Chapter 7

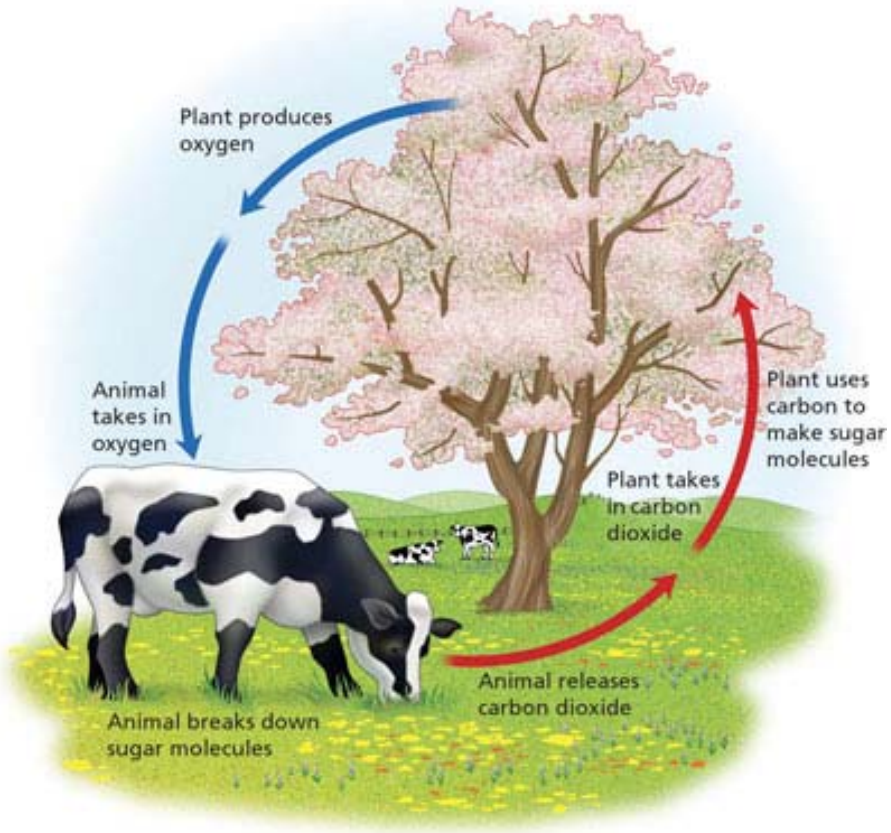
Cellular Respiration

$$C_6H_{12}O_6 + O_2 \longrightarrow CO_2 + H_2O$$

- Oxidation Reactions – Can release energy (think combustion)

- We've got to control the energy release and capture it. That means we can't release all the energy at once. We have to do it in steps.

- Also, think about how warm we are. We're pretty warm. A lot of the energy released from our food goes towards heating us up.



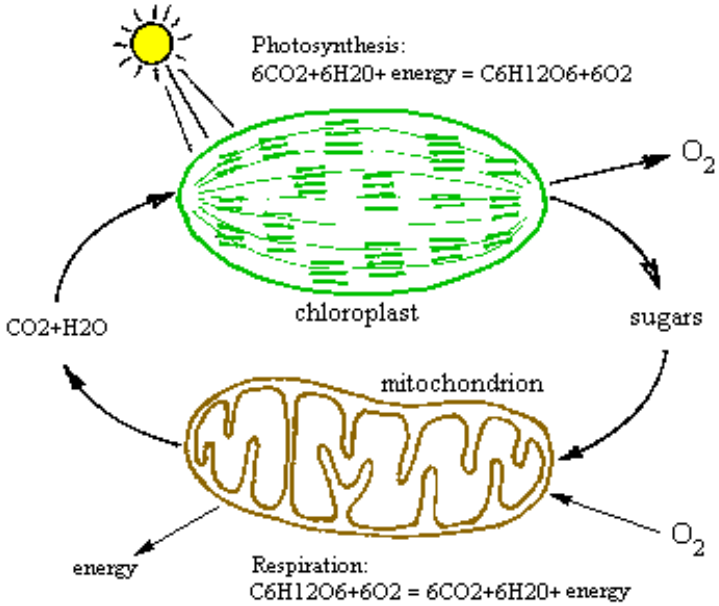


Figure 16 - With the photosynthesis, the solar energy is cumulated by the chloroplasts as sugar molecules. With the glycolysis and the respiration, made by mitochondria, the energy is liberated and supplied to the cell for its biochemical processes.

