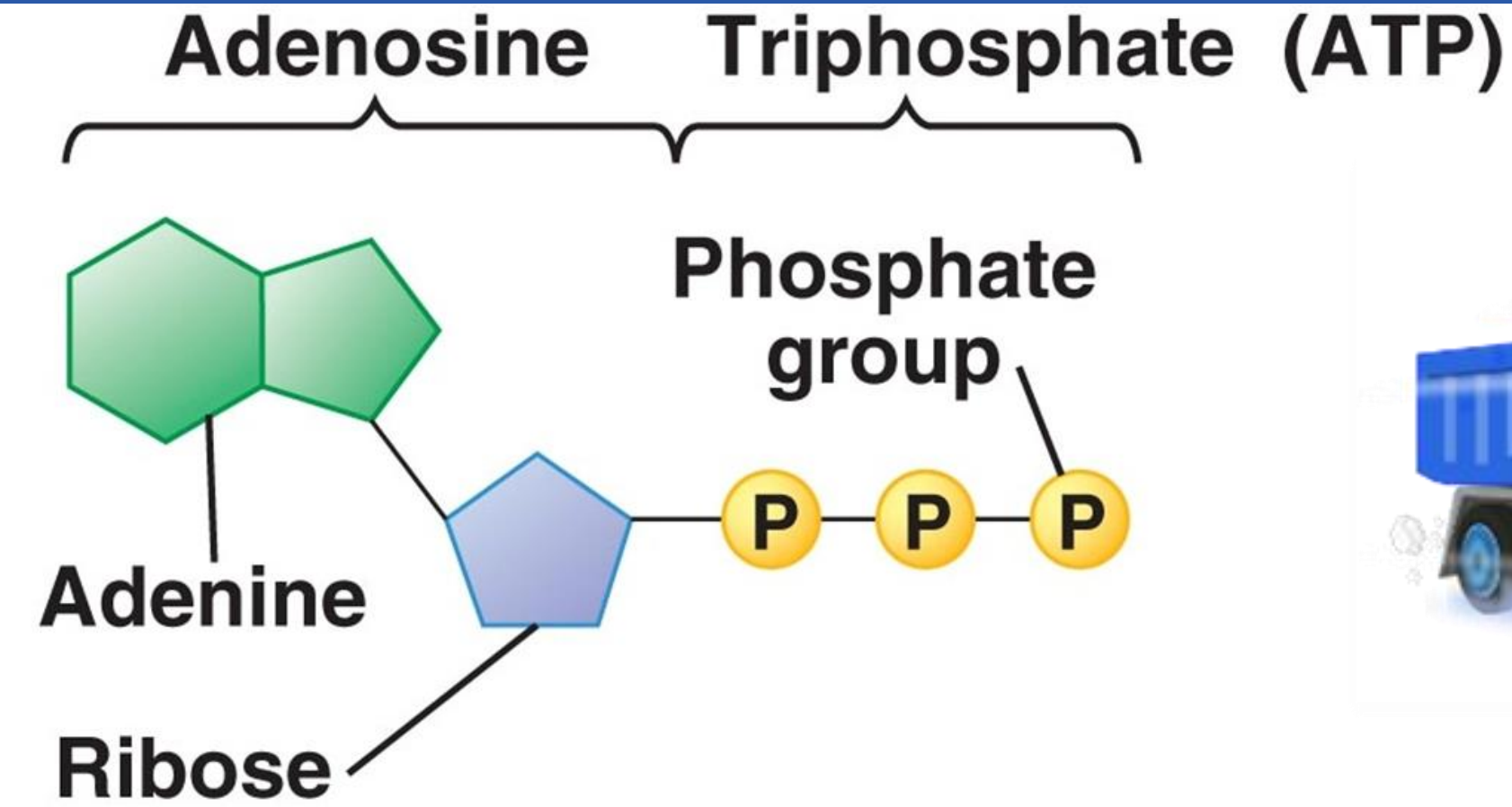
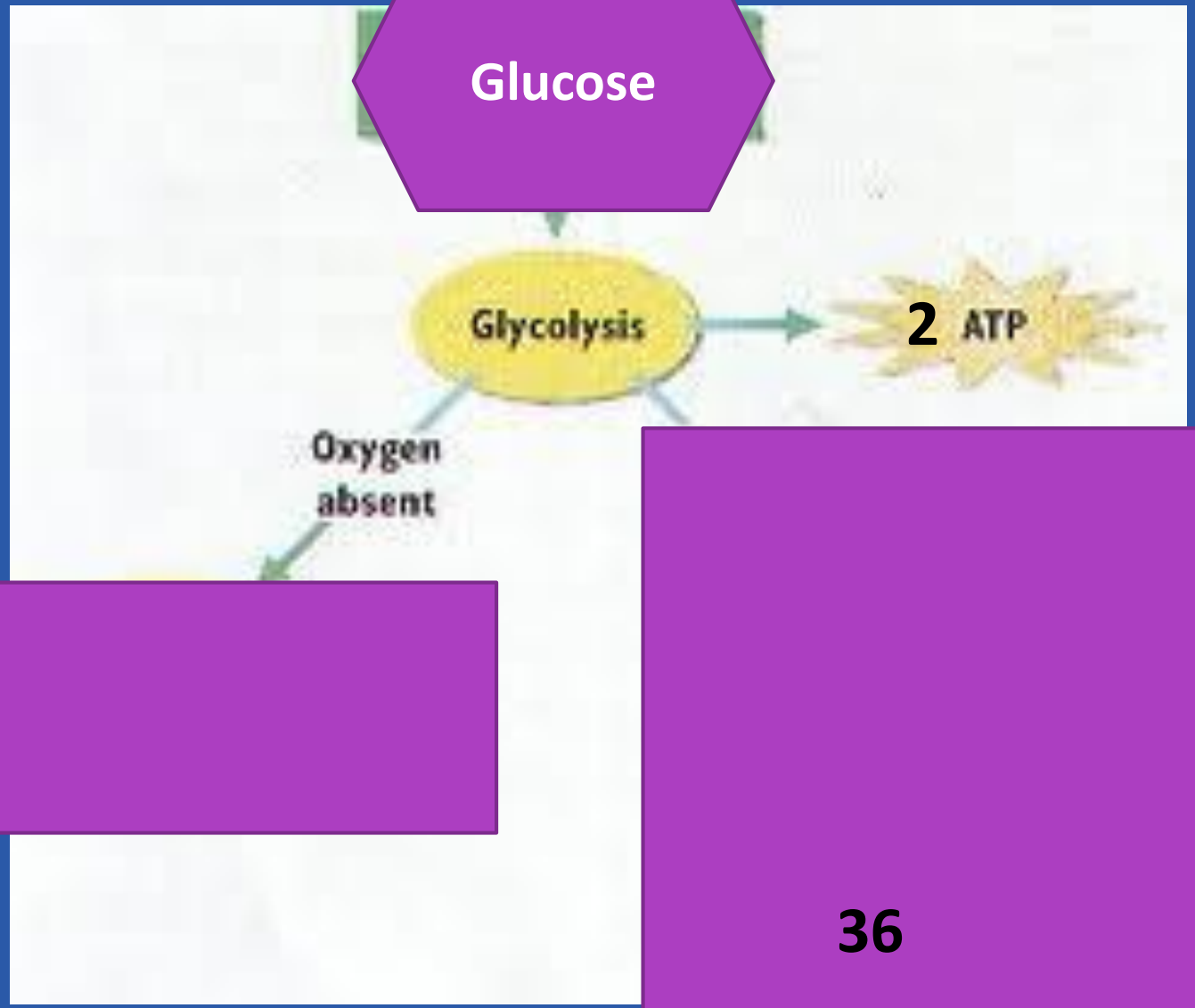
Remember …. **ALL** cell activities require stored energy from what molecule?

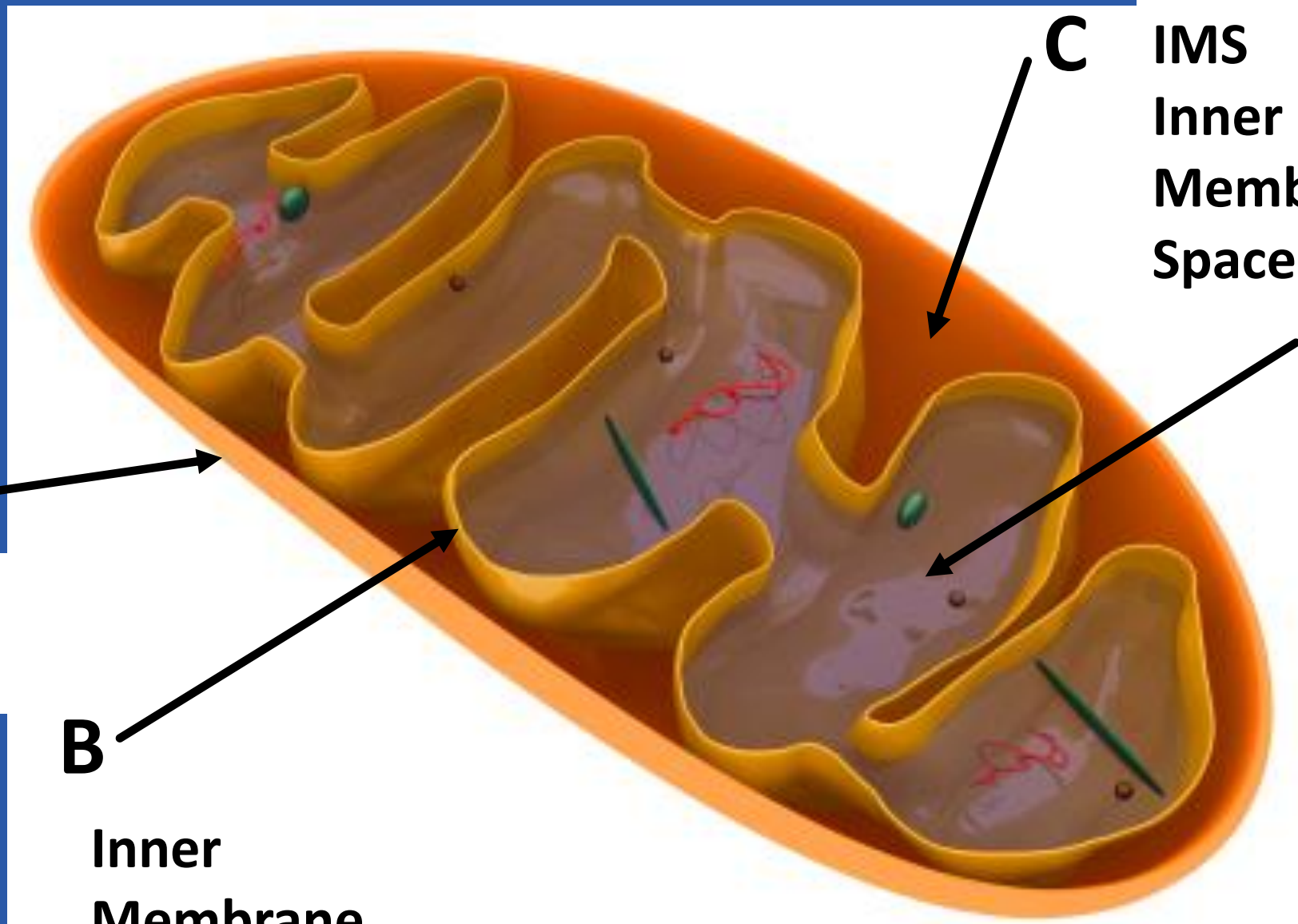


AEROBIC VS ANAEROBIC RESPIRATION



36

Let's Identify some KEY Mitochondria structures



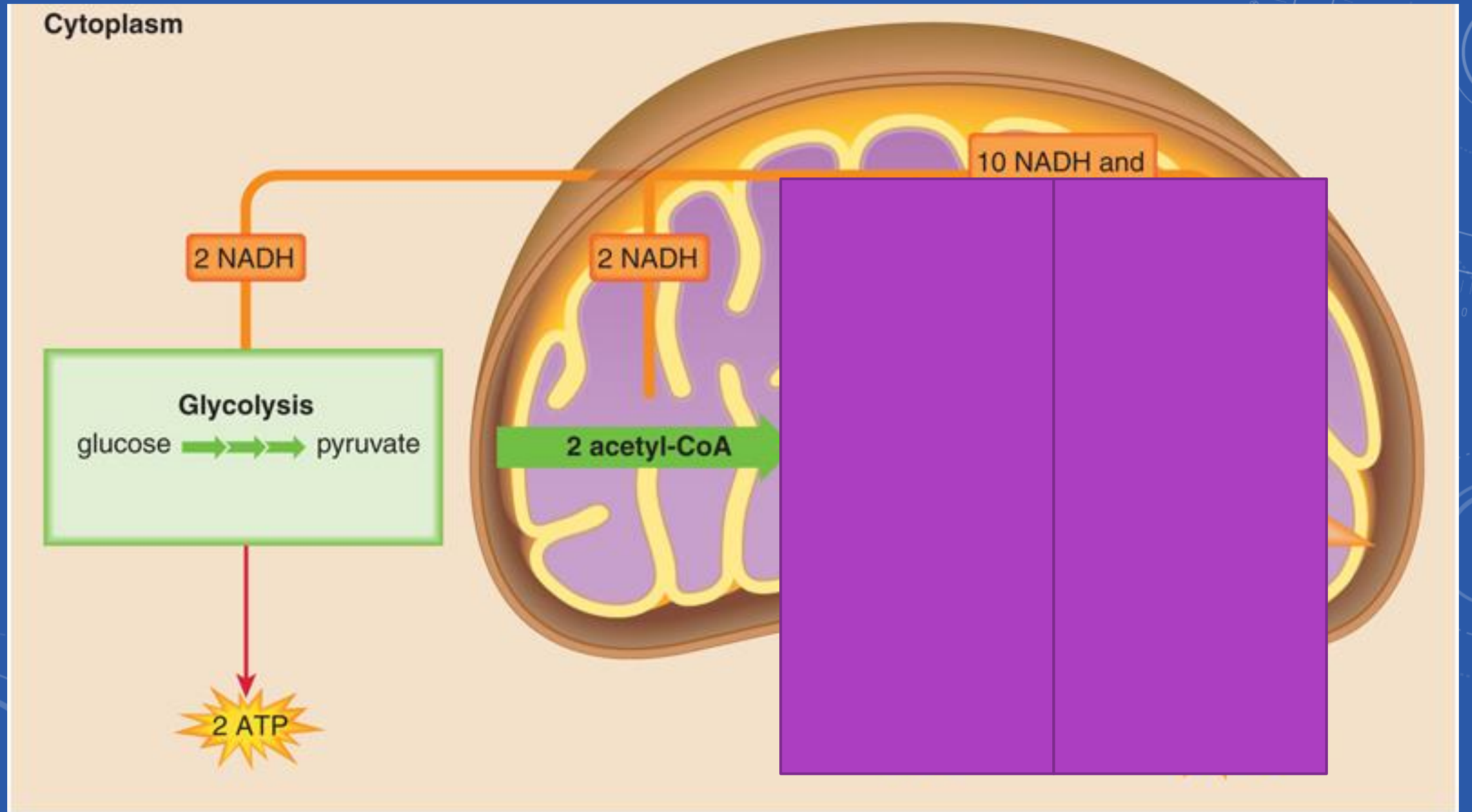
A
Outer Membrane

B
Inner Membrane

C
IMS
Inner Membrane
Space

D
Matrix

Let's Outline Aerobic Respiration

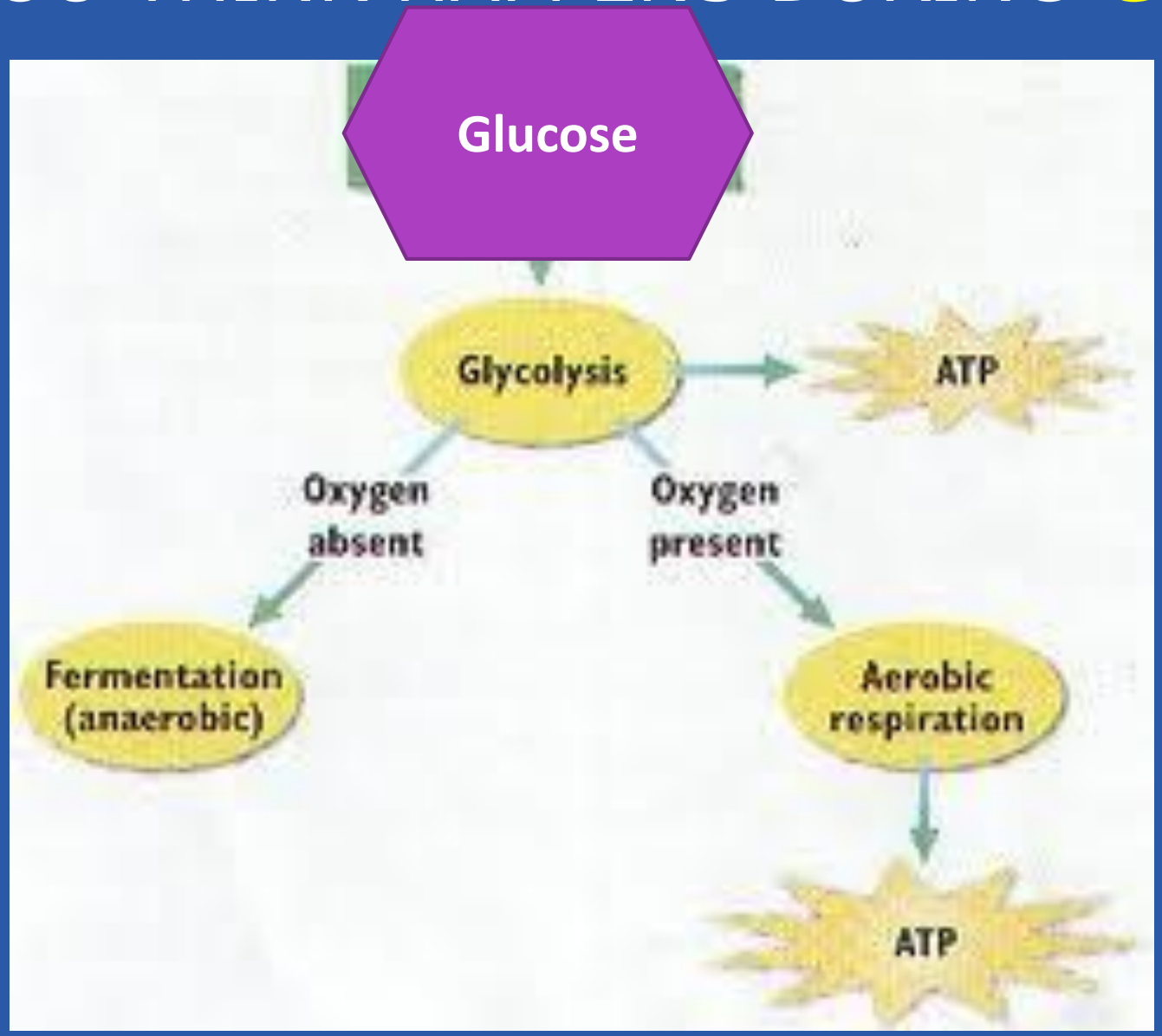


WHAT DO YOU THINK HAPPENS DURING **GLYCOLYSIS?**

Glycolysis Song

[CR video intro]

