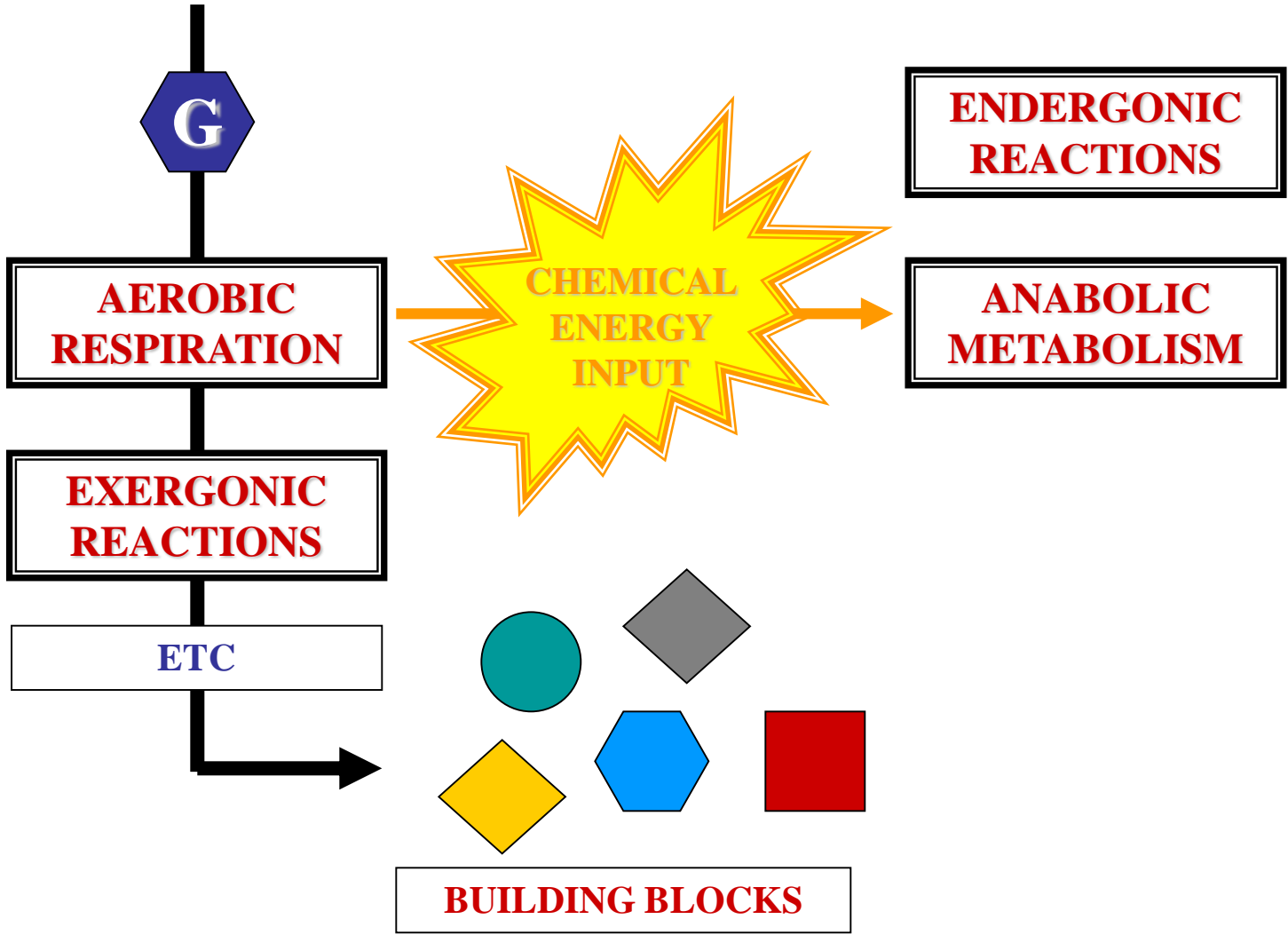
EN

GLUCOSE



METABOLISM

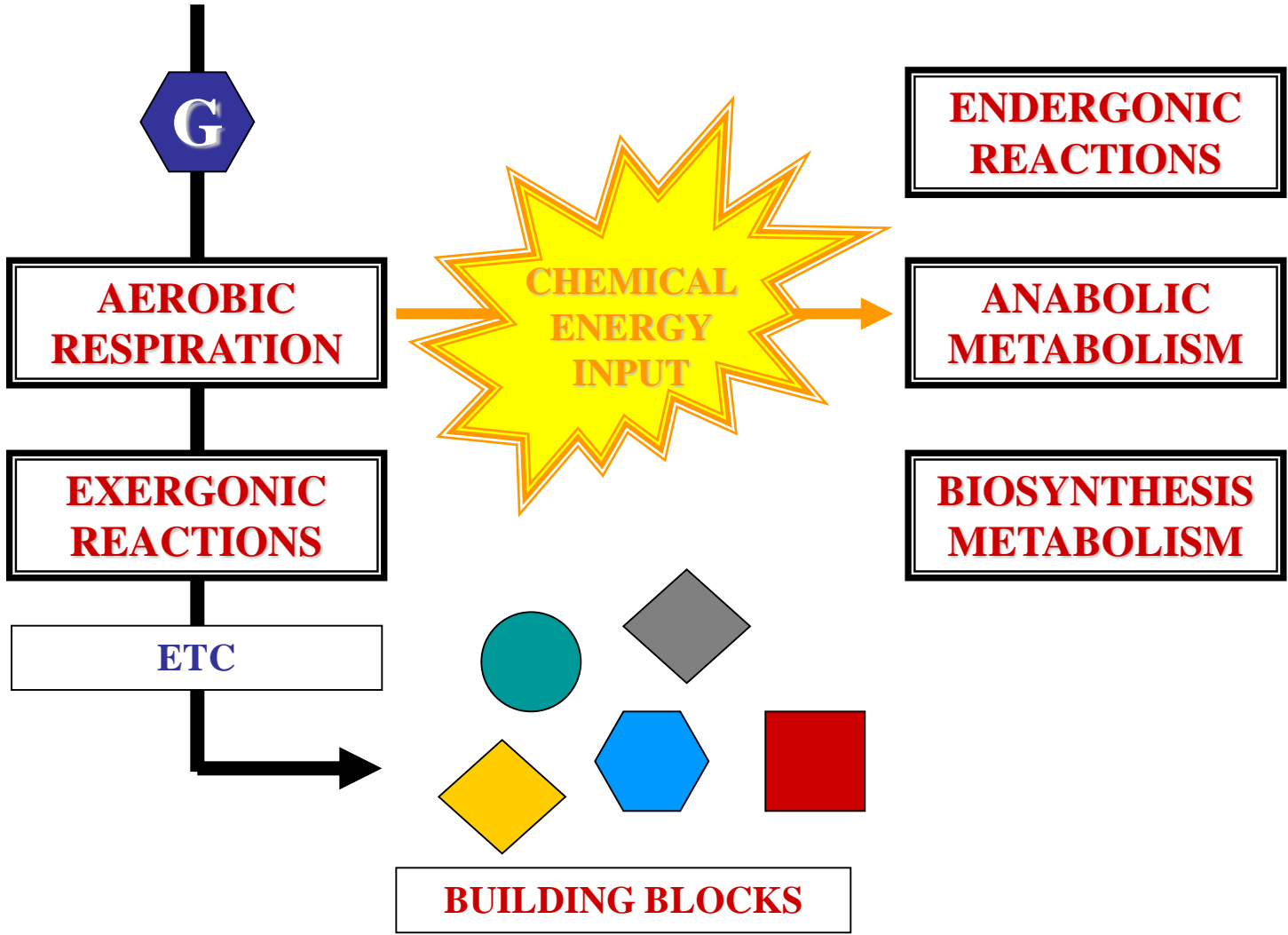
GLUCOSE





METABOLISM

GLUCOSE

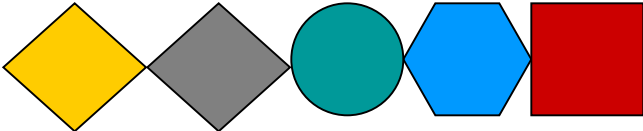




METABOLISM