OK…Now What?

If you have oxygen, aerobic respiration can occur.

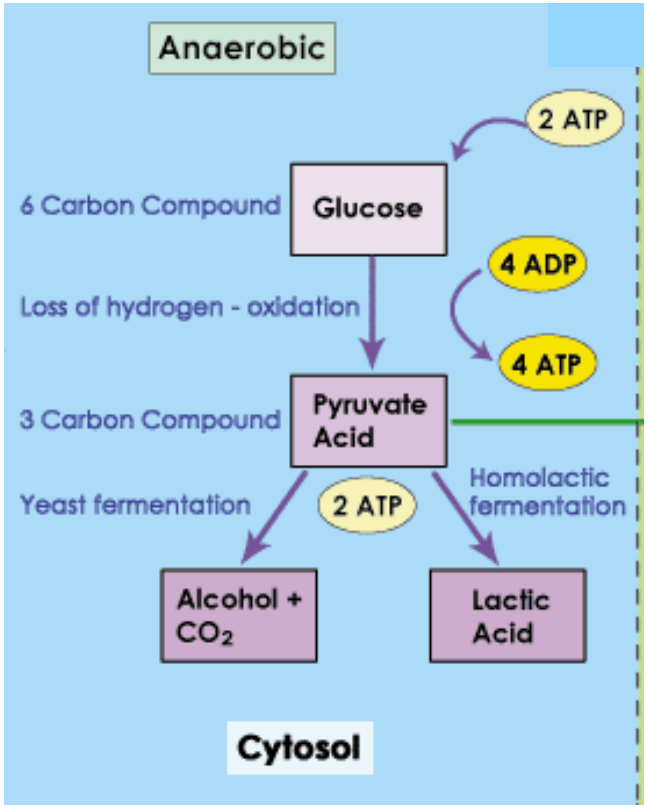
$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_20$$

OK…Now What?

If you don't have enough oxygen, aerobic respiration can't occur, but fermentation can.

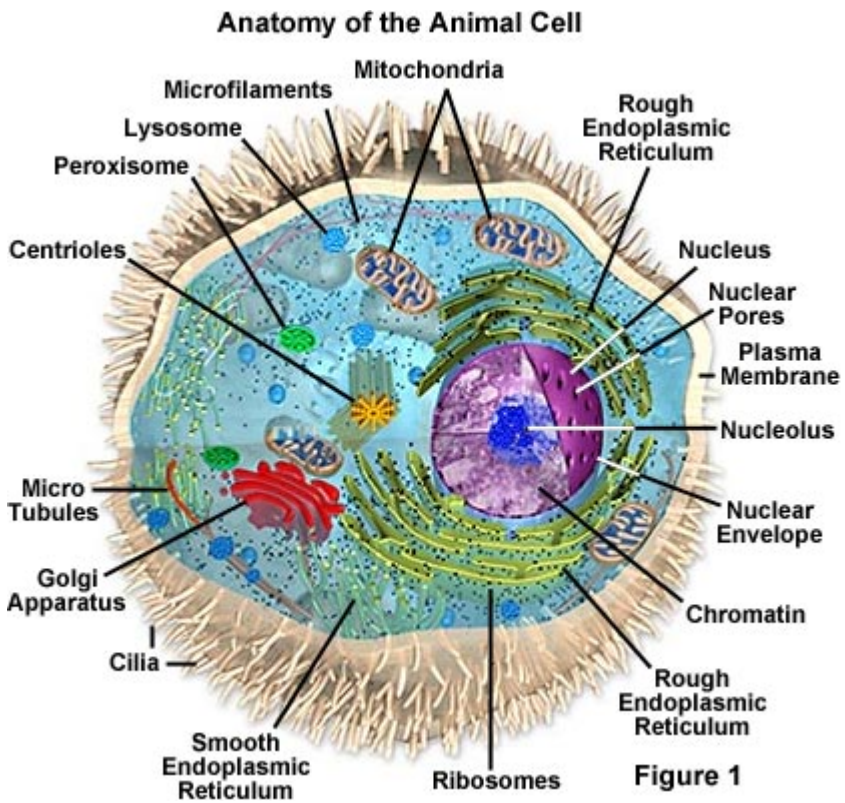
$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_20$$