[CR video1]



2 ATP

36 ATP

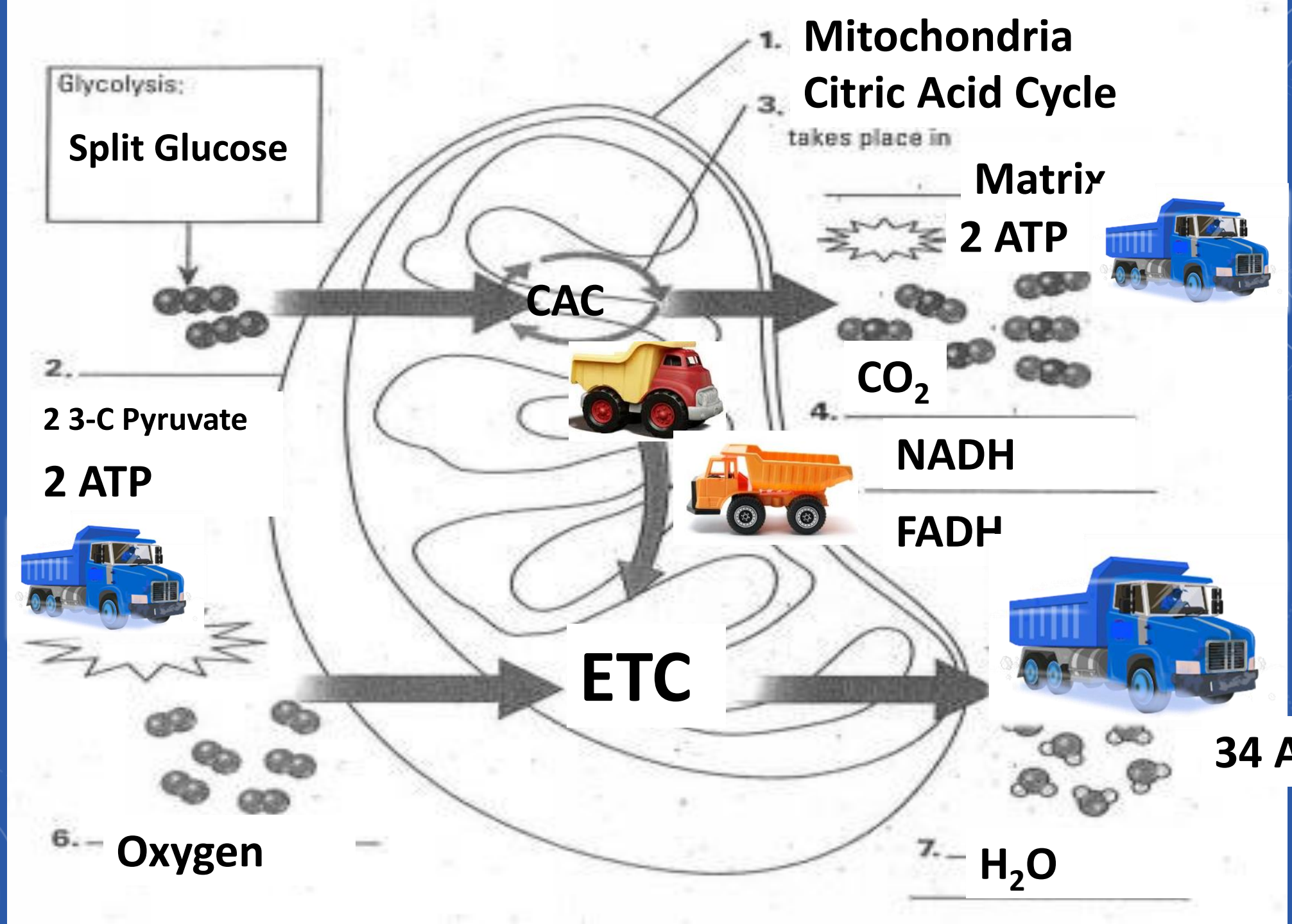
CELLULAR RESPIRATION

- Reactants: $C_6H_{12}O_6$ (glucose) & O_2 (oxygen)
- Products: CO_2 (carbon dioxide) & H_2O (water)

- $C_6H_{12}O_6 + O_2 \rightarrow H_2O + CO_2$

CR Video

Yeast CR demo


1. Mitochondria
Citric Acid Cycle
3.
takes place in
Matrix
Glycolysis:
Split Glucose
2 ATP
CAC
2.
2 3-C Pyruvate
CO_2
4.
NADH
2 ATP
FADH
ETC
34 ATP
6. Oxygen
7. H_2O

HOW IS A MARATHON RUNNER DIFFERENT FROM A SPRINTER?

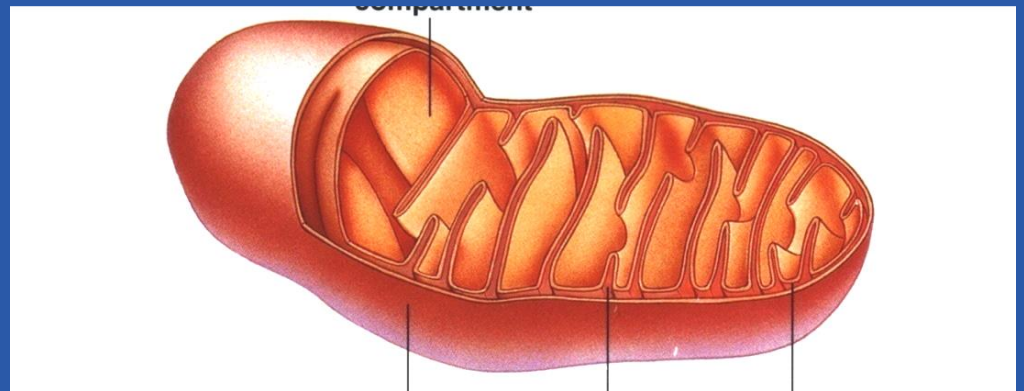
[CR Video]

[CR Overview CC]

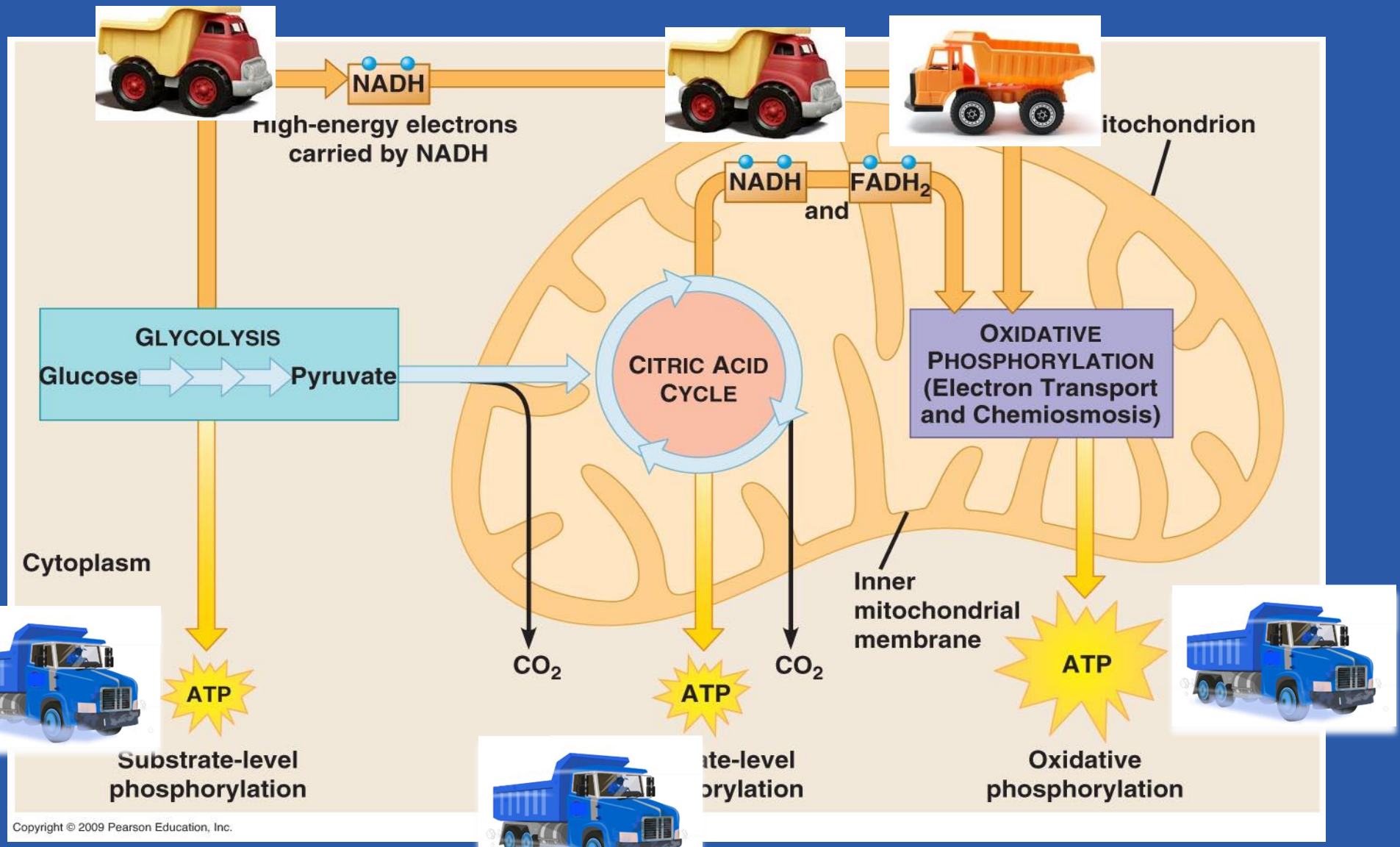
CELLS CAN GENERATE **ATP ENERGY** FROM GLUCOSE IN **2** DIFFERENT WAYS:

1. **Aerobic** Respiration mixes glucose with **oxygen** inside a **mitochondria** to release **38** ATP per glucose

- Results in a **slow** steady supply of energy
- Glucose is completely broken down into **CO_2** and **H_2O**.

