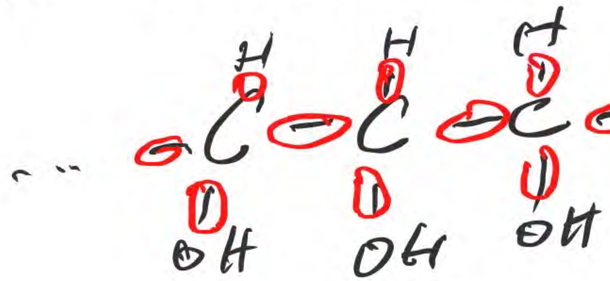
BIG PICTURE

Electron carriers:

* All covalent bonds have shared electrons (e-).



... → FOOD = high-energy bonds (high-energy e-)

ENERGY need to be capture by cellular respiration.

* Captured e- → transport by B vitamins NAD^+ and FAD = TRANSPORTER.

↓

ELECTRON TRANSPORT SYSTEM

REDOX Reactions

HOW IT WORKS!

- Reduction - (gain e-)

- oxydation - (loss e-)

REDUCTION : Oxydant + e- ⟶ Product

Electrons gained ; oxydation number decreases

Ex : Copper II : $\underset{+II}{Cu^{2+}} + e^- \longrightarrow \underset{+I}{Cu^{+}}$

OXYDATION : Reductant ⟶ Product + e-

Electrons lost ; oxydation number increases

KEY FEATURES

GLYCOLYSIS

"SUGAR" = Glucose

= degradation

in biology:

DEGRADATION OF MOLECULE = CATABOLIC PATHWAY!!!

* LOCATION: CYTOPLASM

* INPUT: GLUCOSE

* OUTPUT: 2 PYRUVATE

* ANAEROBIC: NO NEED OXYGEN!

* COST TO THE CELL: 2 ATP in

* BACK TO THE CELL: 4 ATP out

NET BENEFIT FOR CELL: +2 ATP

* on top of 2 ATP → +2 NADH (reduced of coenzymes)