Anaerobic vs. Aerobic



Oxygen is the key to making large amounts of energy…can you see the difference?

Gylcolysis


Anatomy of the Animal Cell
Mitochondria
Microfilaments
Lysosome
Peroxisome
Rough Endoplasmic Reticulum
Centrioles
Nucleus
Nuclear Pores
Plasma Membrane
Nucleolus
Micro Tubules
Nuclear Envelope
Golgi Apparatus
Chromatin
Cilia
Rough Endoplasmic Reticulum
Smooth Endoplasmic Reticulum
Ribosomes
Figure 1

Gylcolysis

What goes in? What comes out?

Glucose →

2 ATP →

2 NAD+ →

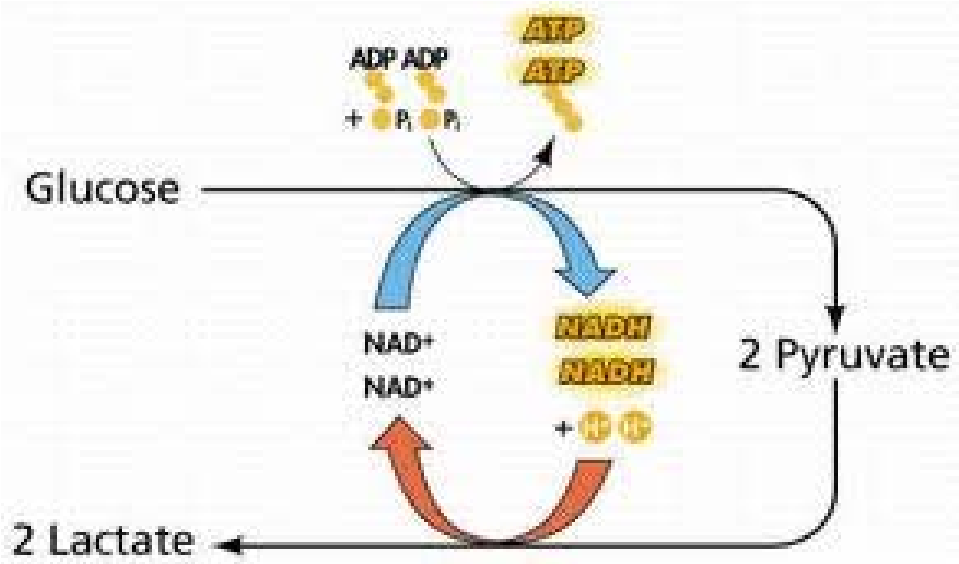
4 ADP →

Fermentation

- Uses _____to regenerate NAD+ and produce small amounts of ATP
- Occurs in the _____
- Enzymes that perform this process and some of the products differ among different organisms.