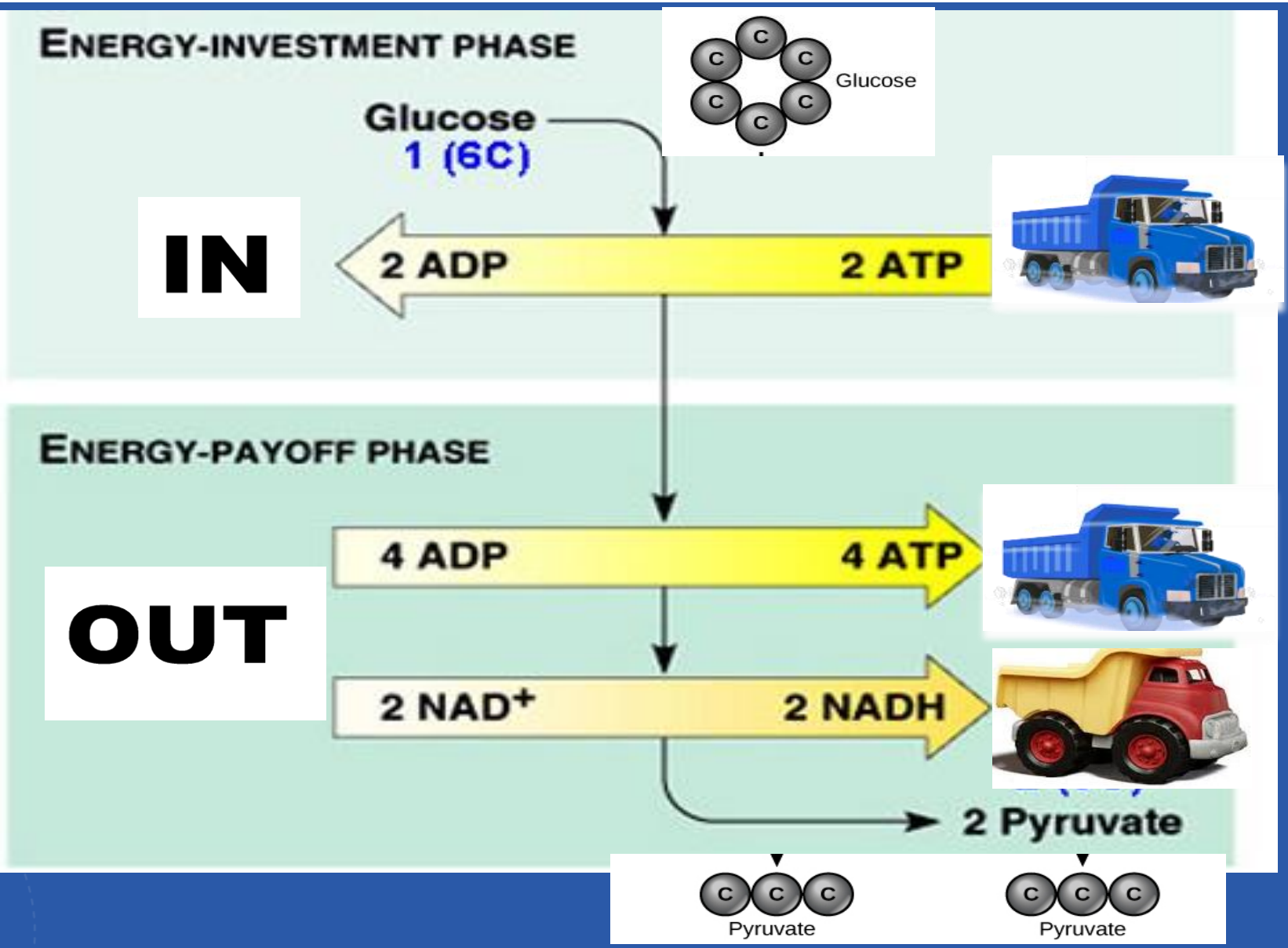


AEROBIC RESPIRATION IN A MUSCLE CELL



Glycolysis Song

Glycolysis in the cytoplasm

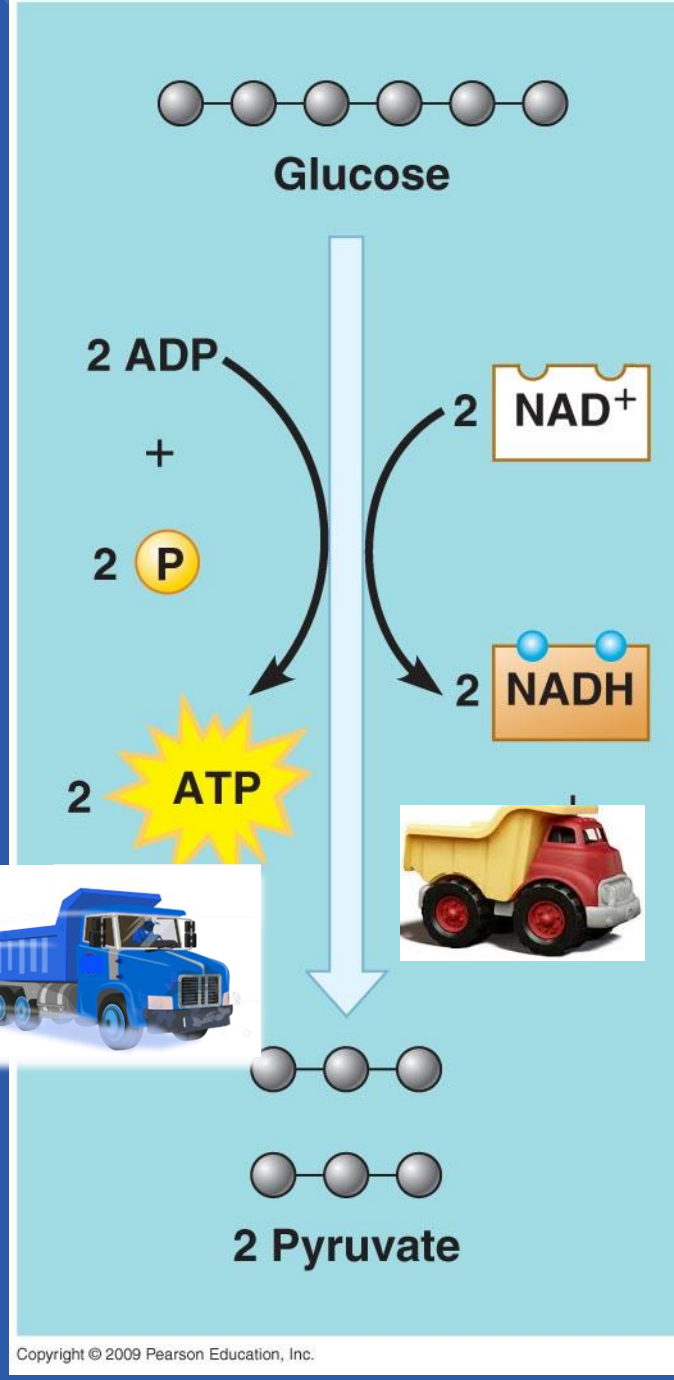


Glycolysis Song

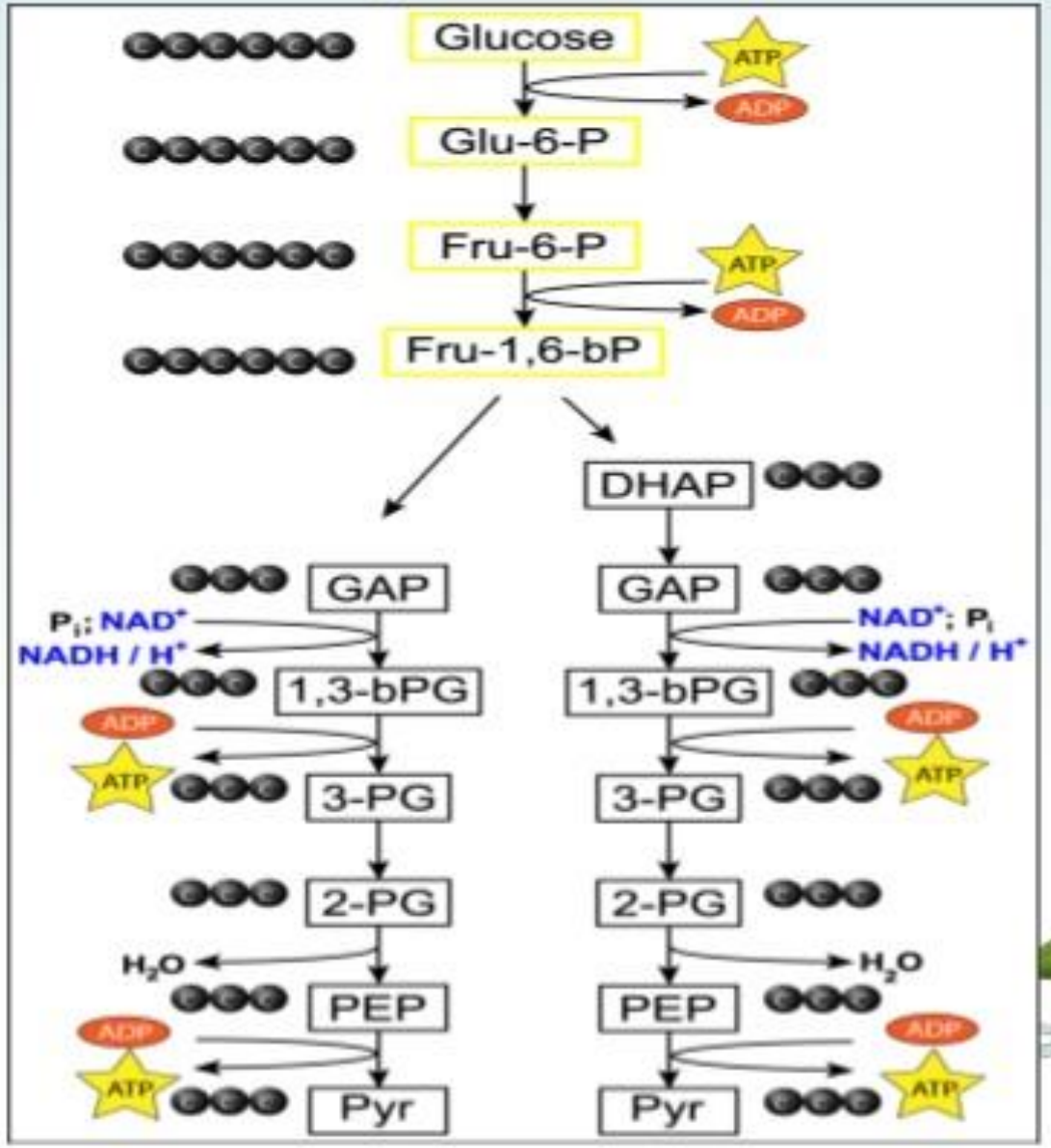
GLYCOLYSIS :

1) happens in the **cytoplasm**
2) "**cracks**" a glucose in half
3) Forms **2** 3-C Pyruvate molecules
4) Recharges **2** ATP
5) Loads **2** NADH energized electron "dumptrucks" that carry the energy to the **mitochondria**

Glycolysis Song



10 Steps involves in Glycolysis



[Glycolysis Do Re mi]

CAC in the Mitochondria Matrix

What goes in to the CAC?

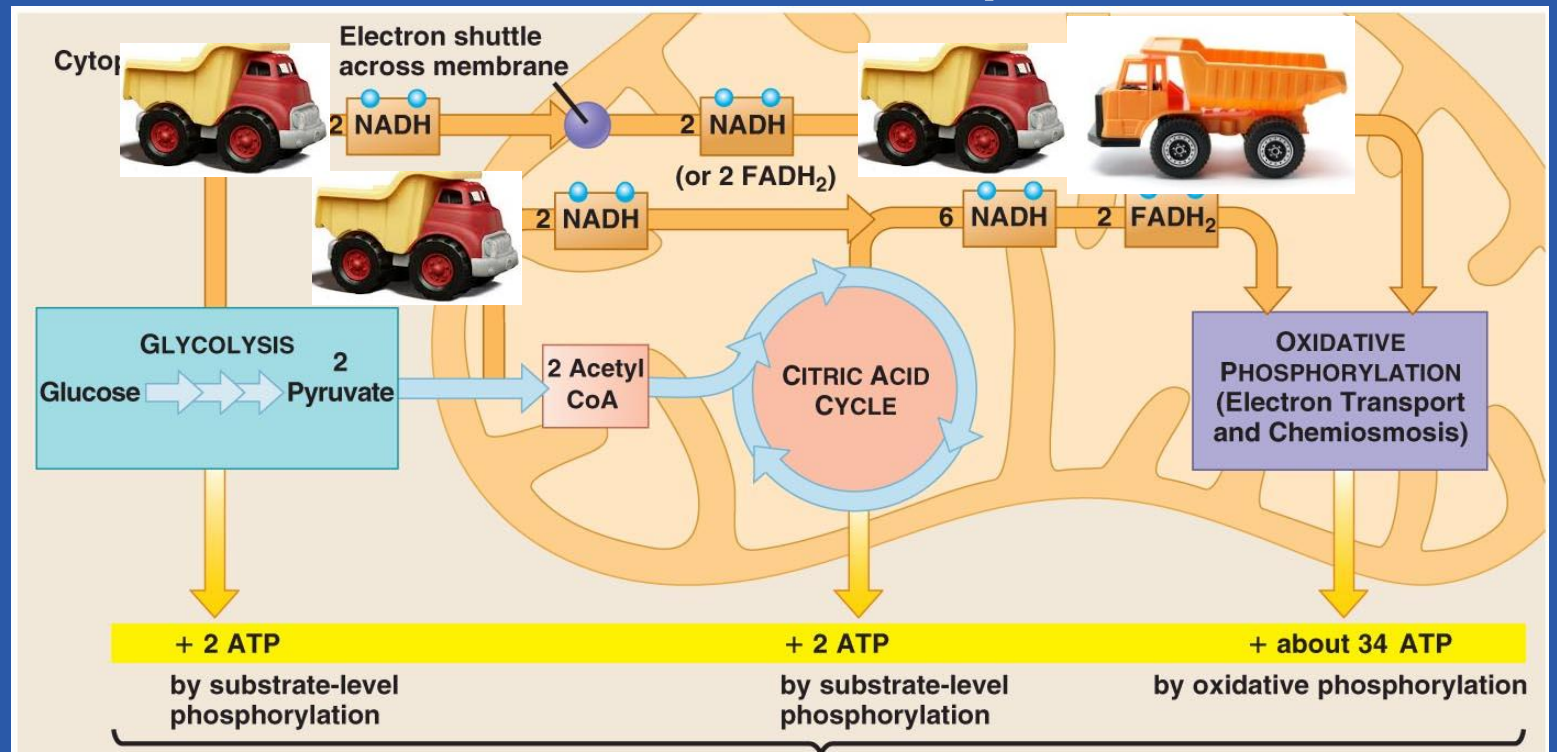
What goes out of the CAC?

AKA … Kreb's Cycle

CAC video

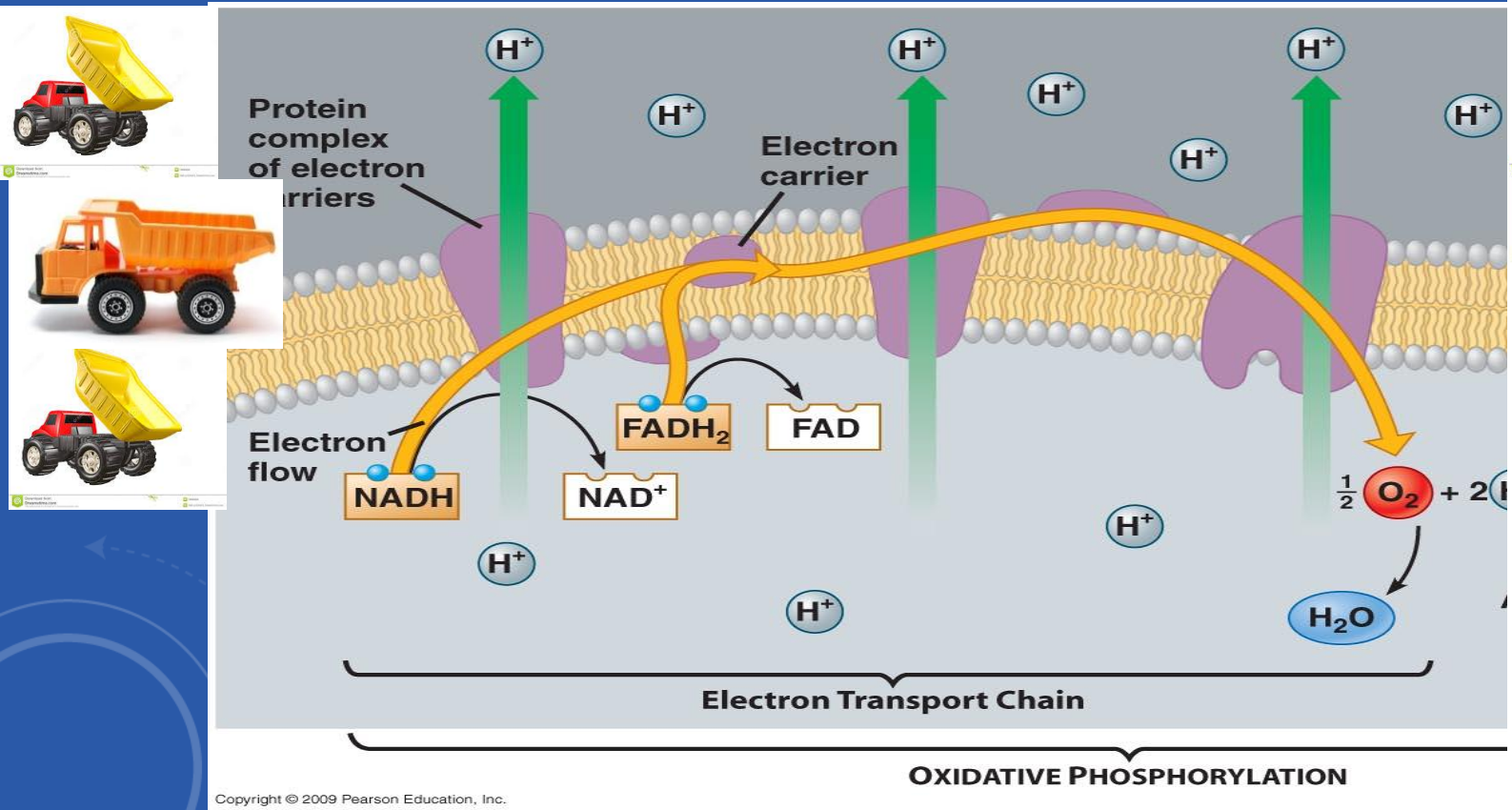
AEROBIC Respiration :

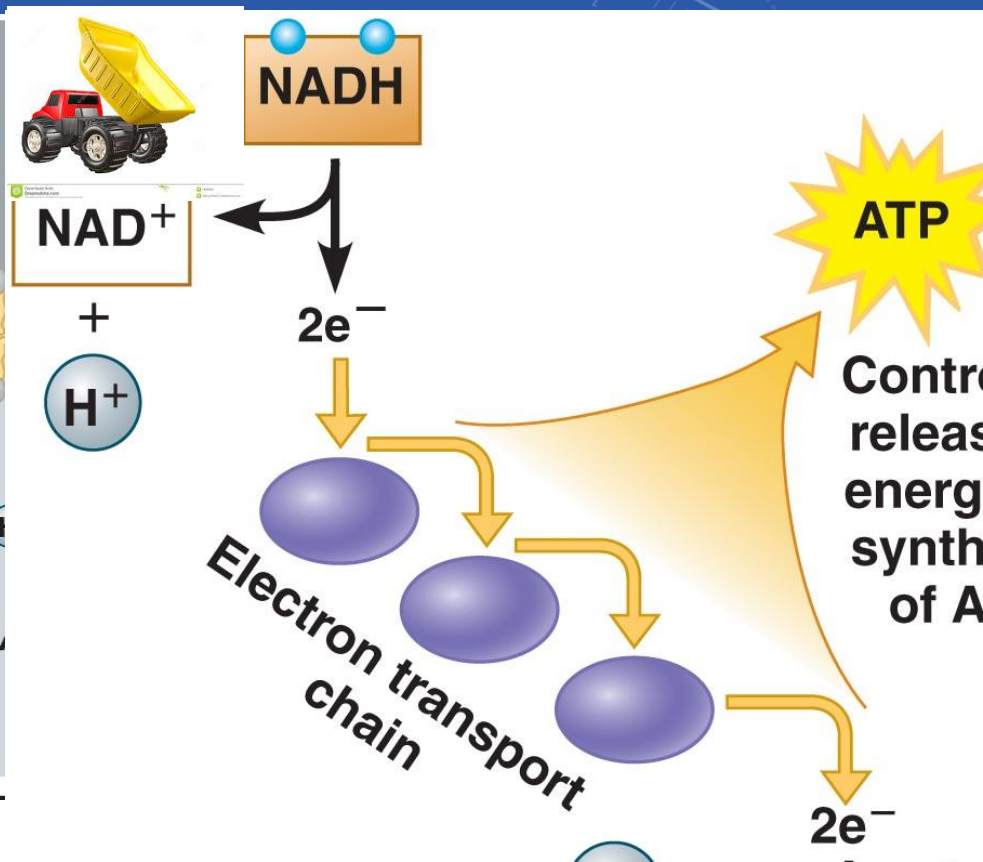
1) happens in the **mitochondria**
2) Loads many more energized electron "dumptrucks" (**NADH**, **$FADH_2$**) with energy released from the 2 **pyruvate** molecules during the **Citric Acid** cycle



AEROBIC Respiration :