GLUCOSE

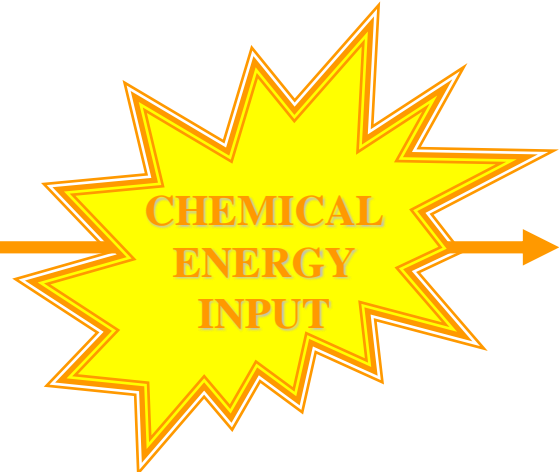
COMPLEX BIO-CHEM-CMPS



**AEROBIC
RESPIRATION**

**EXERGONIC
REACTIONS**

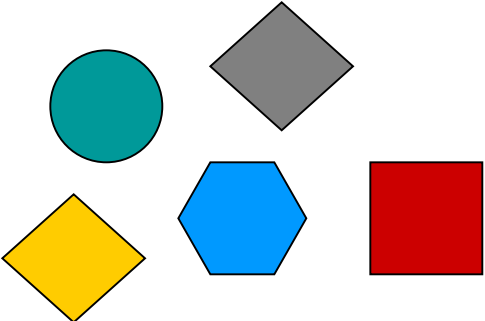
ETC



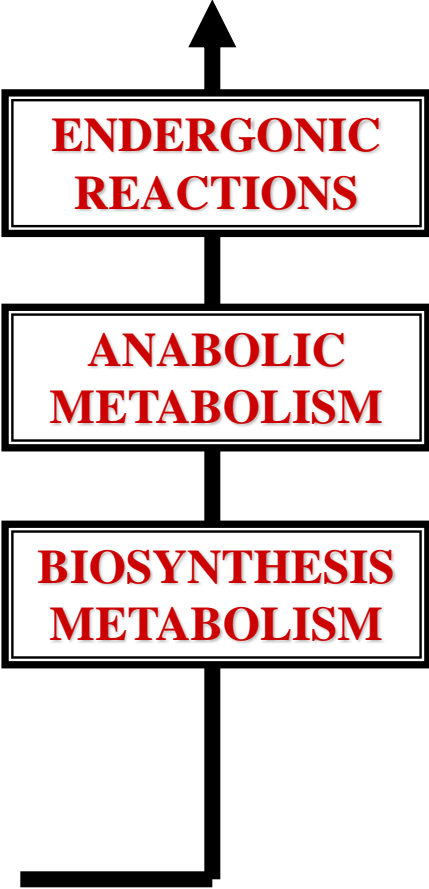