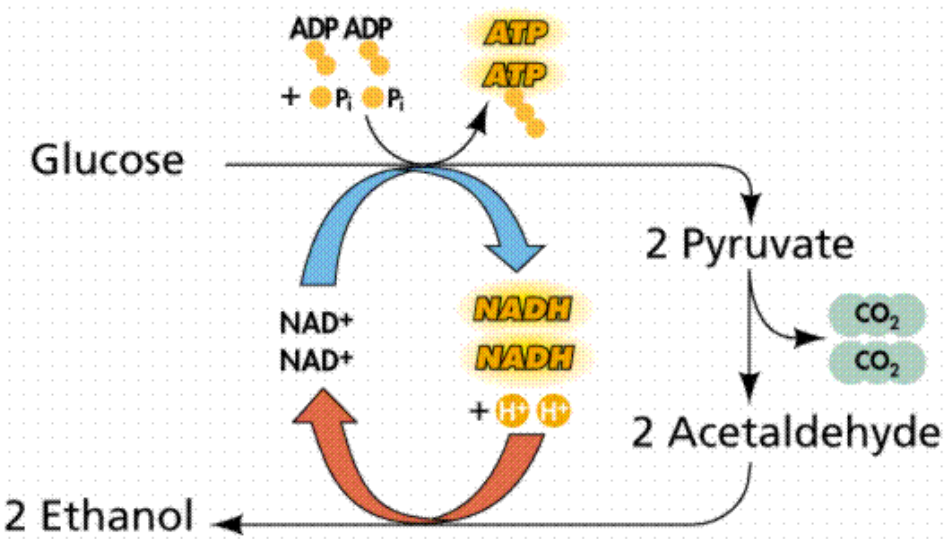
Fermentation

Lactic Acid Fermentation

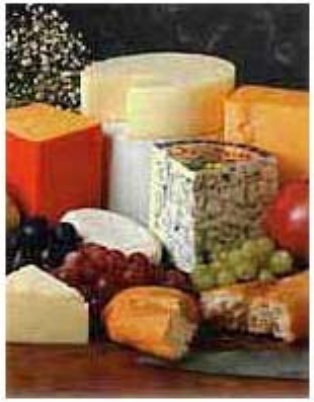


Fermentation

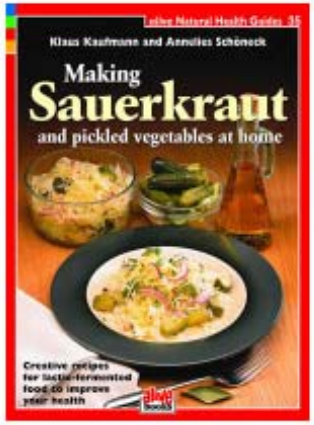
Alcoholic Fermentation




Leinenkugel's
Creamy Dark
LAGER




SCHARFFEN
BERGER
NATURAL
COCOA POWDER
UNSWEETENED


Klaus Kaufmann and Annelies Schönock
Making
Sauerkraut
and pickled vegetables at home