3) **Unload** many energized electron "dumptrucks" (NADH & $FADH_2$) releasing **electrons** that fall down the **ETC** "stairway" of the mitochondria's inner membrane



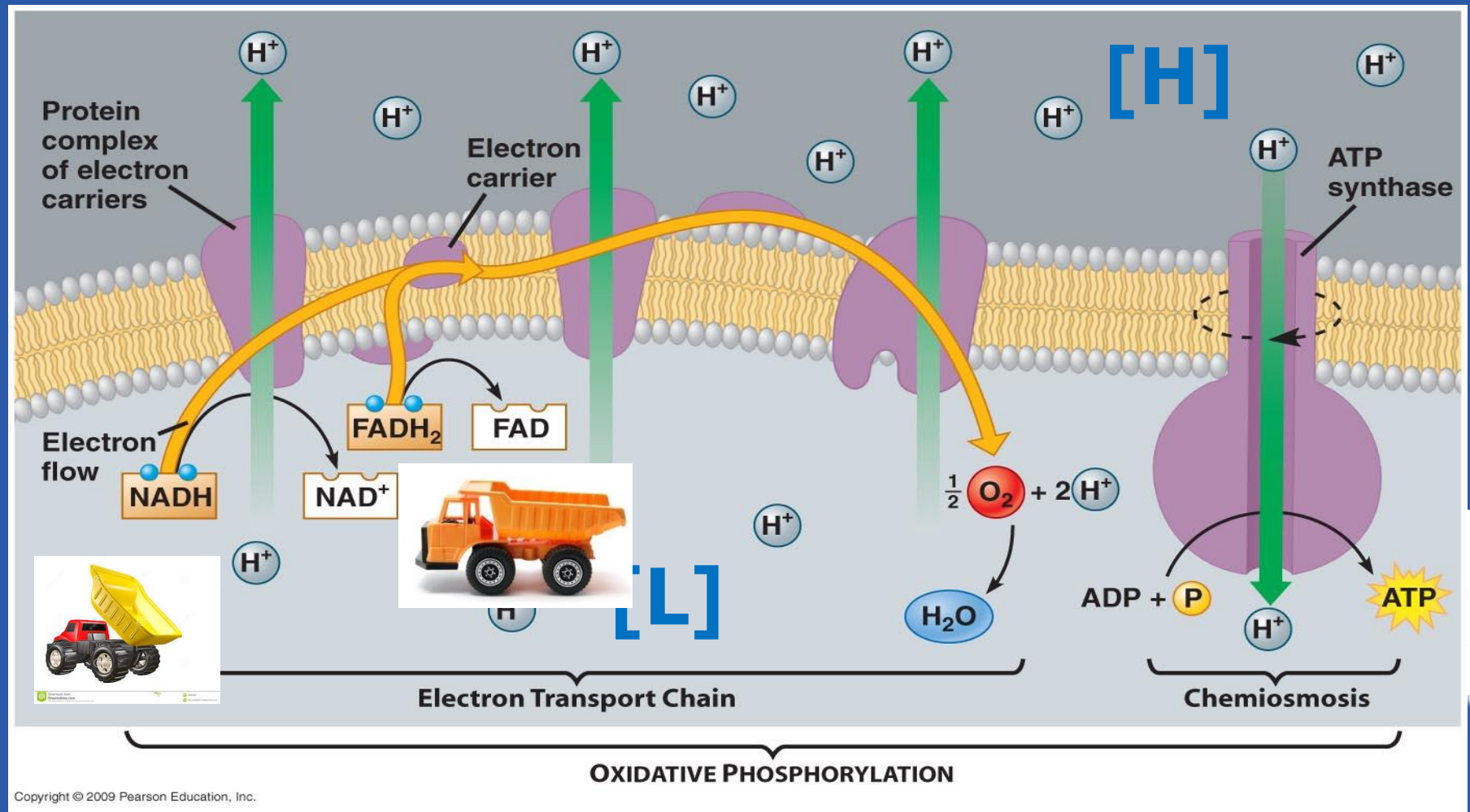


CAN YOU SEE WHAT O_2 IS DOING?

See any Active Transport?

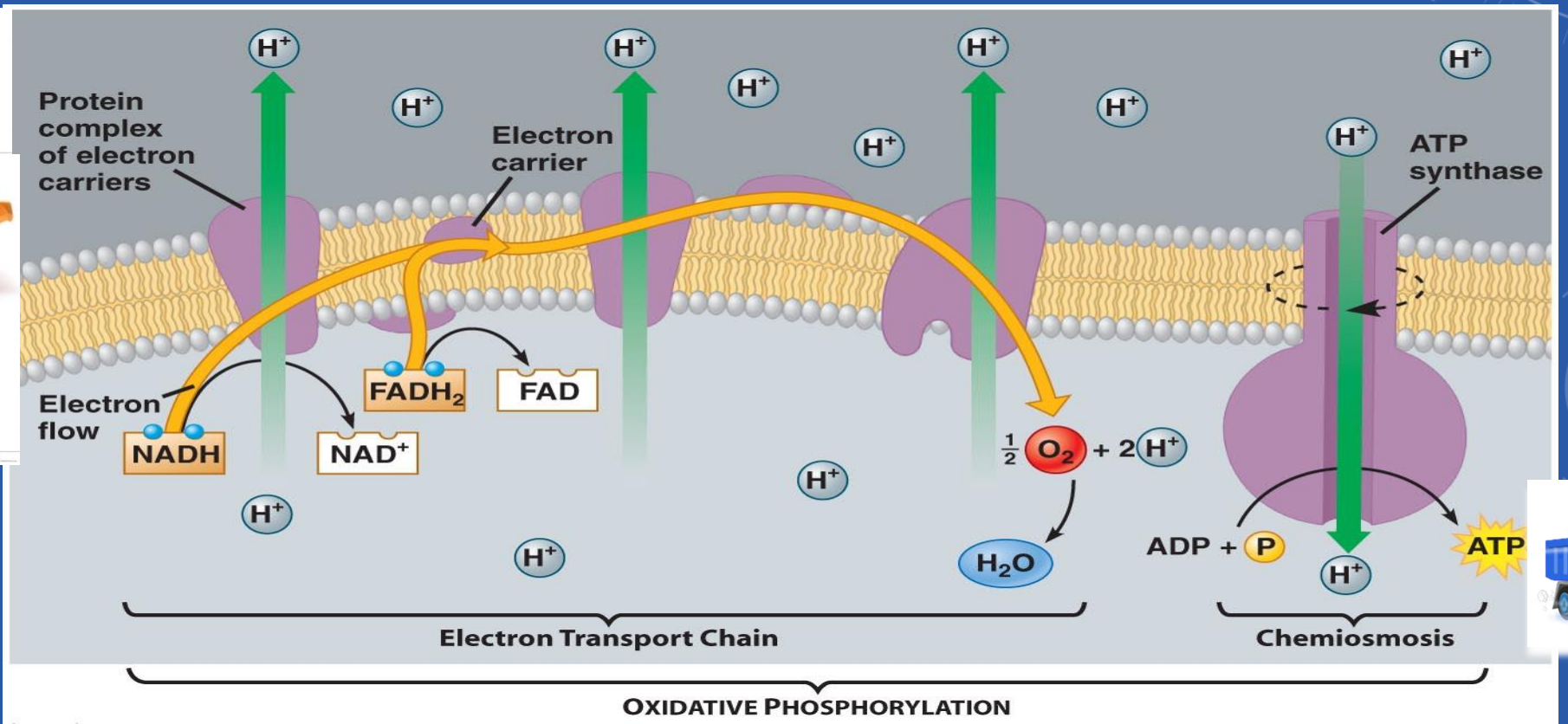
See any Passive Transport

ETC video



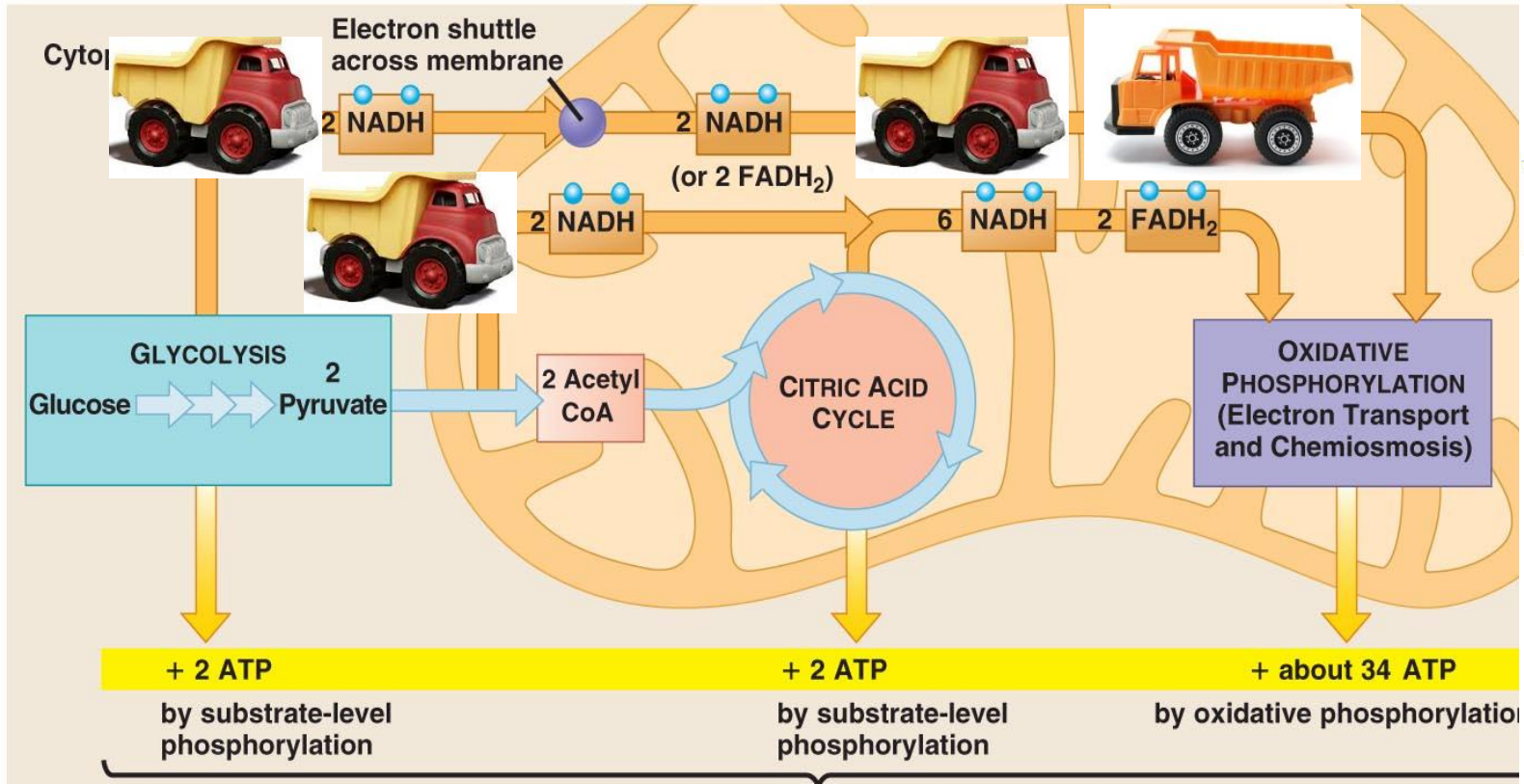
AEROBIC Respiration :

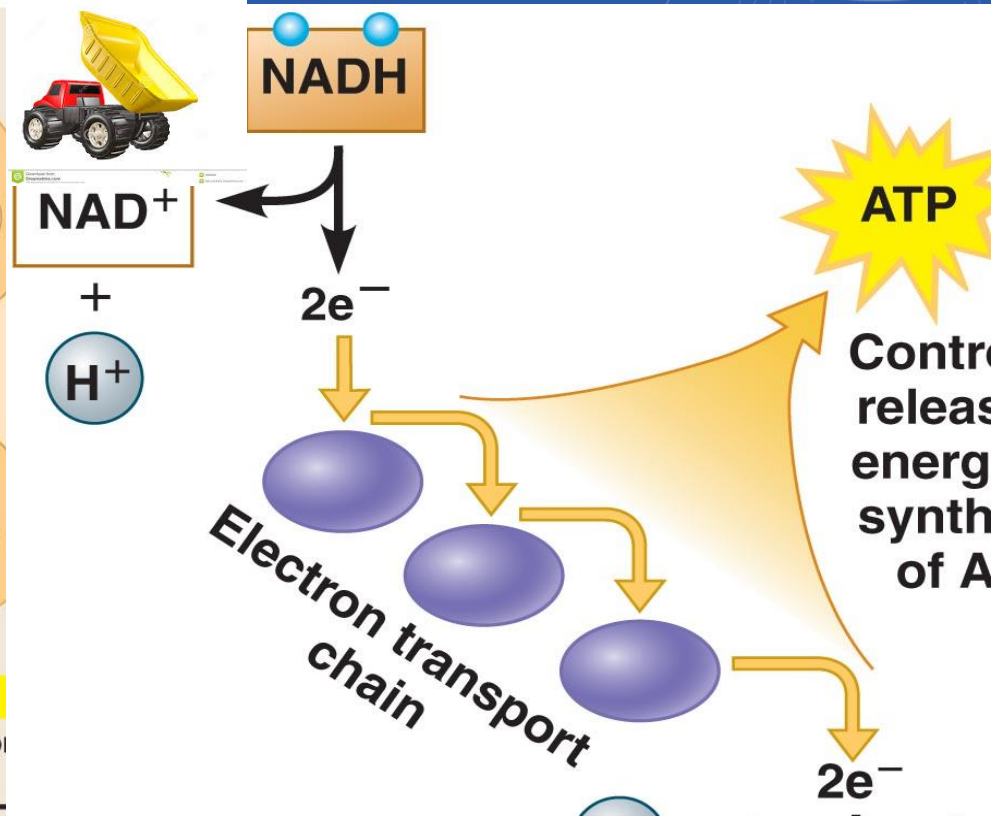
4) ___Oxygen___ is needed to remove these electrons by forming ___H_2O___ that can be used or removed from the cell. This keeps the ETC "stairway" ___open___ for the next electron



AEROBIC Respiration :

5) Recharges 2 ATP in the Citric Acid cycle
6) Recharges 34 ATP as energized electrons play "slinky" down the **ETC** during the process of Oxidative Phosphorylation