**ENDERGONIC
REACTIONS**

**ANABOLIC
METABOLISM**

**BIOSYNTHESIS
METABOLISM**



BUILDING BLOCKS

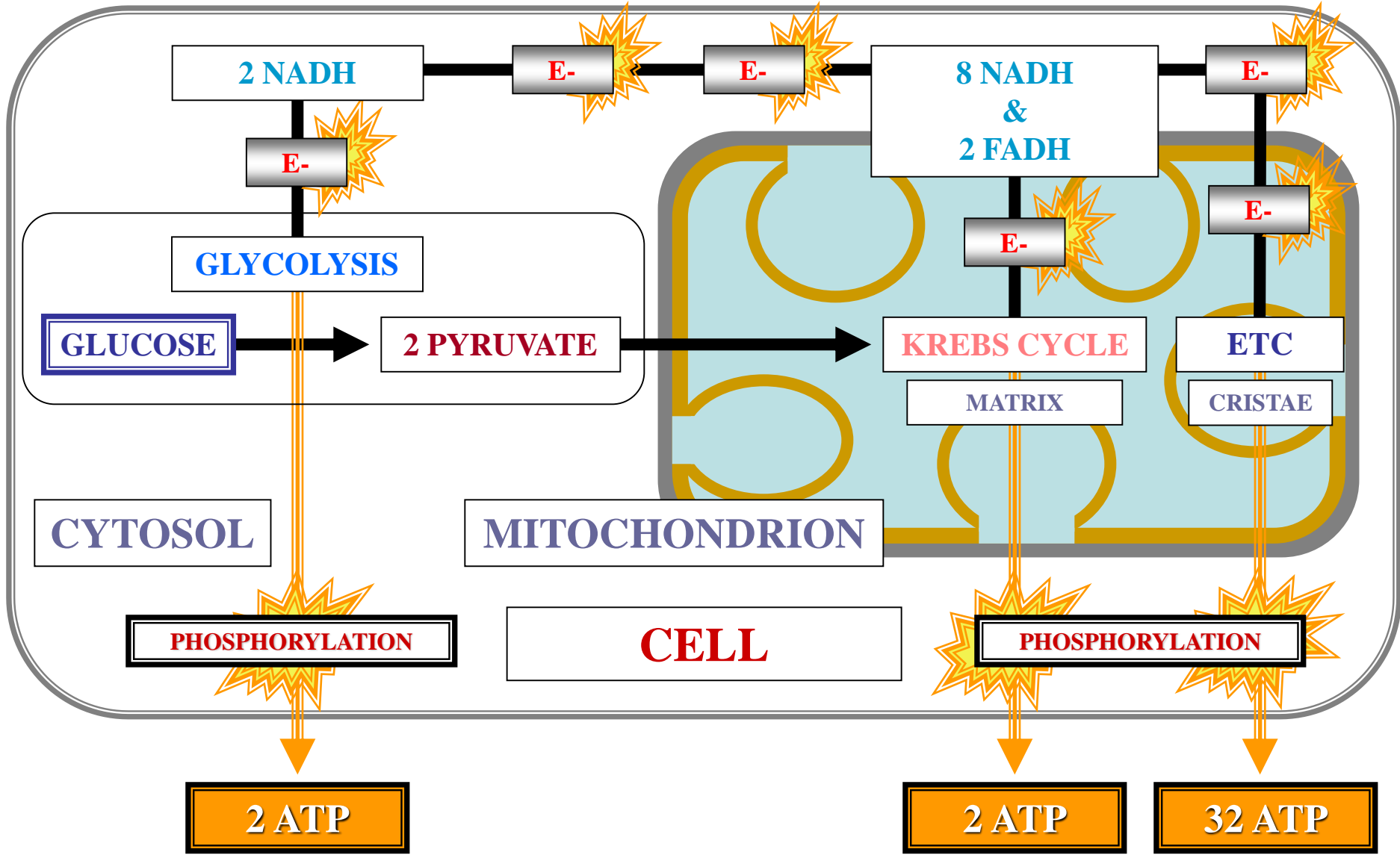
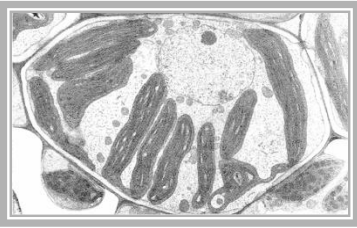