Vinegar
APPLE CIDER FLAVORED


KIKKOMAN
Soy Sauce


LEA & PERRINS
WORCESTERSHIRE
SAUCE


Stonyfield Farm
ORGANIC
WHOLE MILK
PLAIN
YOGURT


Dean's
LARGE CURD
COTTAGE CHEESE


Corned Beef

Efficiency of Glycolysis

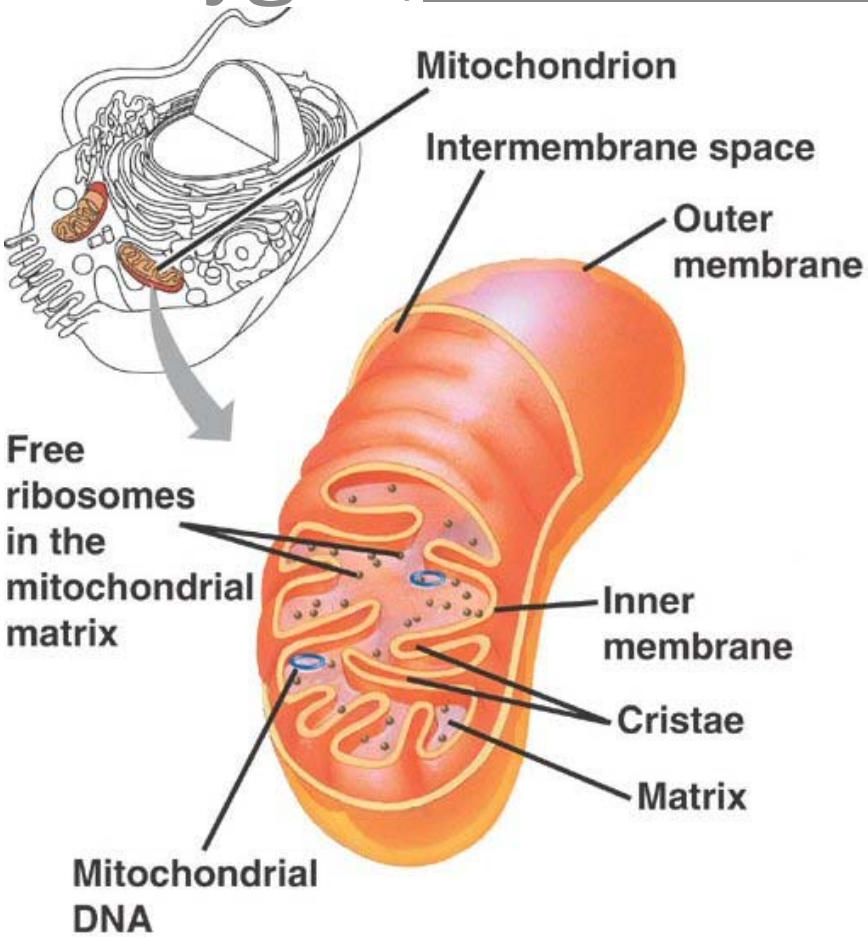
686 kilocalories = Energy released from oxidation of 1 mole of Glucose

7 kilocalories = Energy needed to make an ADP into an ATP

Glycolysis yields a net of 2 ATP

OK…Now What?

If you have oxygen,_____



Aerobic Respiration

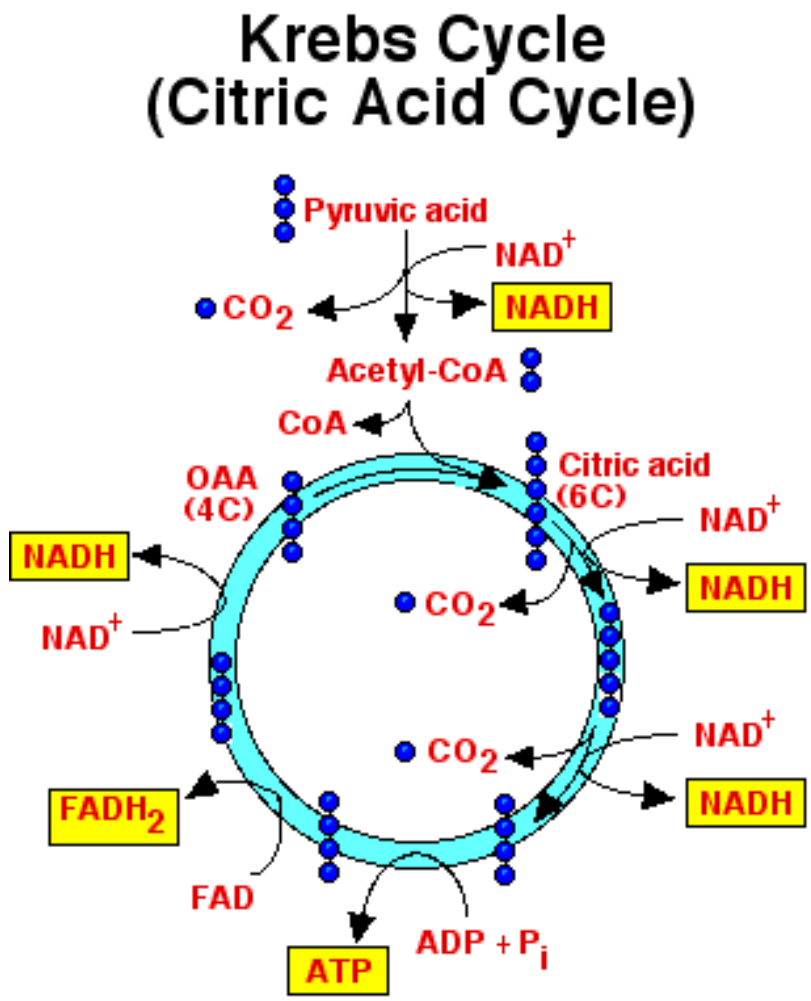
This follows glycolysis when O2 is available.