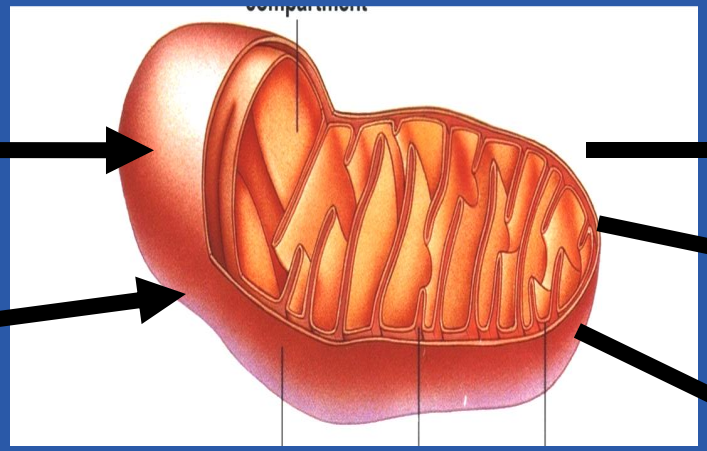




LET'S REVIEW **AEROBIC** RESPIRATION

Input Materials

Output Materials



glucose

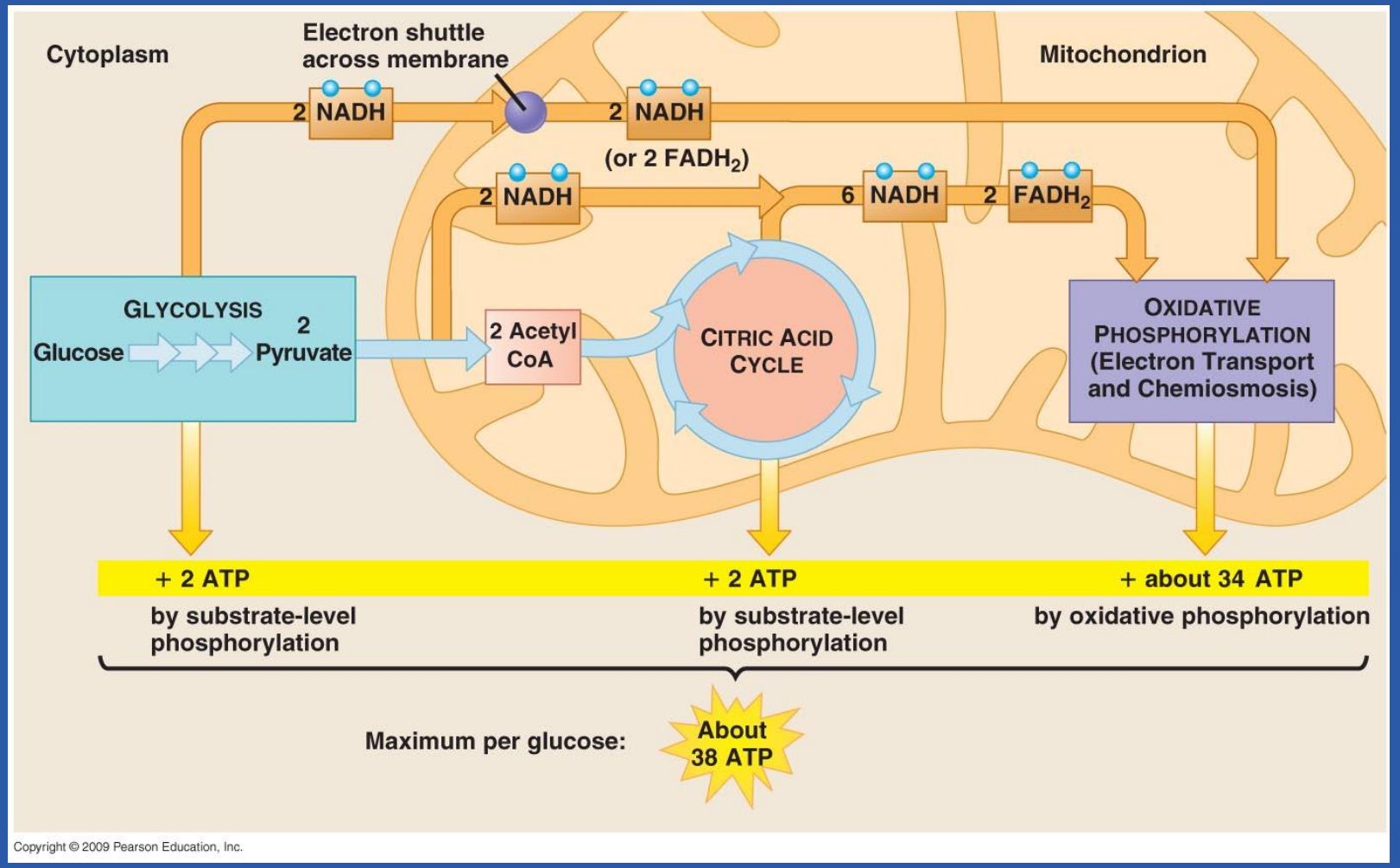
O_2

CO_2

H_2O

38 ATP

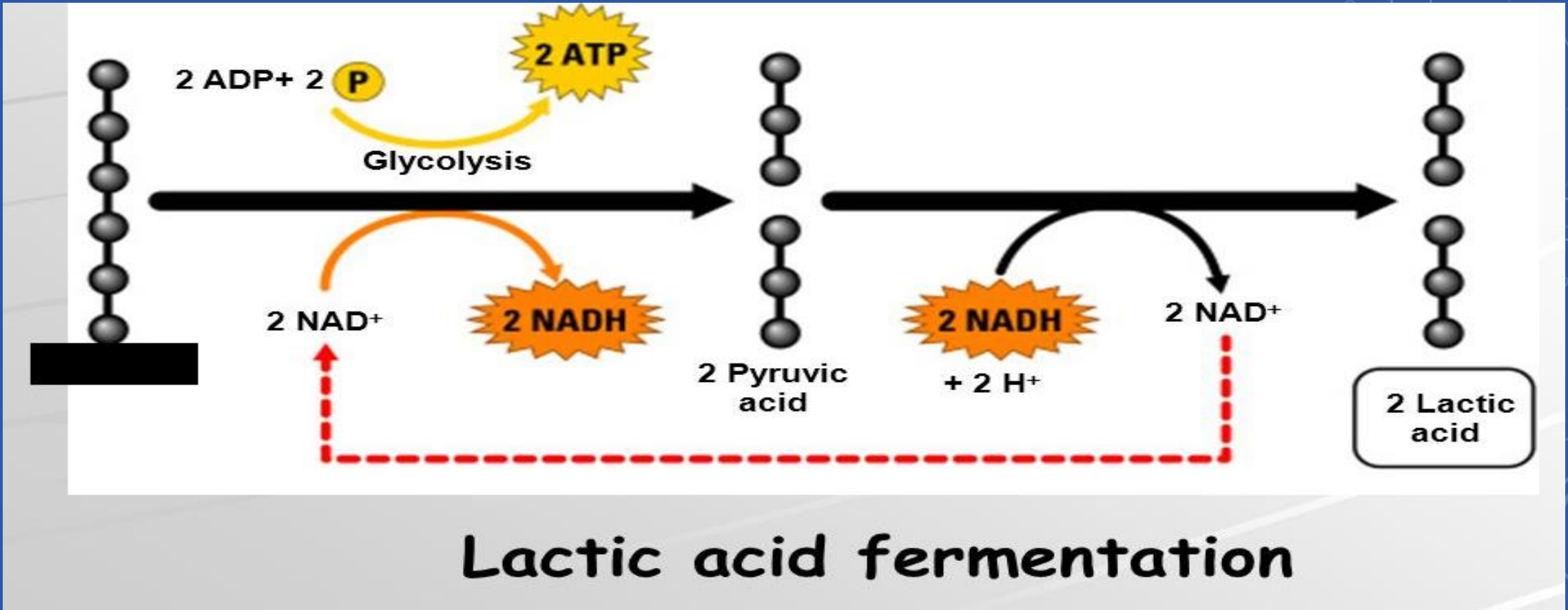
Glycolysis Song **Kreb's Song** **OP Song**



CELLS CAN GENERATE **ATP ENERGY** FROM GLUCOSE IN **2** DIFFERENT WAYS:

2. **Anaerobic** Respiration breaks down glucose without **oxygen** in the cytoplasm to release **2** ATP per glucose
- Results in a short, quick **blast** of energy
- Glucose is partially broken down into **Lactic Acid** which leads to sore and quickly fatigued muscles

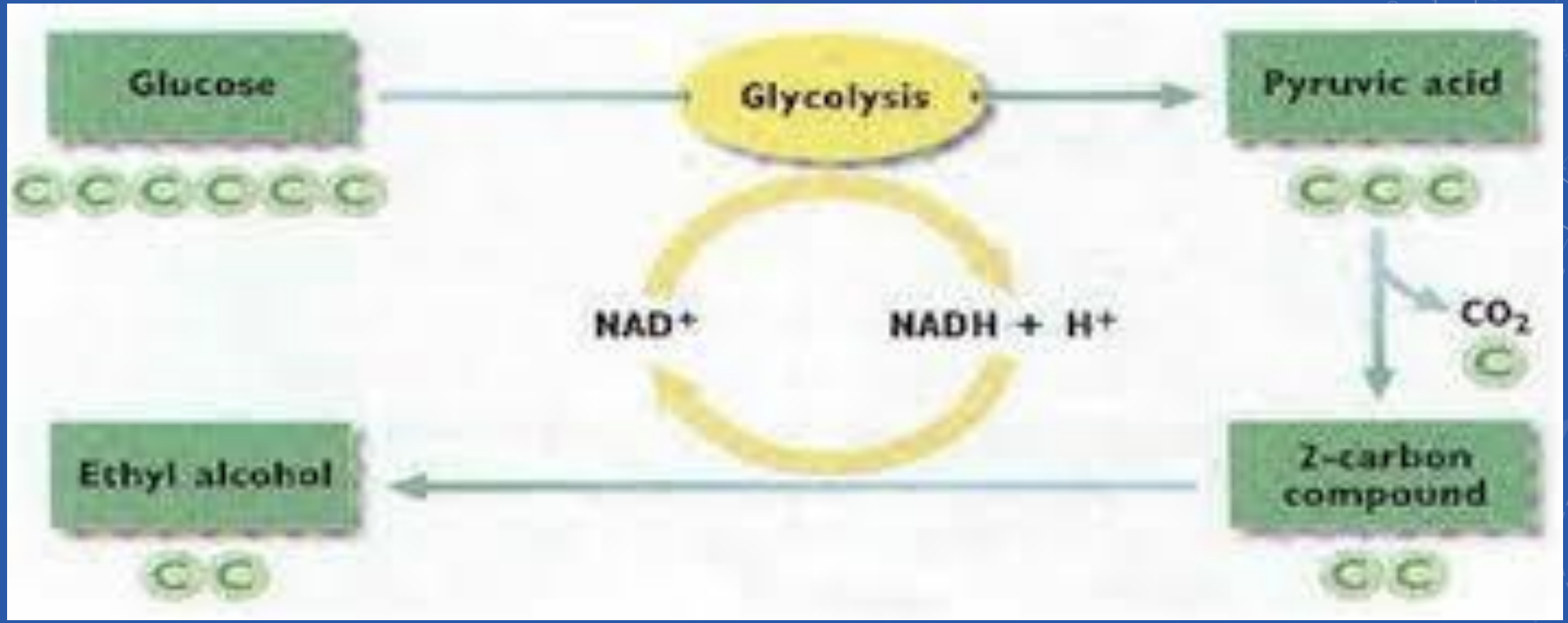
ANAEROBIC RESPIRATION COMES IN IN 2 DIFFERENT TYPES: AKA " FERMENTATION"



LACTIC ACID FERMENTATION HAPPENS IN

Muscle Cells , Bacteria

ANAEROBIC RESPIRATION COMES IN IN 2 DIFFERENT TYPES: AKA " FERMENTATION"



ALCOHOL FERMENTATION HAPPENS IN

Yeast

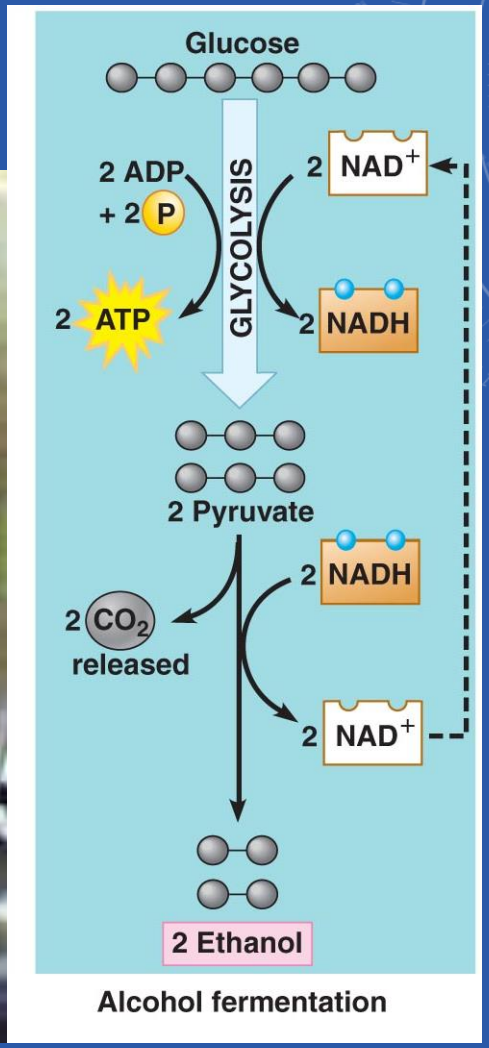
WHAT MAKES BREAD DOUGH RISE?

Fermentation Demo

Fermentation Video 2

Fermentation Bozeman video

Here is a HINT



Alcohol fermentation

CAN YOU IDENTIFY THESE OTHER FOODS PRODUCED THROUGH ANAEROBIC FERMENTATION?

Foods made by fermentation of sugars

Pickles

Foods made by fermentation of sugars

Sauerkraut

Foods made by fermentation of sugars

Sourdough bread

Foods made by fermentation of sugars

cheese

Foods made by fermentation of sugars

Soy sauce

Foods made by fermentation of sugars

yogurt

Foods made by fermentation of sugars

Blue Cheese

Foods made by fermentation of sugars

Kimchi

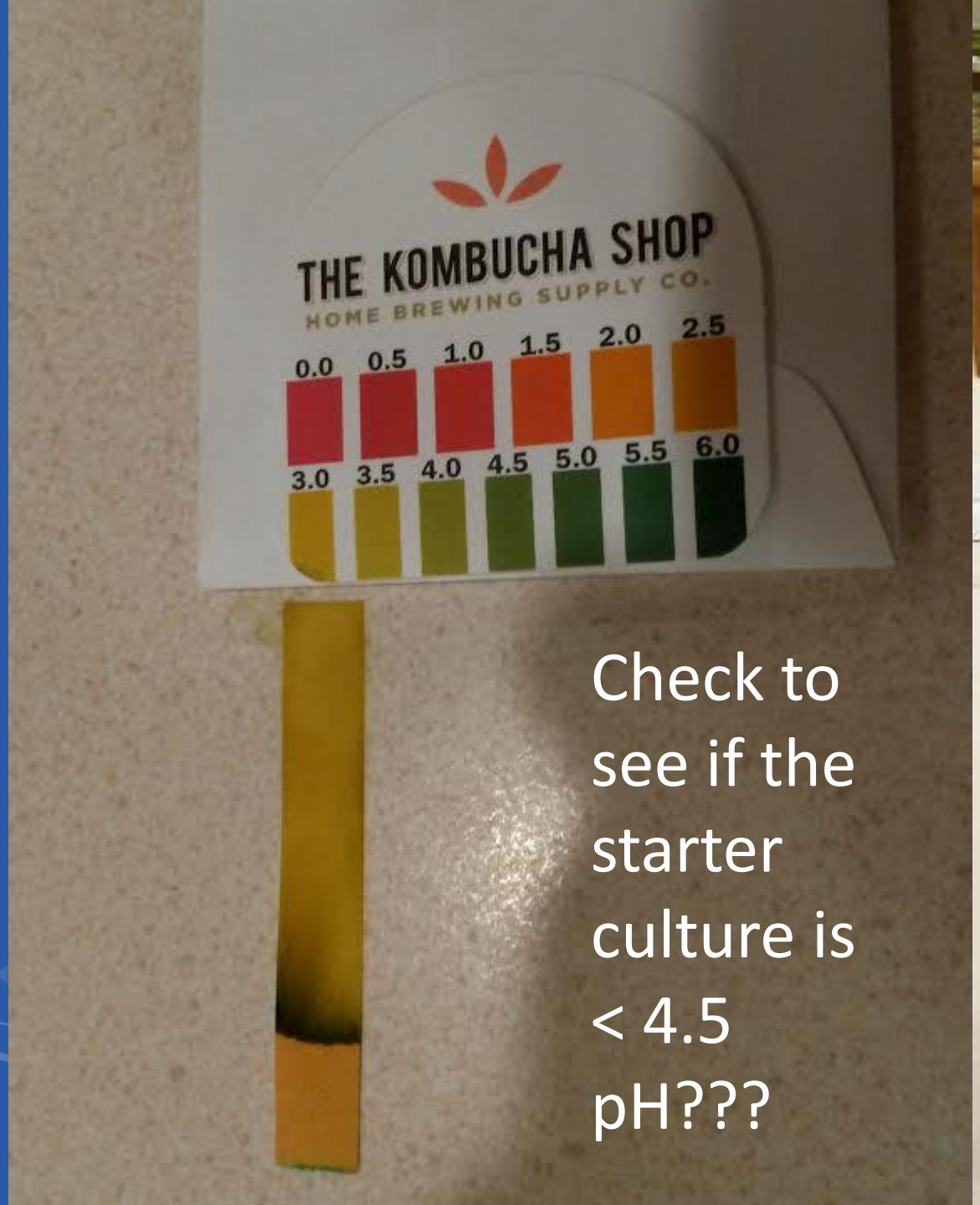
Foods made by fermentation of sugars

Kefir grains from milk

Foods made by fermentation of sugars

Kombucha

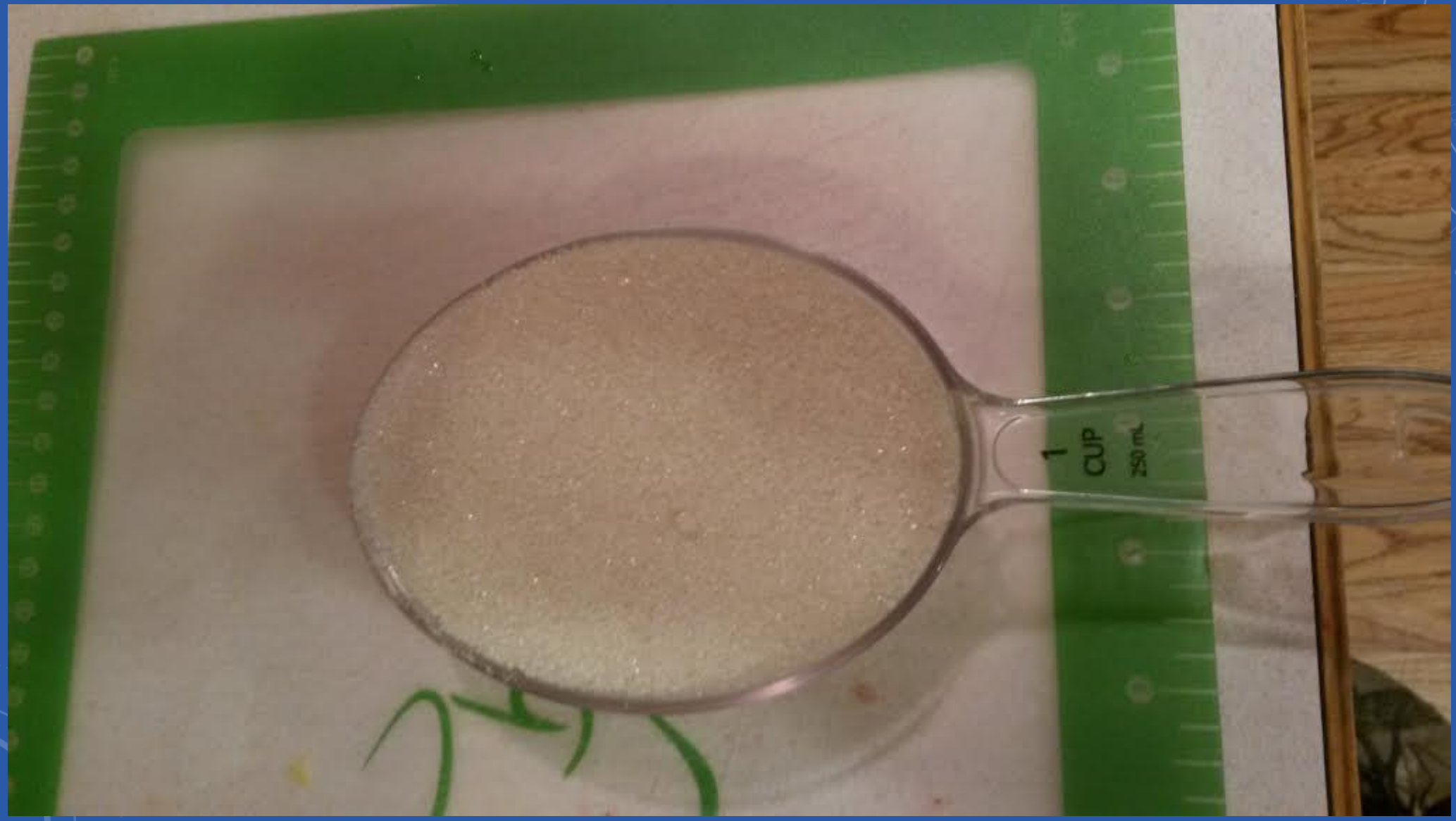
Make at home



Check to see if the starter culture is < 4.5 pH???