***CELL
GROWTH
&
MAINTENANCE***

HOMEOSTASIS

An electron micrograph showing a cross-section of a cell. The image displays various organelles, including several mitochondria with visible internal folds (cristae), a large nucleus with a prominent nucleolus, and sections of endoplasmic reticulum. The overall structure is highly detailed, showing the granular texture of the cytoplasm and the distinct membranes of the organelles.

AEROBIC RESPIRATION



ETC

PHOSPHORYLATION

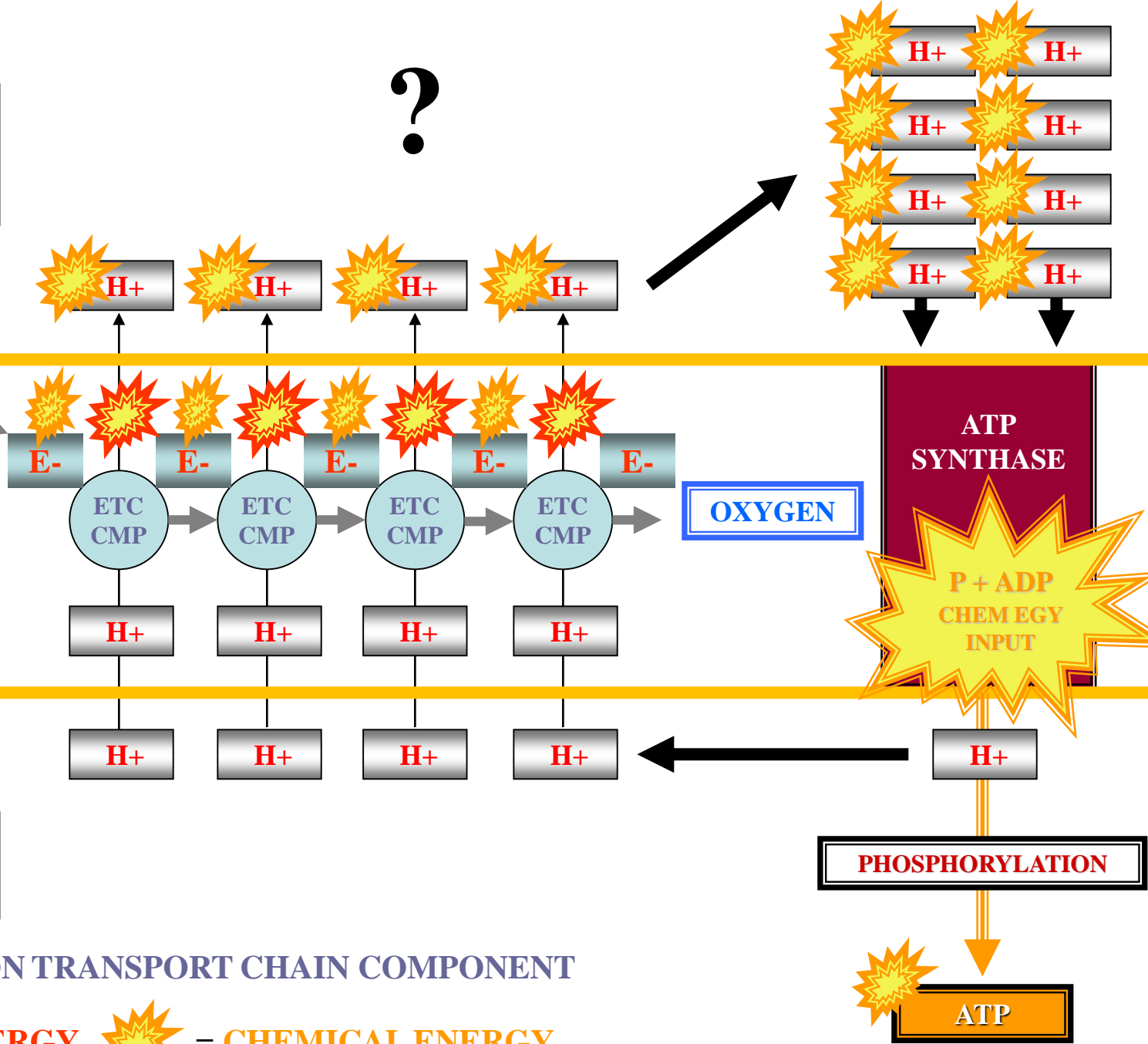
C

MITOCHONDRION CRISTAE SPACE

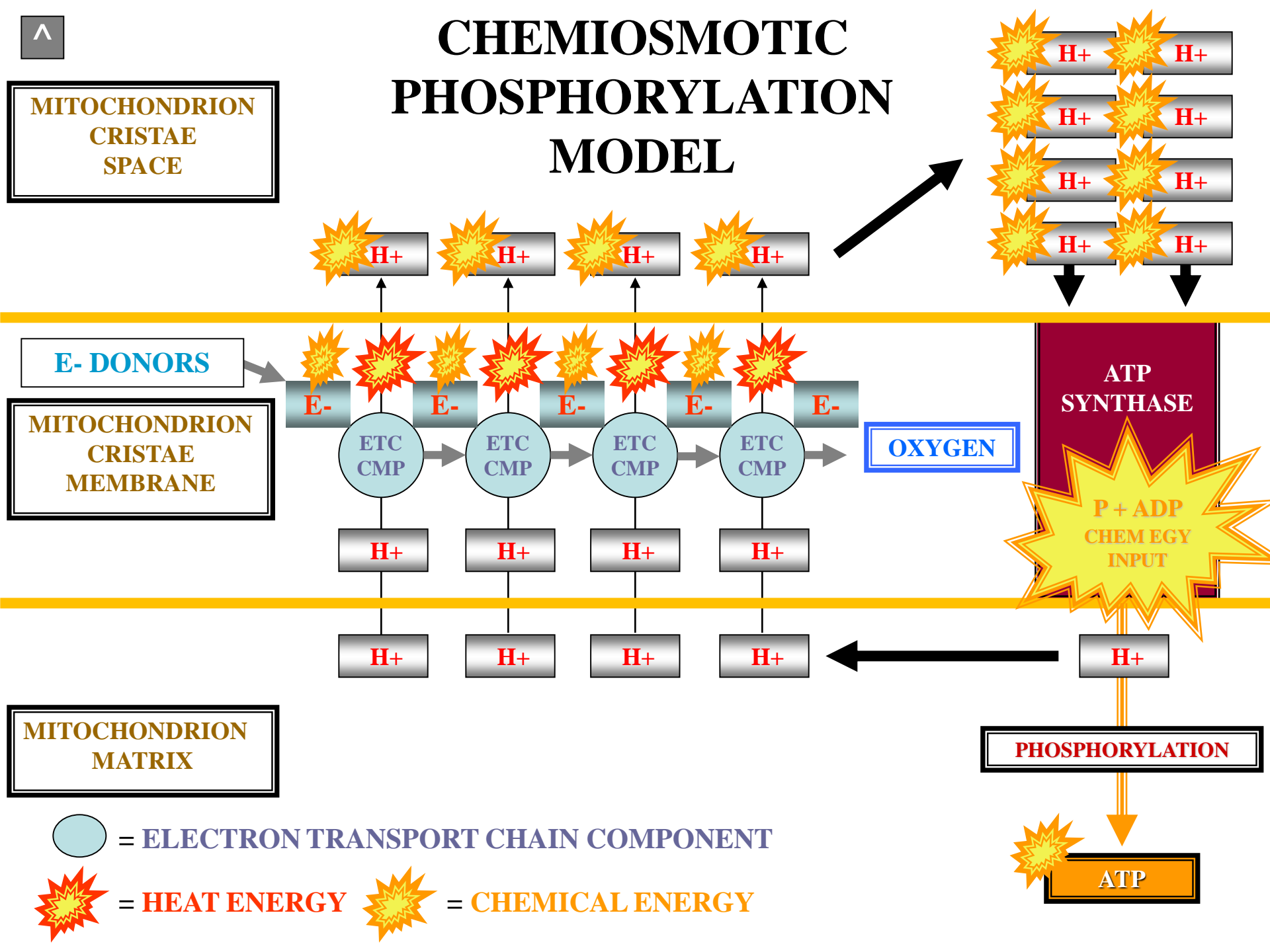
?