C = carbon

GLYCOLYSIS

Glucose — IN

2 ATP — IN

2 ADP

Fructose diphosphate

Glyceraldehyde 3-phosphate

Glyceraldehyde 3-Phosphate

NAD^+

NADH — OUT

2 ADP

2 ATP — OUT

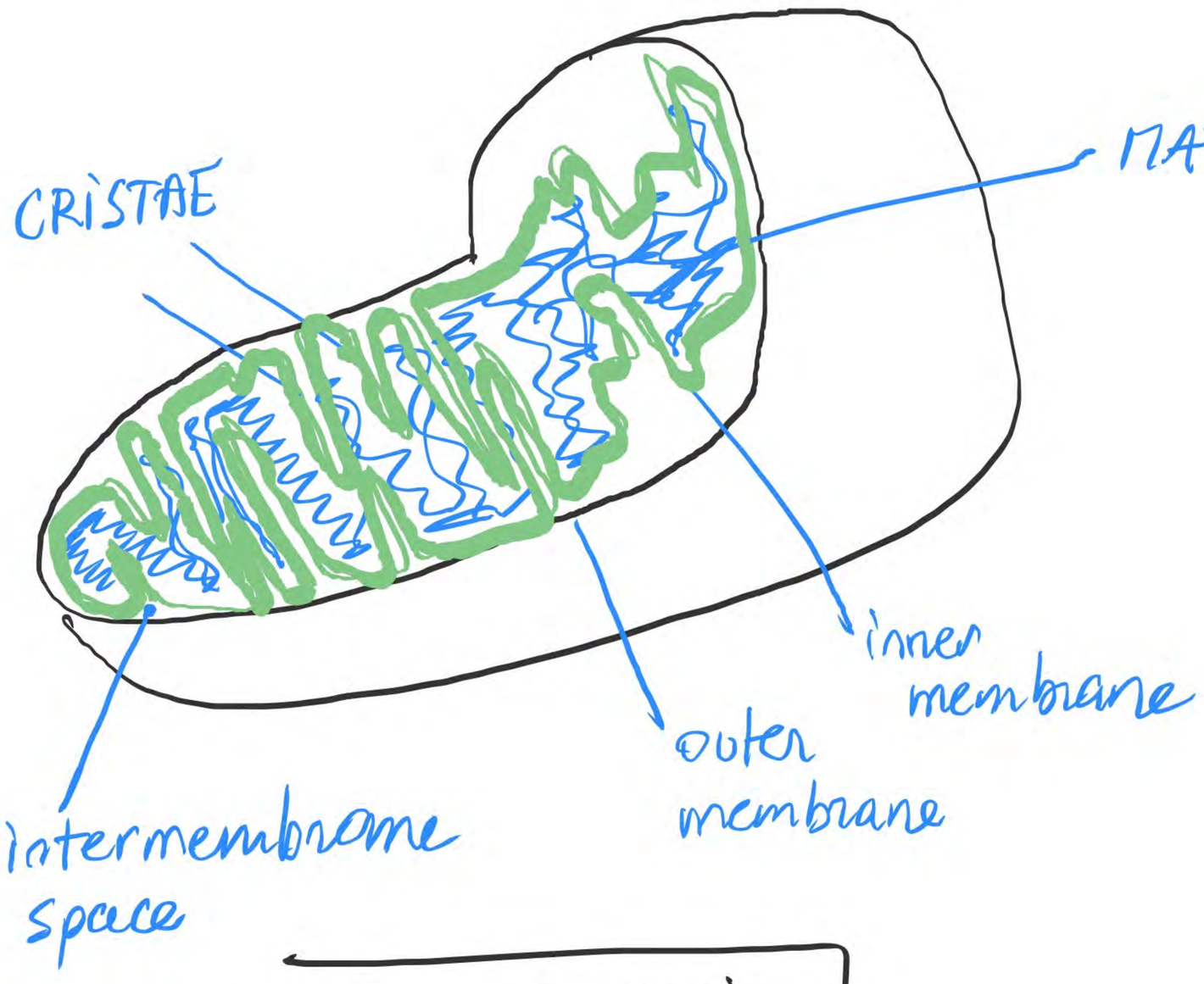
PYRUVATE

PYRUVATE

OUT

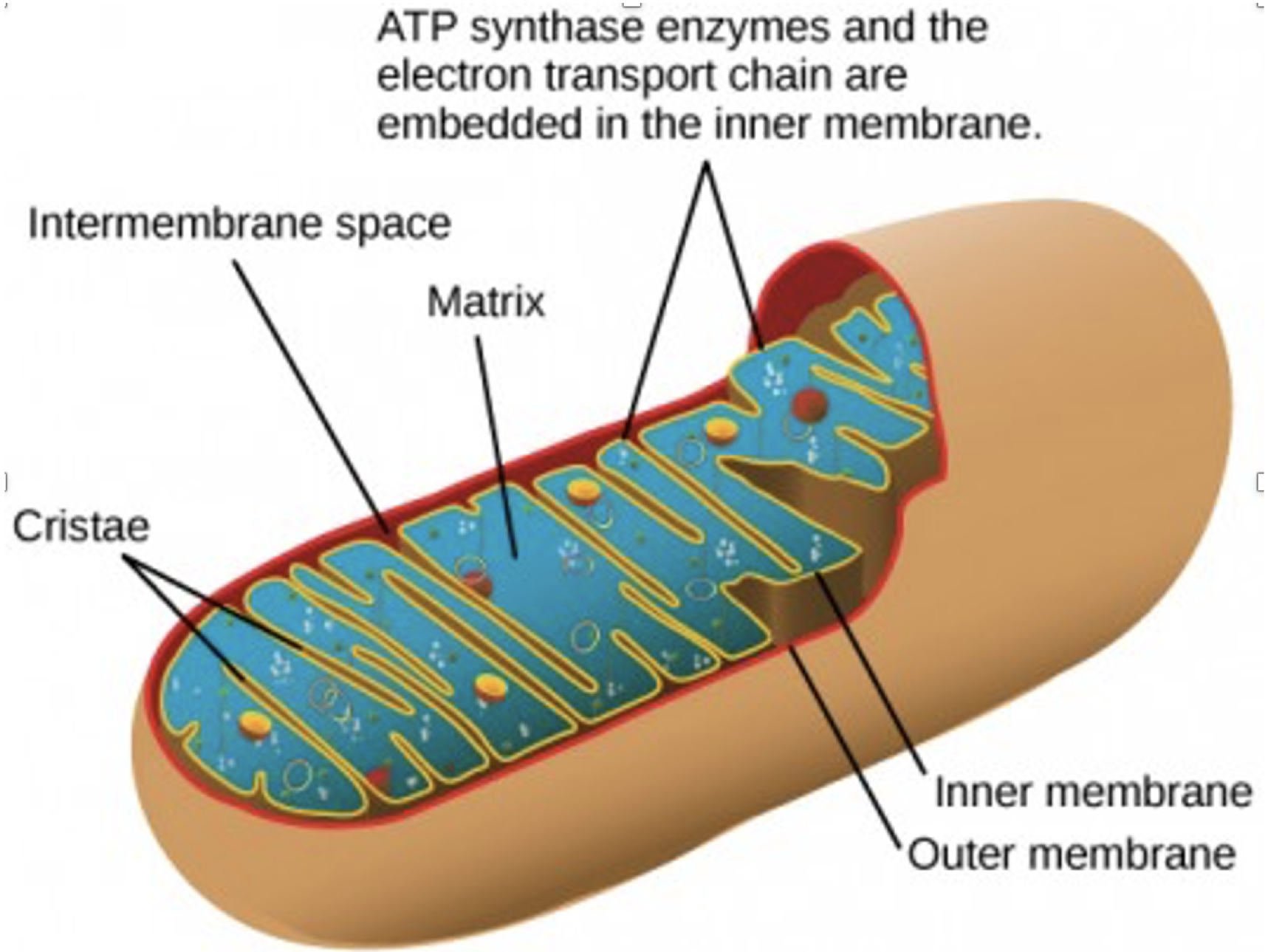
→ slide #6

EUKARYOTE CELLS: OXIDATIVE PHOSPHORYLATION ⟶ MITOCHONDRIA.
(vs procaryotes, → plasma membrane)



MITOCHONDRIA

ATP synthase
Enzymes and the electrons transport chain are embedded in the inner membrane


ATP synthase enzymes and the electron transport chain are embedded in the inner membrane.
Intermembrane space
Matrix
Cristae
Inner membrane
Outer membrane

CITRIC ACID CYCLE

INPUT: ACETYLCoA

OUTPUT: 2 CO_2 ; reduced coenzymes (3 NADH + 1 $FADH_2$) + 1 ATP

⚠ Double these numbers for each molecule of Glucose.