Make a batch of Black and Green Tea

Add 1 cup of sugar



Cool Tea with ice cold water

Make sure new batch is < 4.5 pH ?

Transfer the SCOBY to the new batch

Symbiotic
Colony
Of
Bacteria &
Yeast

Keep the Kombucha warm at ~80 F for about 1 -2 weeks

Flavor the 2nd Ferment (FRUIT) and leave for 3-4 days

2nd Ferment with fruit

New Kombucha batch

Place Flavored Kombucha into bottles

Bacteria live here

Yeast live here

At FIRST, OXYGEN diffuses at the surface into the sweet tea

Can Bacteria break down sugar aerobically?

Will any bubbles form?

At FIRST, OXYGEN diffuses at the surface into the sweet tea

Can Yeast break down sugar aerobically? #ATP?

What products form?

Will any bubbles form?

After a few days the **Bacteria** use the sugar to build a **cellulose mat** across the top of the SCOBY

This keeps most **OXYGEN** from diffusing into the tea

After a few days the **Bacteria** use the sugar to build a **cellulose mat** across the top of the SCOBY

Now the Yeast begin to ferment the sugar anaerobically ... # ATP?

What products form?

Will any **bubbles** form?

Soon the alcohol will poison the Bacteria, so they convert it to acetic acid.

This also discourages other types of bacteria from living in the Kombucha.

The longer we let the Kombucha ferment or brew, the more the pH will ?

Increase or decrease

The longer we let the Kombucha ferment or brew, the sweetness will ?

Increase or decrease

When the SCOBY gets too thick , peel off a few layers and store in a **SCOBY hotel** so you can share them with friends

I hear that Kombucha SCOBYs even make good JERKY !!

IF I CARVE THIS TURKEY … DO I GET WHITE MEAT OR DARK MEAT?

IF I CARVE THIS TURKEY … DO I GET WHITE MEAT OR DARK MEAT?

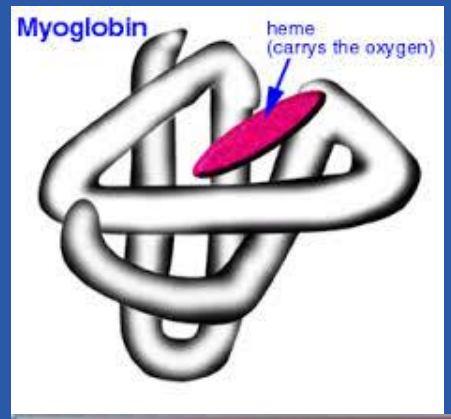
IF I CARVE THIS GOOSE… DO I GET WHITE MEAT OR DARK MEAT?

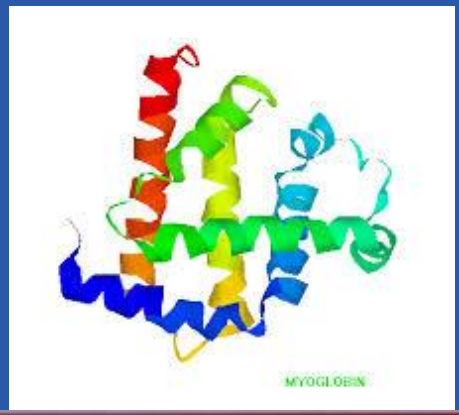
IF I CARVE THIS GOOSE… DO I GET WHITE MEAT OR DARK MEAT?

W vs D video 1

W vs D video 2

MEET MYOGLOBIN … THE O_2 "TAXI"





CELLULAR RESPIRATION

- Reactants: $C_6H_{12}O_6$ (glucose) & O_2 (oxygen)
- Products: CO_2 (carbon dioxide) & H_2O (water)

- $C_6H_{12}O_6 + O_2 \rightarrow H_2O + CO_2$

CR Video

Yeast CR demo


Video 1

FACTORS THAT AFFECT CELLULAR RESPIRATION

SPEED UP

- Increased oxygen
- Increased glucose
- Increased temperature

SLOW DOWN

- Decreased oxygen
- Decreased glucose
- Decreased temperature
- Extreme (hot or cold) temperatures could spell DEATH!!!!!

LET'S COMPARE AEROBIC AND ANAEROBIC RESPIRATION

Topics	Aerobic Respiration	Anaerobic Respiration
1) INPUT material?	Glucose O_2	Glucose
2) OUTPUT material?	CO_2 H_2O	Lactic Acid
3) Muscle Fiber Type?	Slow-fiber	Fast-fiber
4) Cell Location?	Mitochondria	Cytoplasm
5) # ATP Produced?	38	2
6) Energy is Delivered?	Low n steady	High n quick

LET'S COMPARE PHOTOSYNTHESIS AND CELLULAR RESPIRATION

Topics	Photosynthesis	Cell Respiration
1) INPUT material?	CO_2 H_2O	Glucose O_2
2) OUTPUT material?	Glucose O_2	CO_2 H_2O
3) Energy direction?	Absorbed	Released
4) Energy TERM?	Endergonic	Exergonic
5) Chemical bonds are?	formed	broken
6) Organelle needed?	Chloroplast	Mitochondria
7) Cell type?	Plant Only	Both Plant & Animal

IF I CARVE THIS TURKEY … DO I GET WHITE MEAT OR DARK MEAT?

IF I CARVE THIS TURKEY … DO I GET WHITE MEAT OR DARK MEAT?

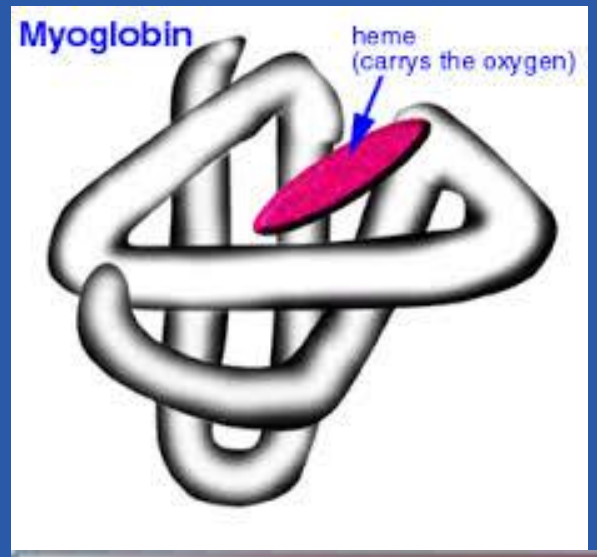
IF I CARVE THIS GOOSE… DO I GET WHITE MEAT OR DARK MEAT?

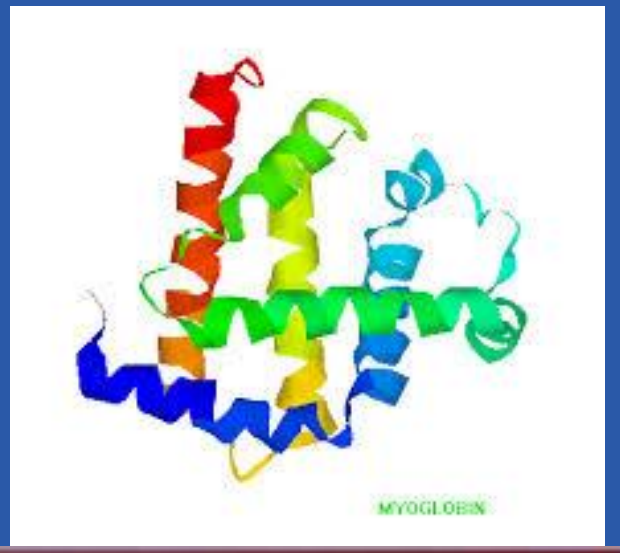
IF I CARVE THIS GOOSE… DO I GET WHITE MEAT OR DARK MEAT?

W vs D video 1

W vs D video 2

MEET MYOGLOBIN … THE O_2 "TAXI"