It occurs in two steps.

1.

2.

Aerobic Respiration



Aerobic Respiration

Krebs Cycle

What goes in? What comes out?

Pyruvic Acid (Acetyl CoA)

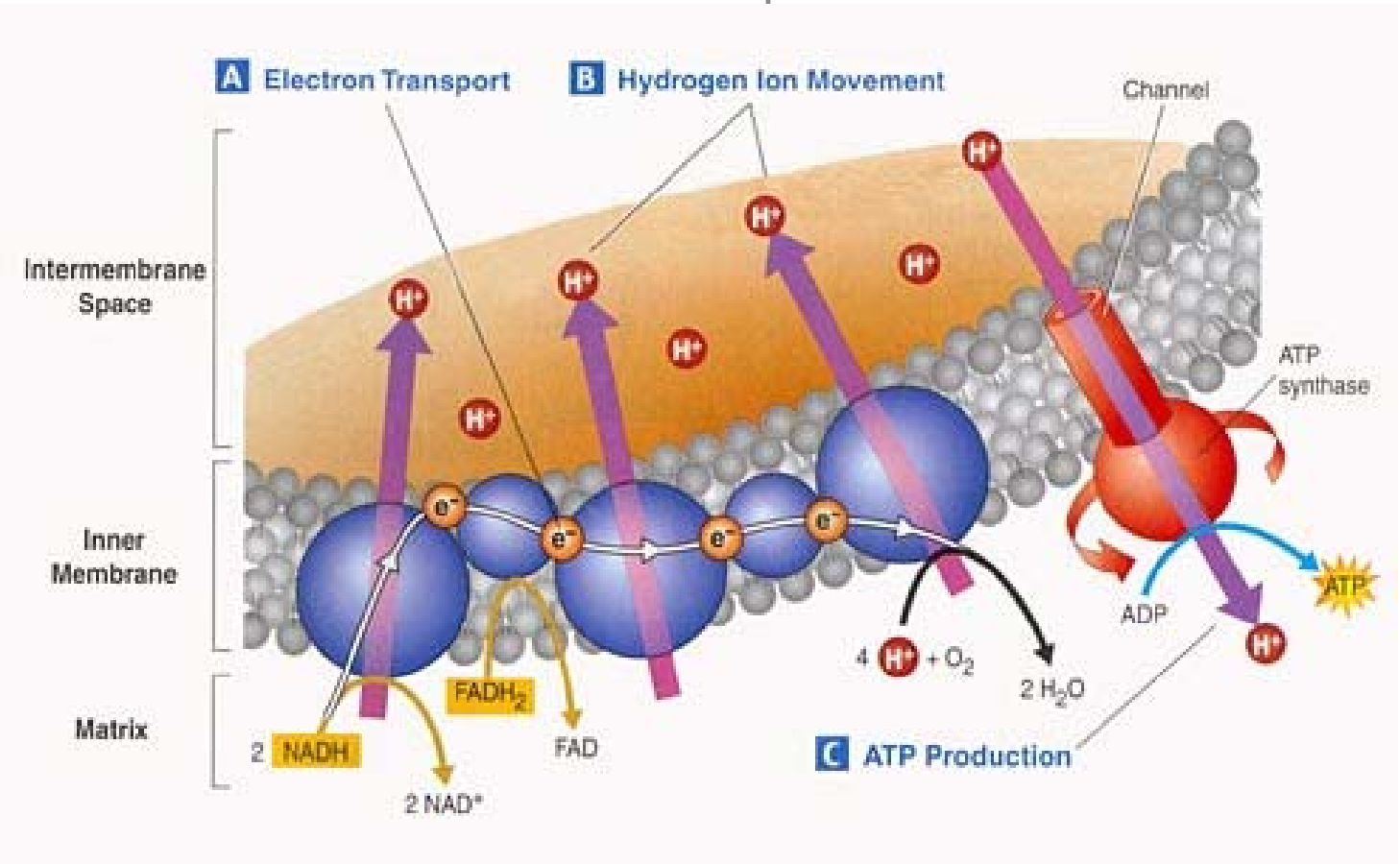
3 NAD+ →

1 ADP →

1 FAD →

Aerobic Respiration

Electron Transport Chain



Aerobic Respiration