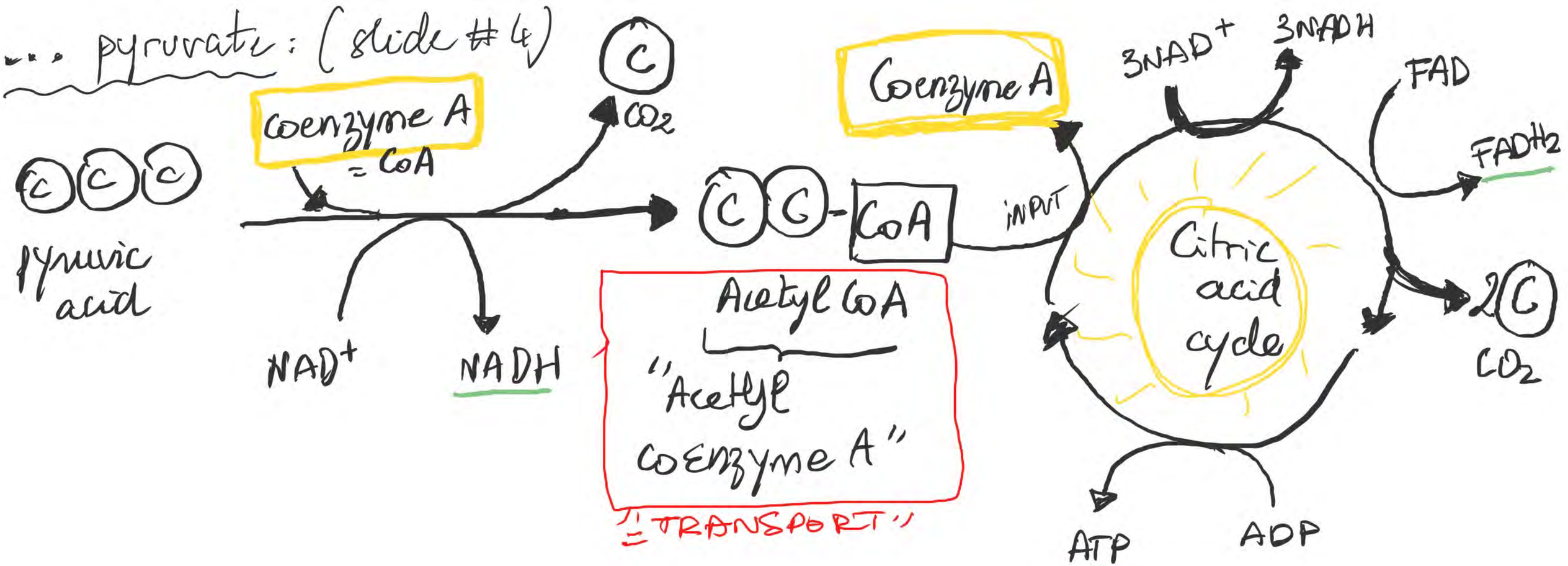
* REQUIRES OXYGEN.
* LOCATION: MITOCHONDRIAL MATRIX

FEW REMARKS:

Glucose totally disintegrated

6 CO_2 are released to our bloodstream and we breath them out

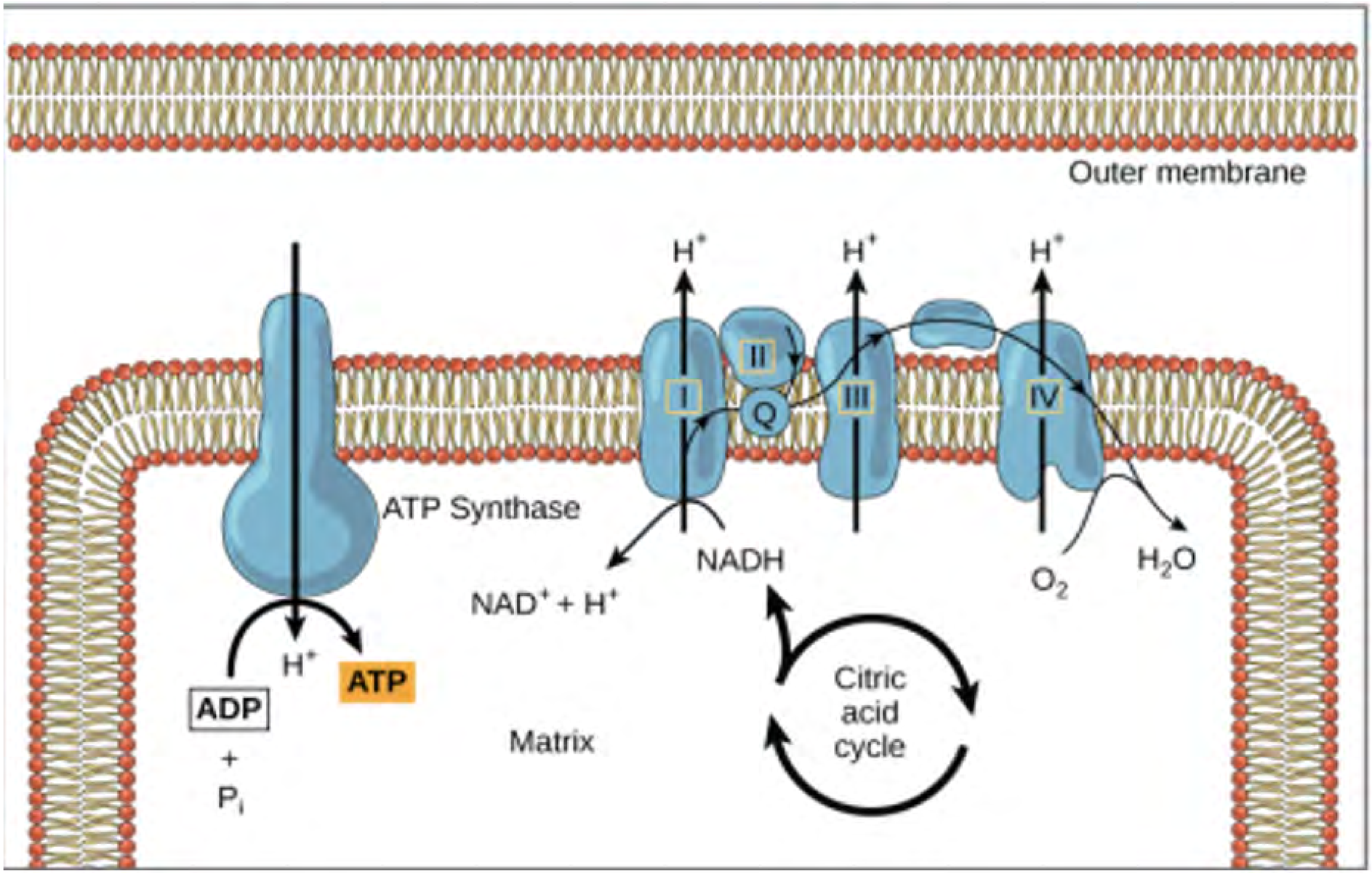
... pyruvate: (slide #4)



Pyruvate is converted into acetyl-CoA before entering the citric acid cycle.

* if oxygene is present, pyruvate is groomed to acetyl CoA
* the 1st CO_2 is released of the eventual 6 CO_2
* OUTPUT = ACETYL COA ⊕ 2 NADH / glucose (1/pyruvate)
  * ACETYL COA GOES TO THE MATRIX OF MITOCHONDRIA.


cytoplasm / (outside mitochondria)
outer memb
e-transport system
cytochrome C
outer membrane
inner membrane
inner membrane
H+
I
II
III
IV
Q
cyt c
e-
ATP synthase
NAD+ + H+
NADH
O2
H2O
ADP + Pi
ATP
CITRIC ACID CYCLE
MATRIX
MITOCHONDRIA


Outer membrane
H+
H+
H+
I
II
III
IV
Q
ATP Synthase
NADH
NAD+ + H+
O2
H2O
H+
ATP
ADP
+
Pi
Matrix
Citric
acid
cycle

ELECTRON TRANSPORT CHAIN

O_2 = Magnet for the flow of electrons through the e- transport system.

As the e- flow, H^+ (proton) are dispatched to and trapped in the intermembrane space.

. the proton gradient that is created has potential energy like water behind a dam.

- A turbine-like ATP synthase captures gradient energy in ATP by chemiosmosis.
- INPUTS: NADH, $FADH_2$ OUTPUT: H_2O, ~36 ATP / glucose total
- 34% efficient at capturing energy - 66% leaving as heat.
- LOCATION: INNER MEMBRANE OF THE MITOCHONDRIA.