CHRISTMAS ISLAND

RED CRABS

Video 1

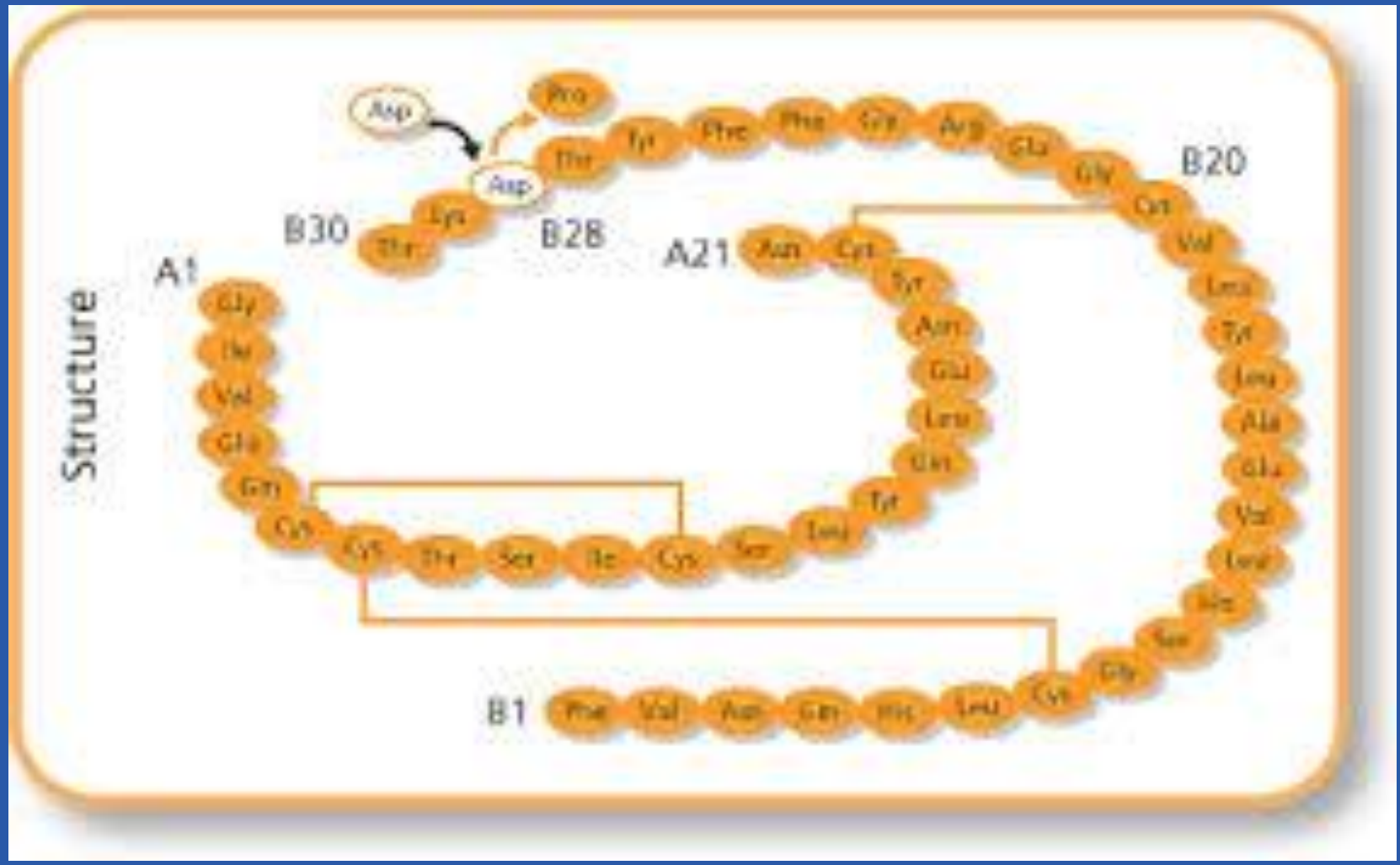
Video 2

Crab Migration

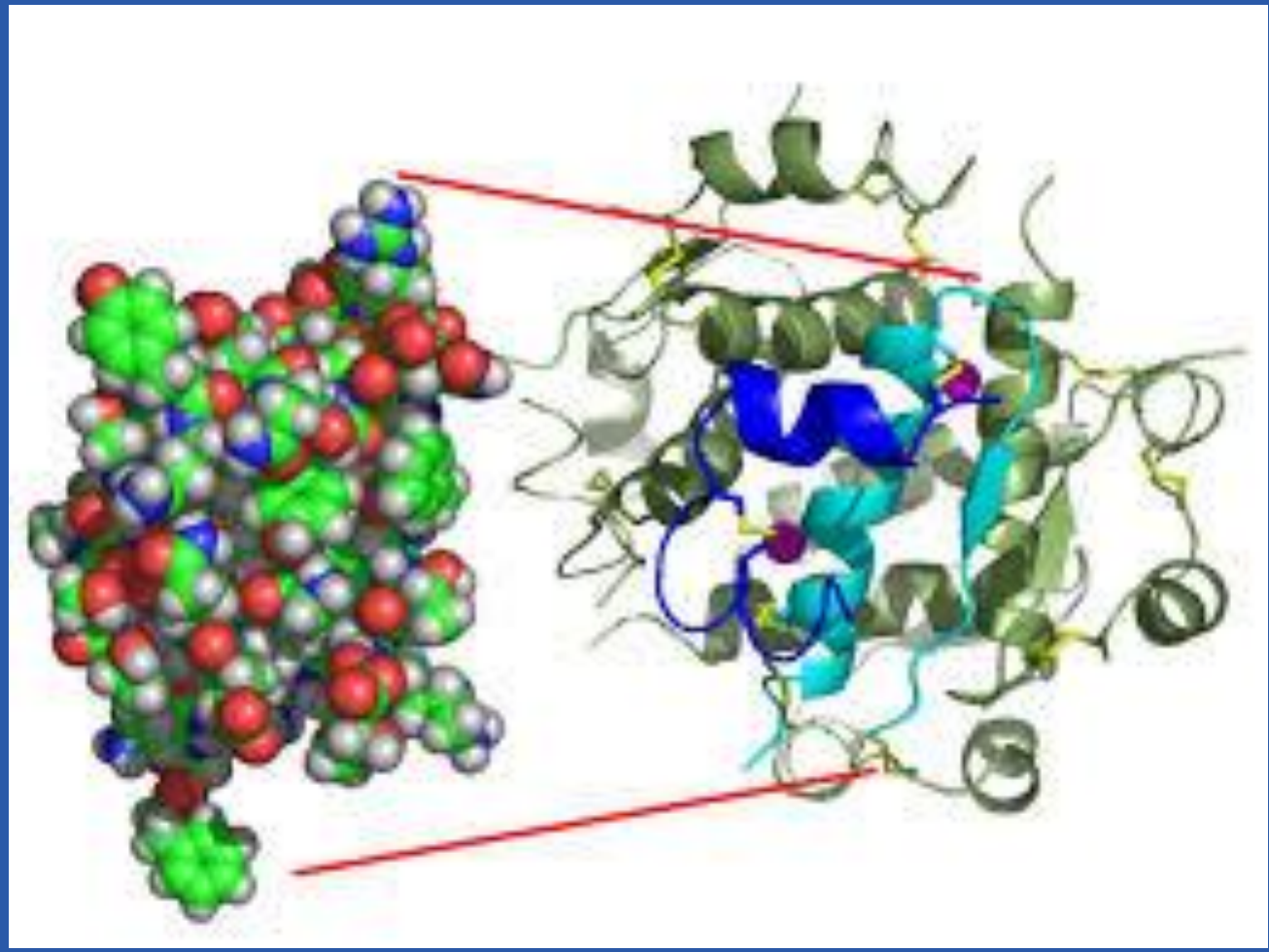
Good Luck Dance

Babies Return

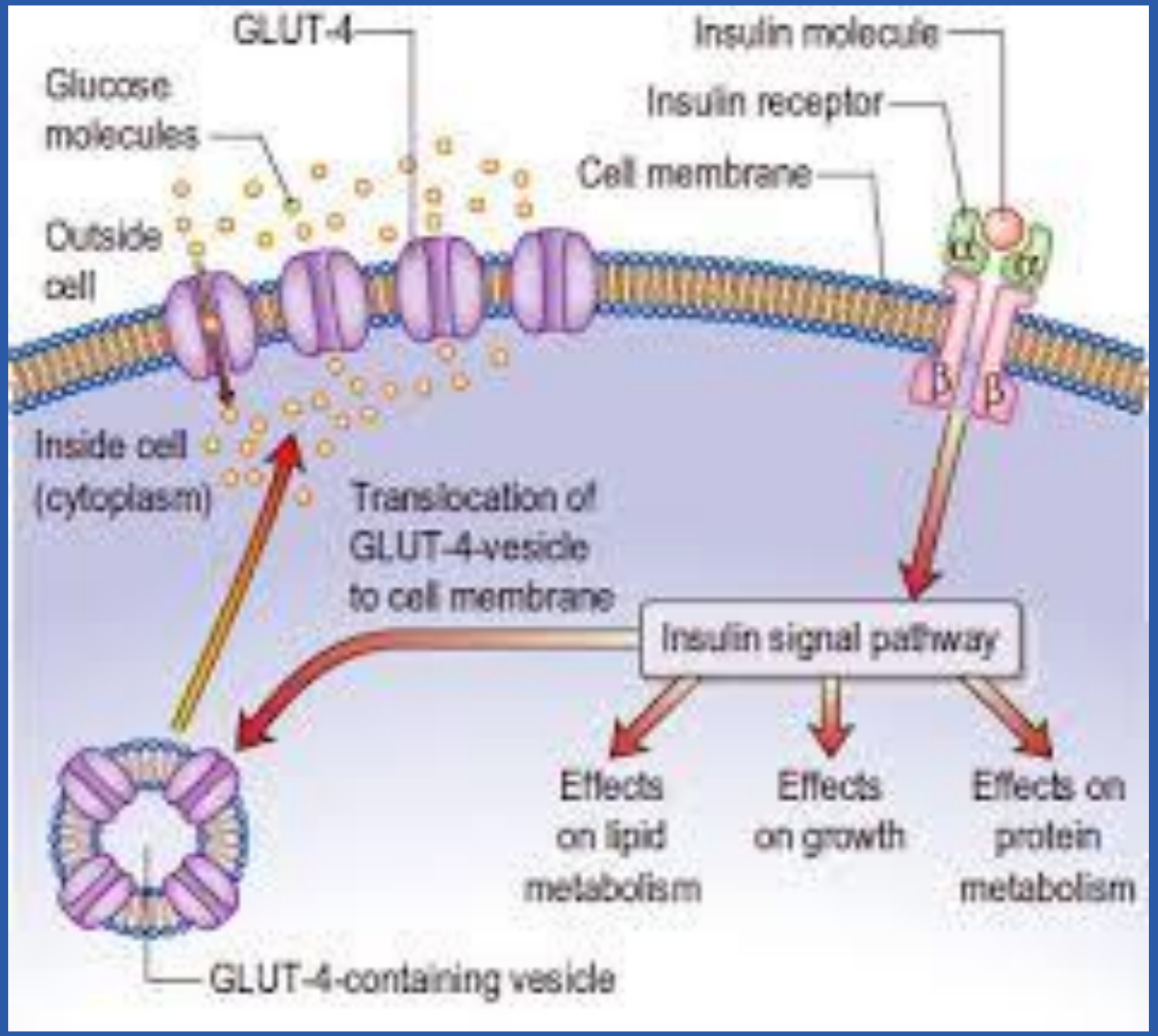
MEET INSULIN … THE "KEY" THAT OPENS THE TRANSPORT PROTEIN FOR GLUCOSE



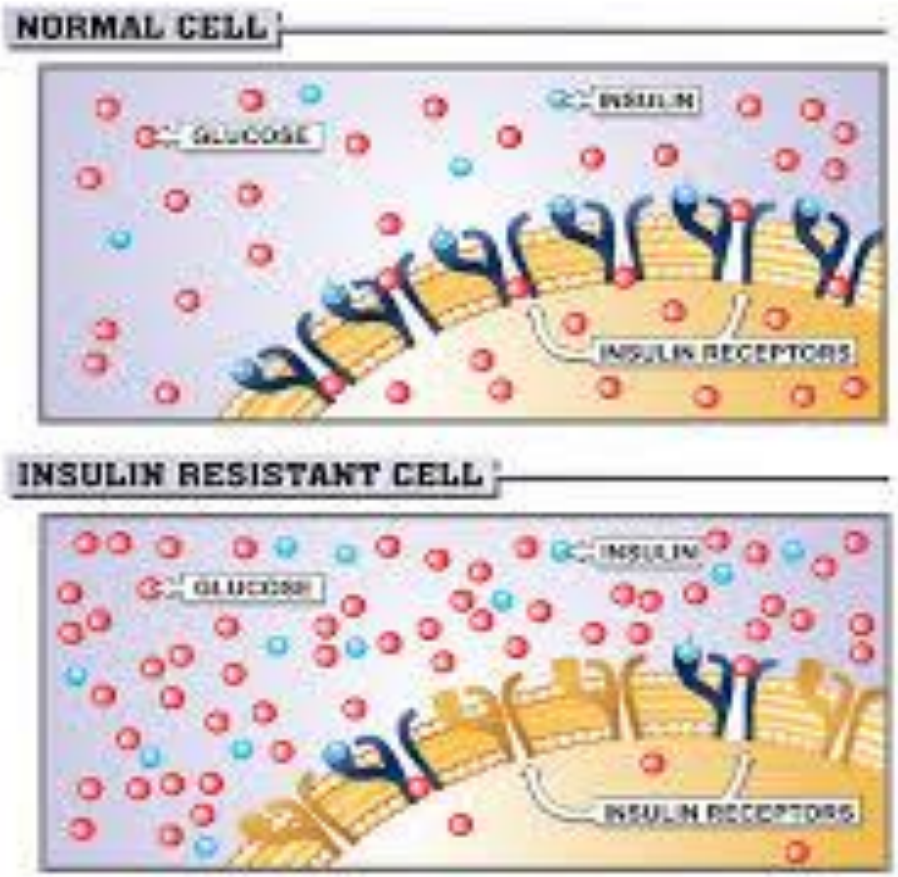
MEET INSULIN … THE "KEY" THAT OPENS THE TRANSPORT PROTEIN FOR GLUCOSE



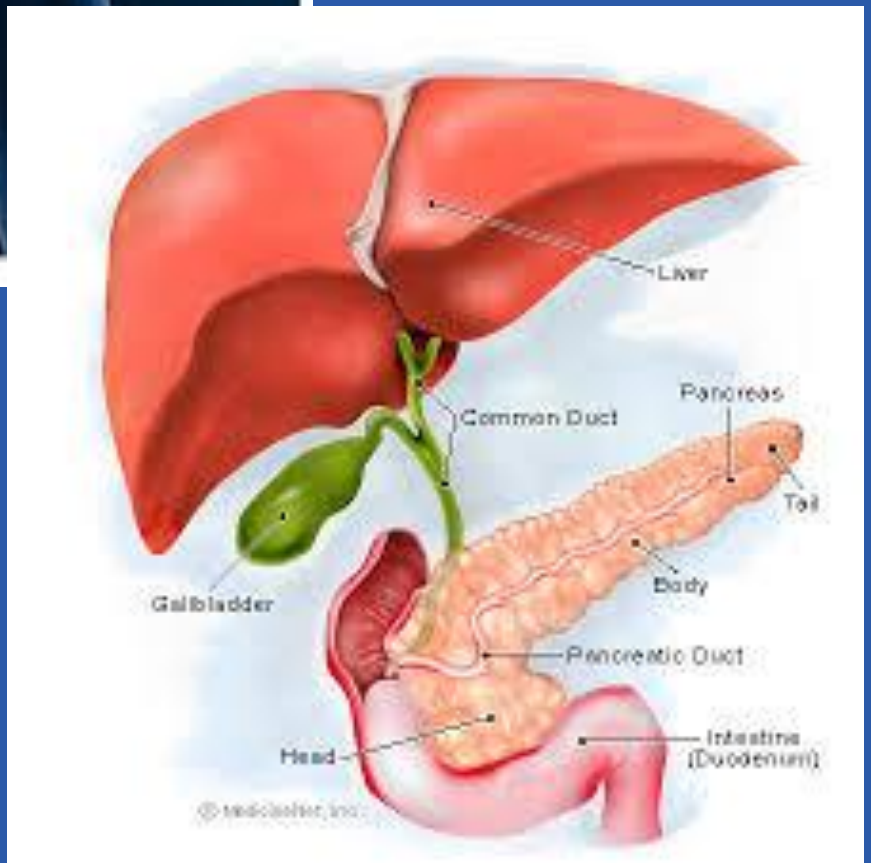
MEET INSULIN … THE "KEY" THAT OPENS THE TRANSPORT PROTEIN FOR GLUCOSE



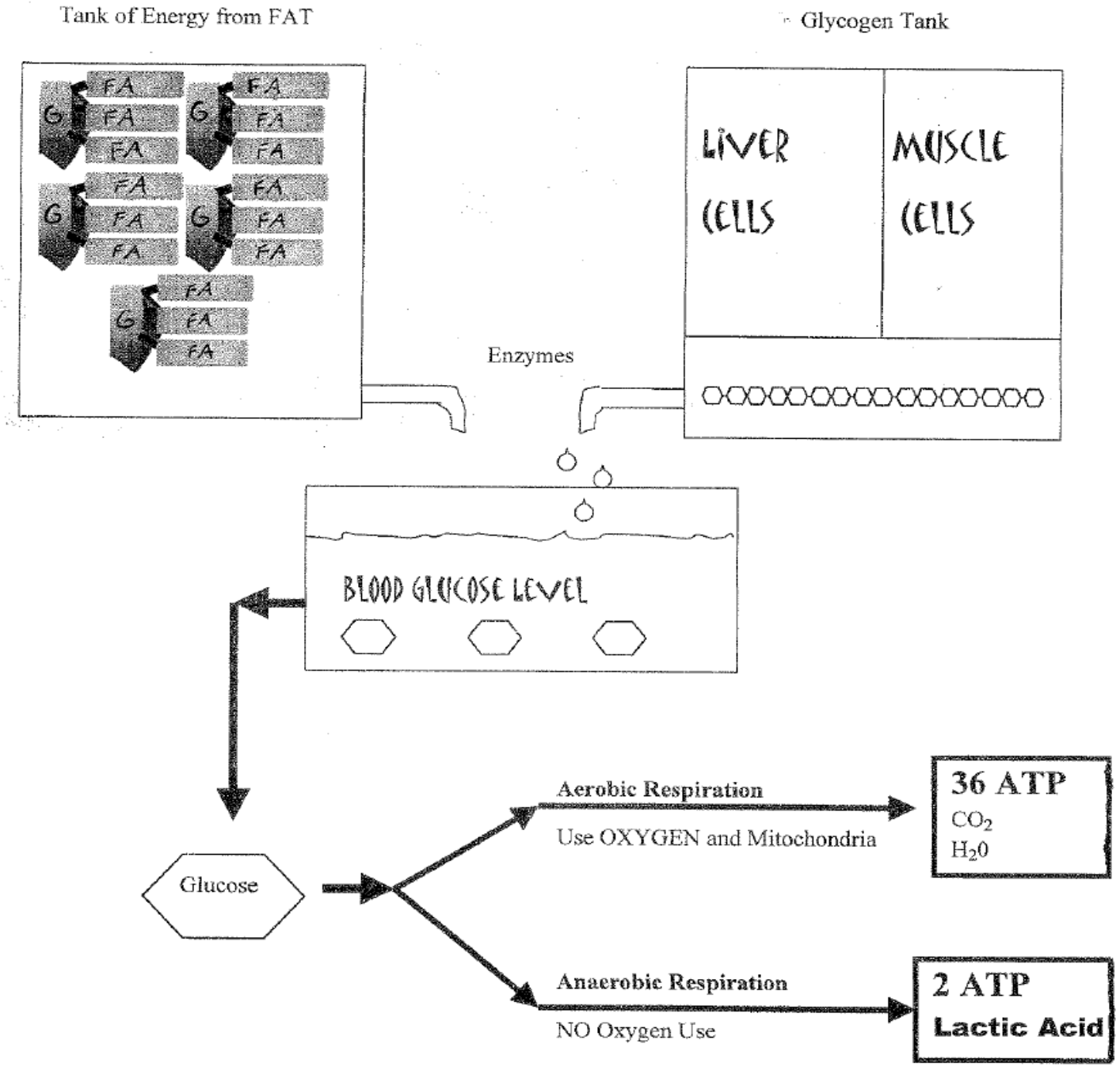
MEET INSULIN … THE "KEY" THAT OPENS THE TRANSPORT PROTEIN FOR GLUCOSE



Insulin video


Liver
Common Duct
Pancreas
Tail
Body
Gallbladder
Pancreatic Duct
Head
Intestine
(Duodenum)

BIG PICTURE of Cellular Respiration Dynamics



ACT Practice: Cell Respiration

PASSAGE III

A scientist wanted to observe the effects of altitude on the respiratory system of mammals. Four different species of mammals were placed in a chamber that underwent gradual changes in pressure (measured in atmospheres, or atm) to simulate the atmosphere at high altitudes. After 5 minutes at each atmospheric pressure tested, the average number of breaths per minute (*respiratory rate*) was determined for each of the 4 mammals while they remained at rest. The data from the experiment are shown in the following graph. (Note: Larger animals typically have slower respiratory rates. Higher respiratory rates indicate rapid breathing, a sign of distress in some mammals.)