E- DONORS
MITOCHONDRION CRISTAE MEMBRANE

MITOCHONDRION MATRIX



CHEMIOSMOTIC PHOSPHORYLATION MODEL





CHEMIOSMOTIC PHOSPHORYLATION MODEL



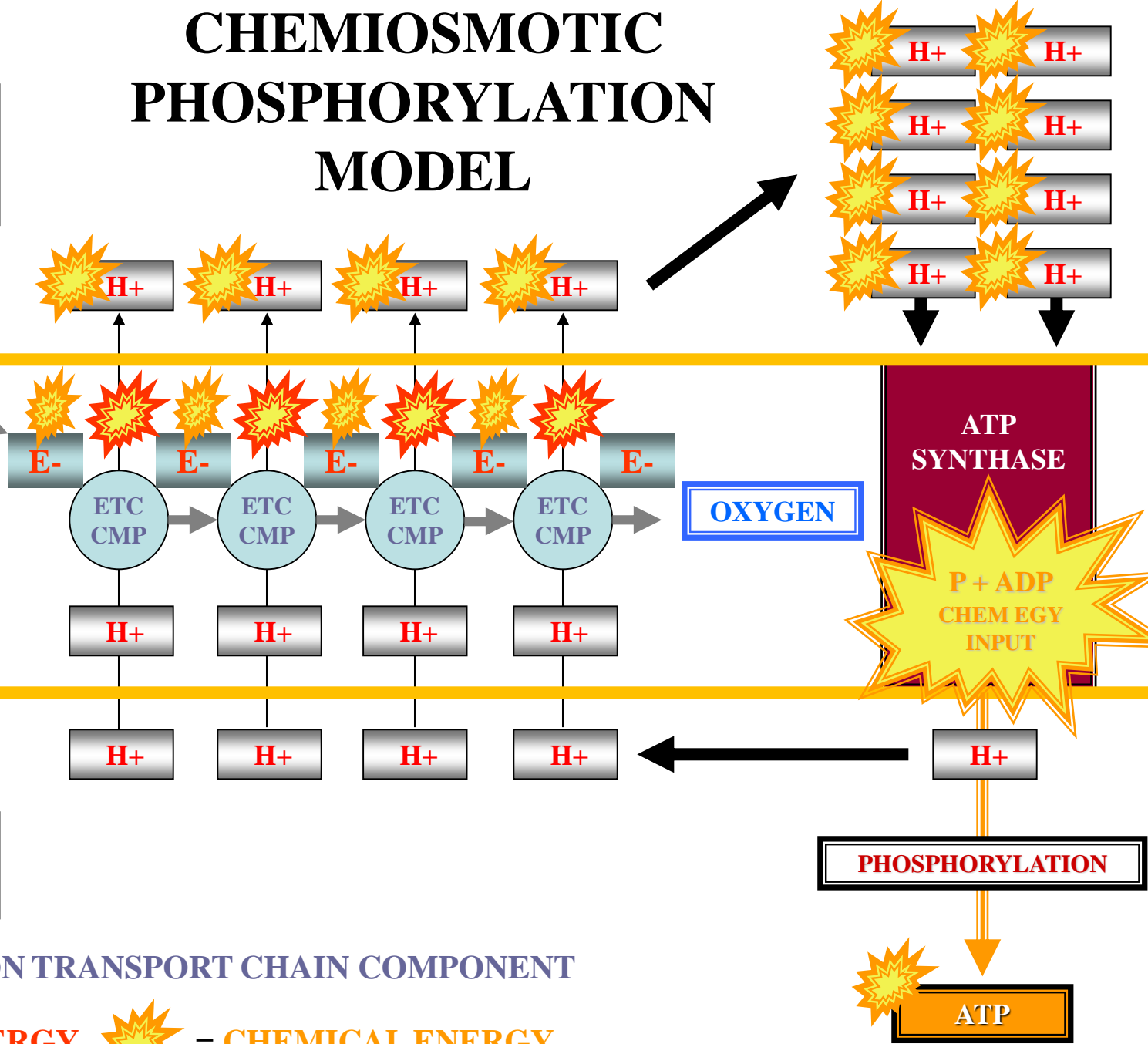
CHEMIOSMOTIC PHOSPHORYLATION MODEL

MITOCHONDRION CRISTAE SPACE

E- DONORS

MITOCHONDRION CRISTAE MEMBRANE