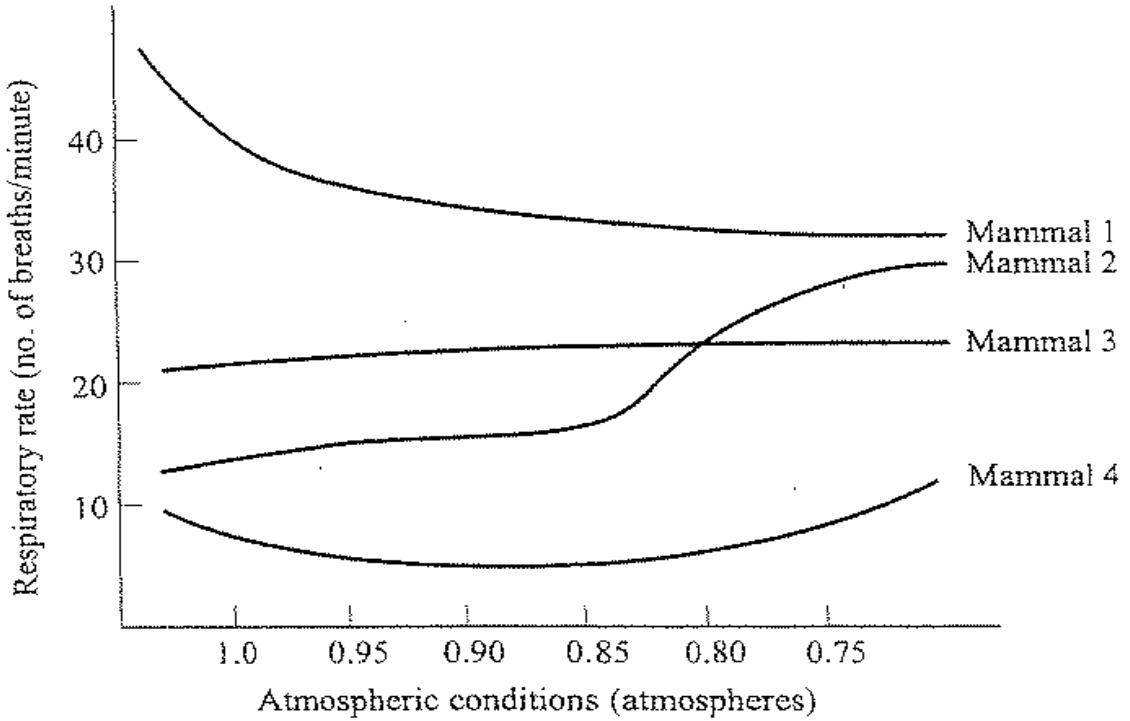


Figure 1


www.pikaworks.com


www.pikaworks.com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© Phillip Colla / Oceanlight.com

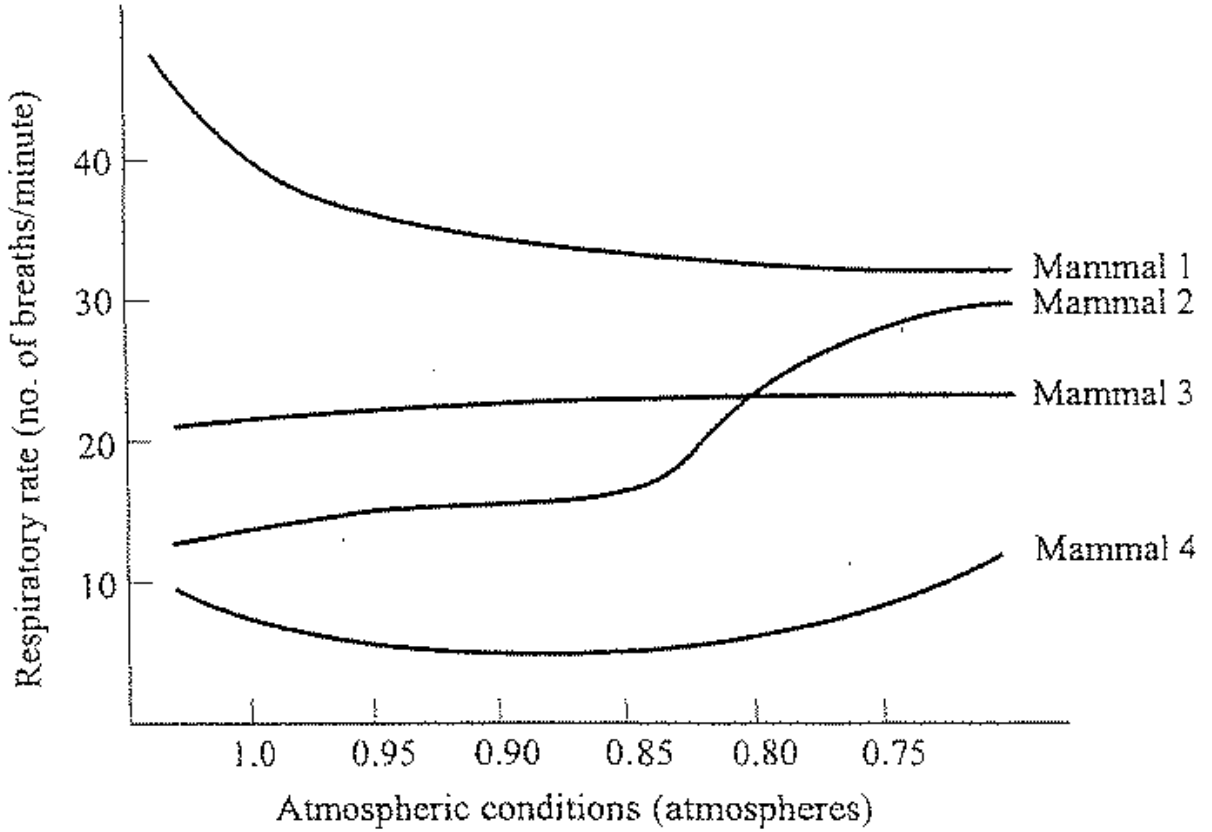

Figure 1

14. What is the general relationship between respiratory rate and atmospheric pressure for Mammal 2?

F. Decreases in pressure decrease the respiratory rate.

G. Decreases in pressure increase the respiratory rate.

H. Pressure changes have no effect on the respiratory rate.

J. Increases in pressure increase the respiratory rate.

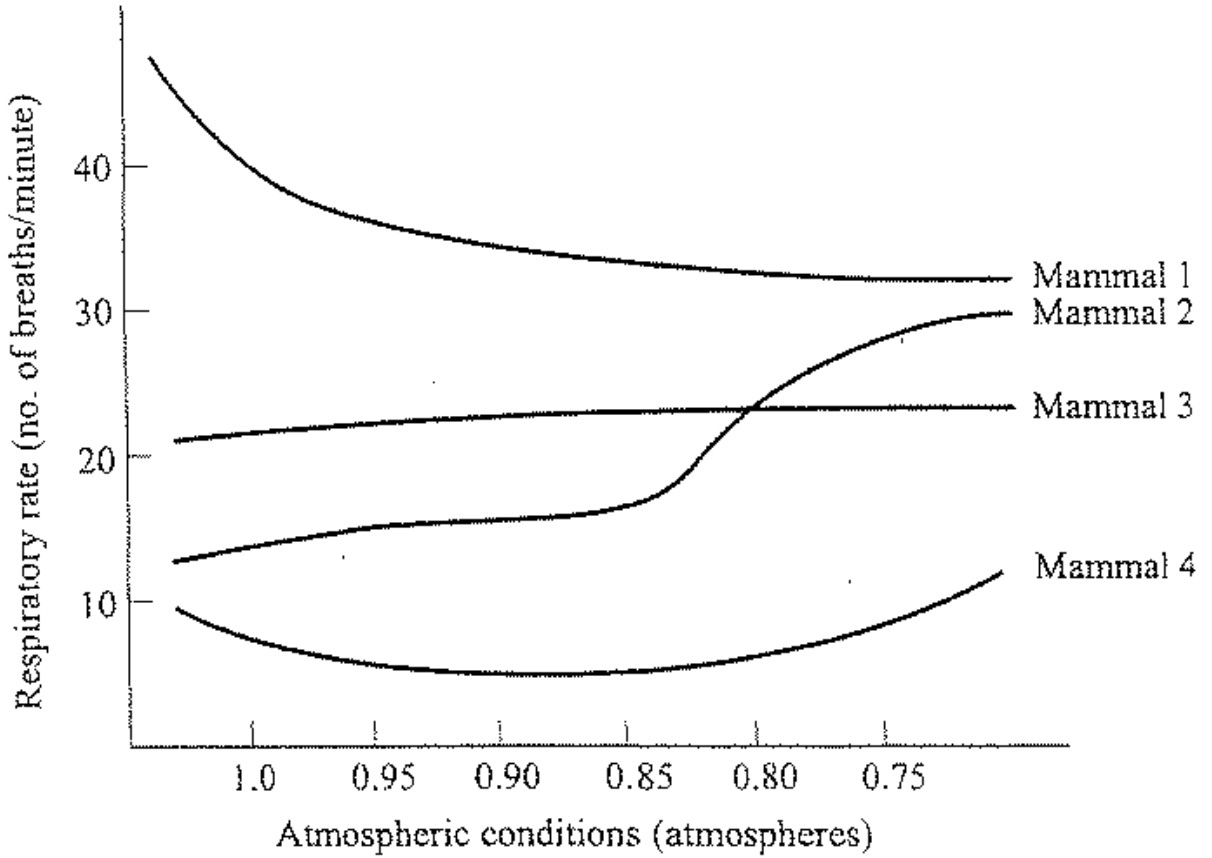

Figure 1

15. At approximately which pressure, in atmospheres, did Mammals 2 and 3 have the same respiratory rate?

A. 1.0
B. 0.95
C. 0.80
D. 0.75

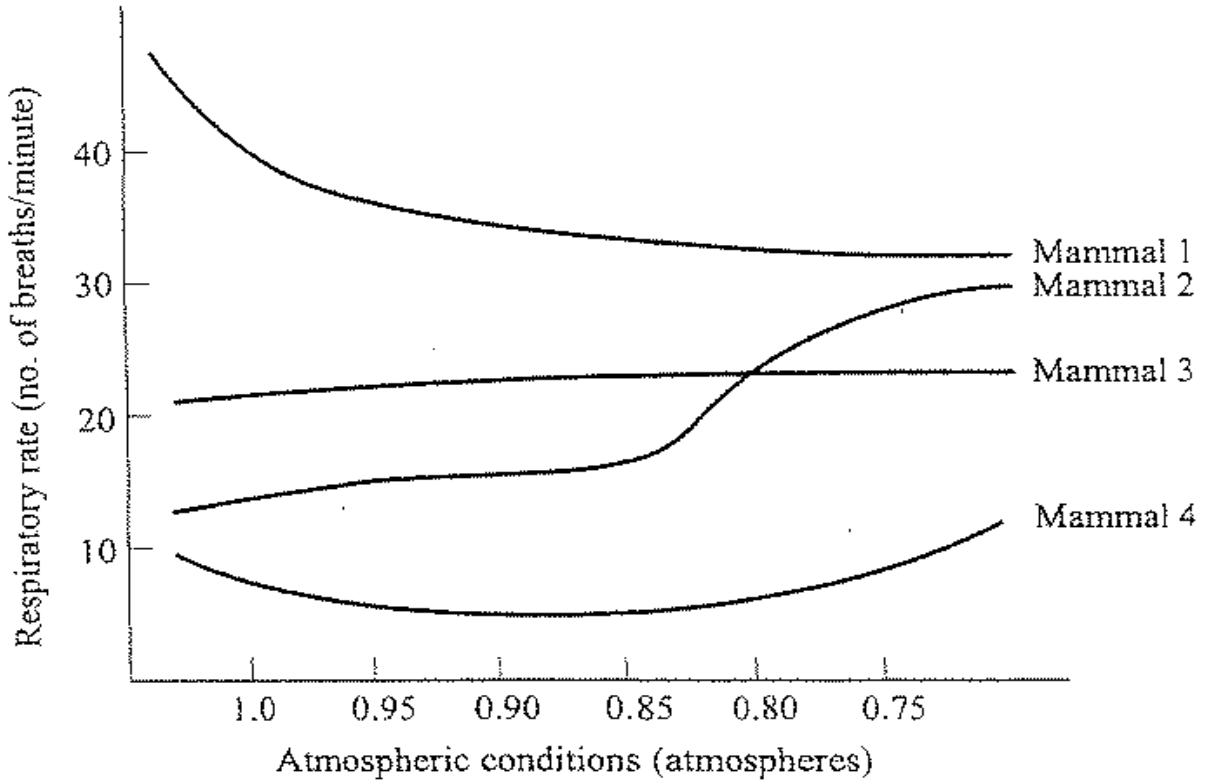

Figure 1

16. Further measurements showed that Mammal 4 used significantly more oxygen per minute than Mammal 2. This would be consistent with the data from the graph if:

F. Mammal 4 was in a warmer environment than Mammal 2.

G. Mammal 4 was significantly larger than Mammal 2.

H. Mammal 2 was significantly larger than Mammal 4.

J. Mammals 2 and 4 were the same weight.

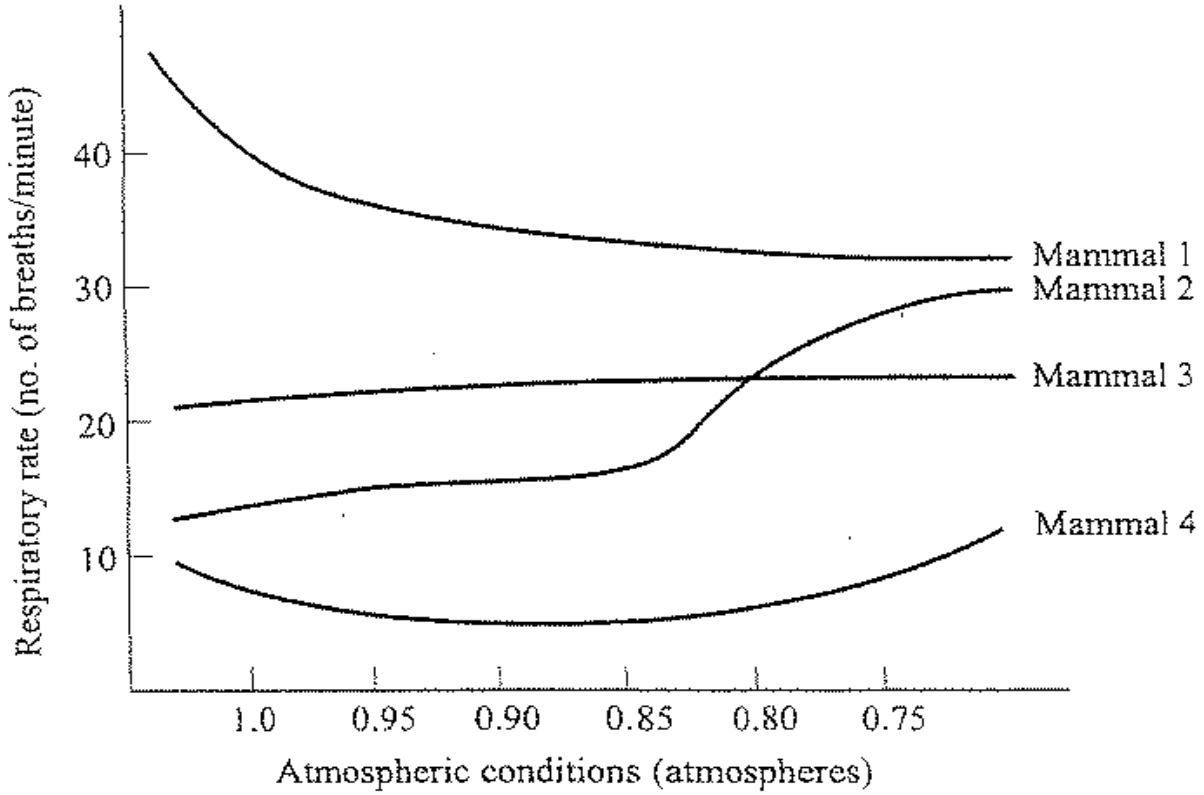

Figure 1

17. A higher respiratory rate causes mammals to have a higher metabolic rate. Which of the mammals would have a higher metabolic rate at a pressure of 1.0 atm than at .80 atm?

A. 1 only
B. 2 only
C. 4 only
D. 1 and 4 only

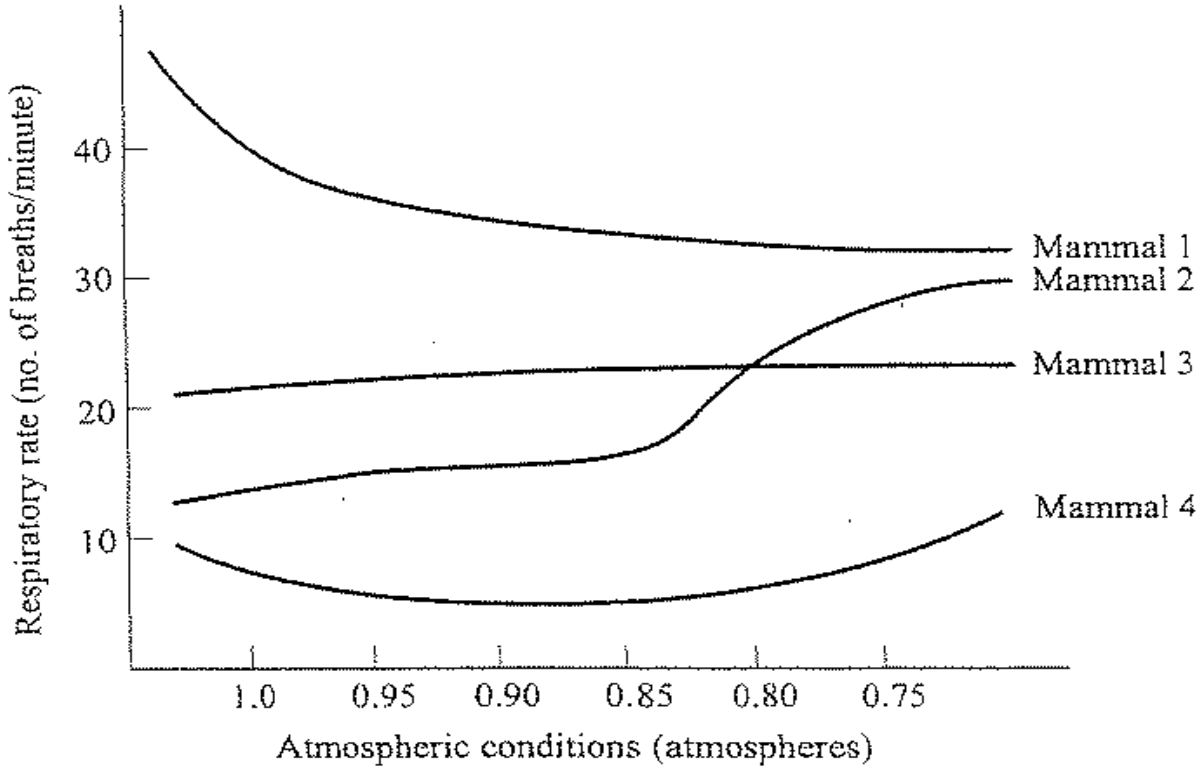

Figure 1

18. Based on the data in the graph, which of the mammals might be native to higher-altitude environments (meaning that they are more comfortable at higher altitudes than at lower altitudes)?

F. 1 only
G. 2 only
H. 3 only
J. 4 only