MITOCHONDRION MATRIX



 = ELECTRON TRANSPORT CHAIN COMPONENT

 = HEAT ENERGY  = CHEMICAL ENERGY



CHEMIOSMOTIC PHOSPHORYLATION

*NOT FULLY
UNDERSTOOD*



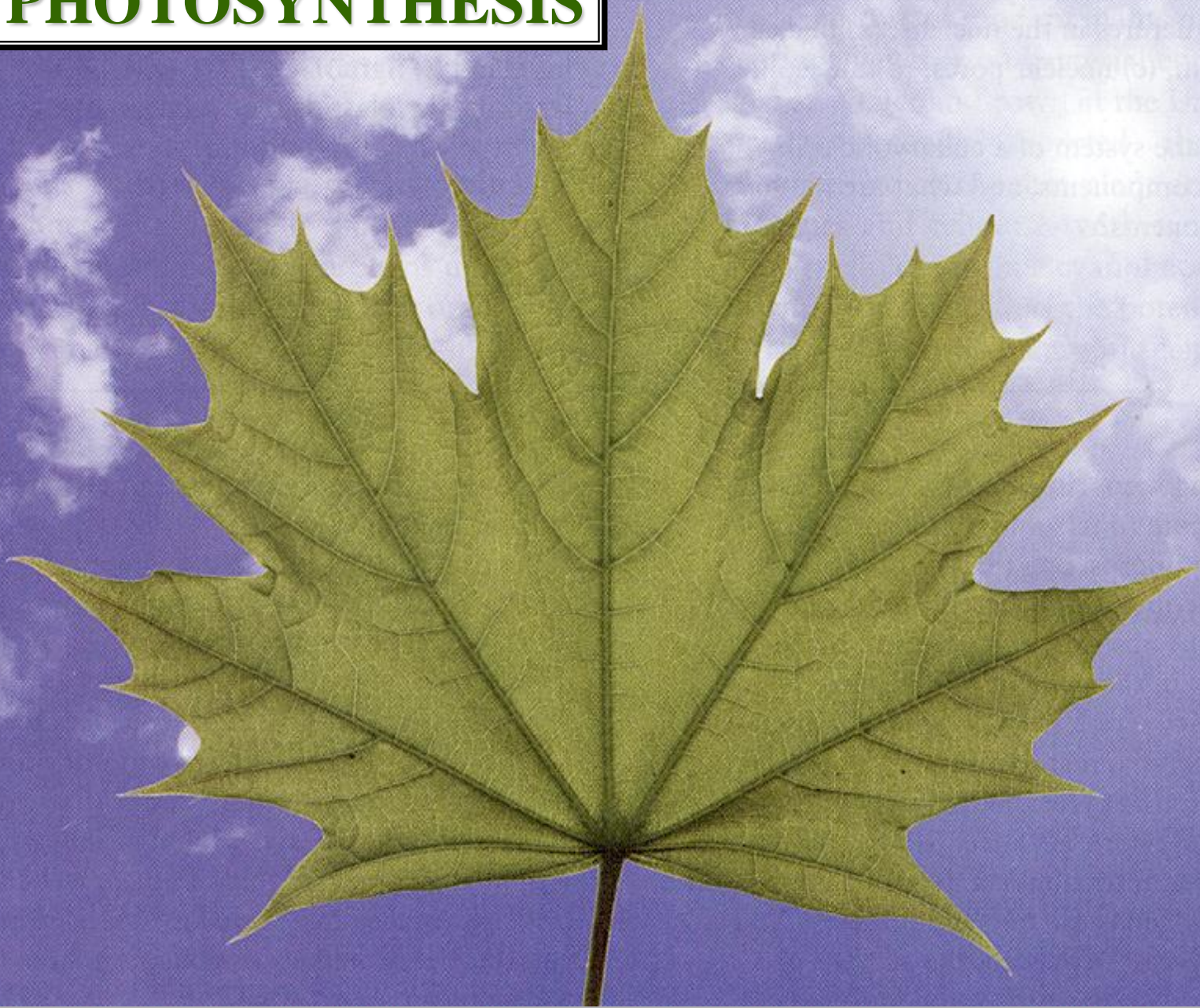
QUESTION

**HAVE WE WORKED
WITH THE
CHEMIOSMOTIC
PHOSPHORYLATION
MODEL PREVIOUSLY?**

QUESTION

PHOTOSYNTHESIS

P



PHOTOSYNTHESIS

P



WATER

CO₂

LIGHT ENERGY

PHOTO

ATMOSPHERE

E-

PHOTOLYSIS



LT RXT

THYLAKOID
GRANUM

ATP
NADPH

DK RXT

STROMA

CHLOROPLAST

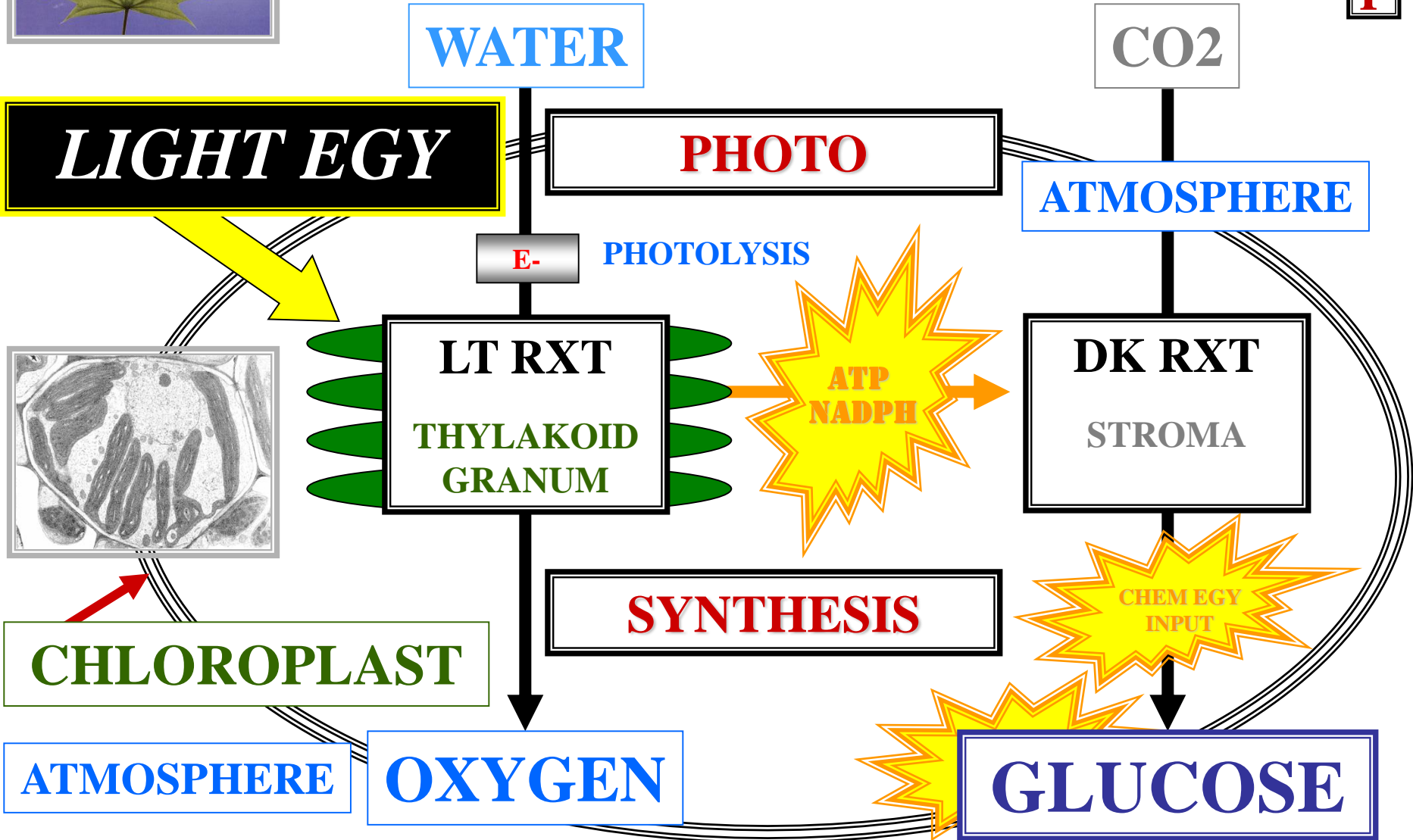
SYNTHESIS

CHEMICAL
INPUT

ATMOSPHERE

OXYGEN

GLUCOSE



PHOTOSYNTHESIS



N