Electron Transport Chain

What goes in? What comes out?

NADH →

$FADH_2$ →

ADP →

O_2 →

Efficiency of Aerobic Respiration

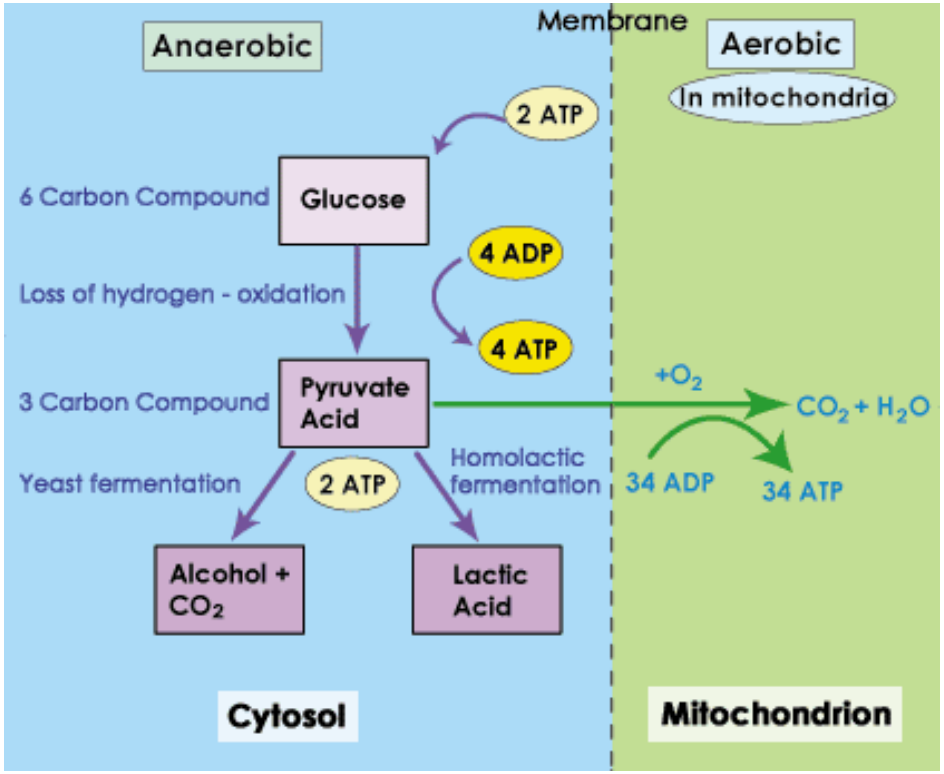
686 kilocalories = Energy released from oxidation of 1 mole of Glucose

7 kilocalories = Energy needed to make an ADP into an ATP

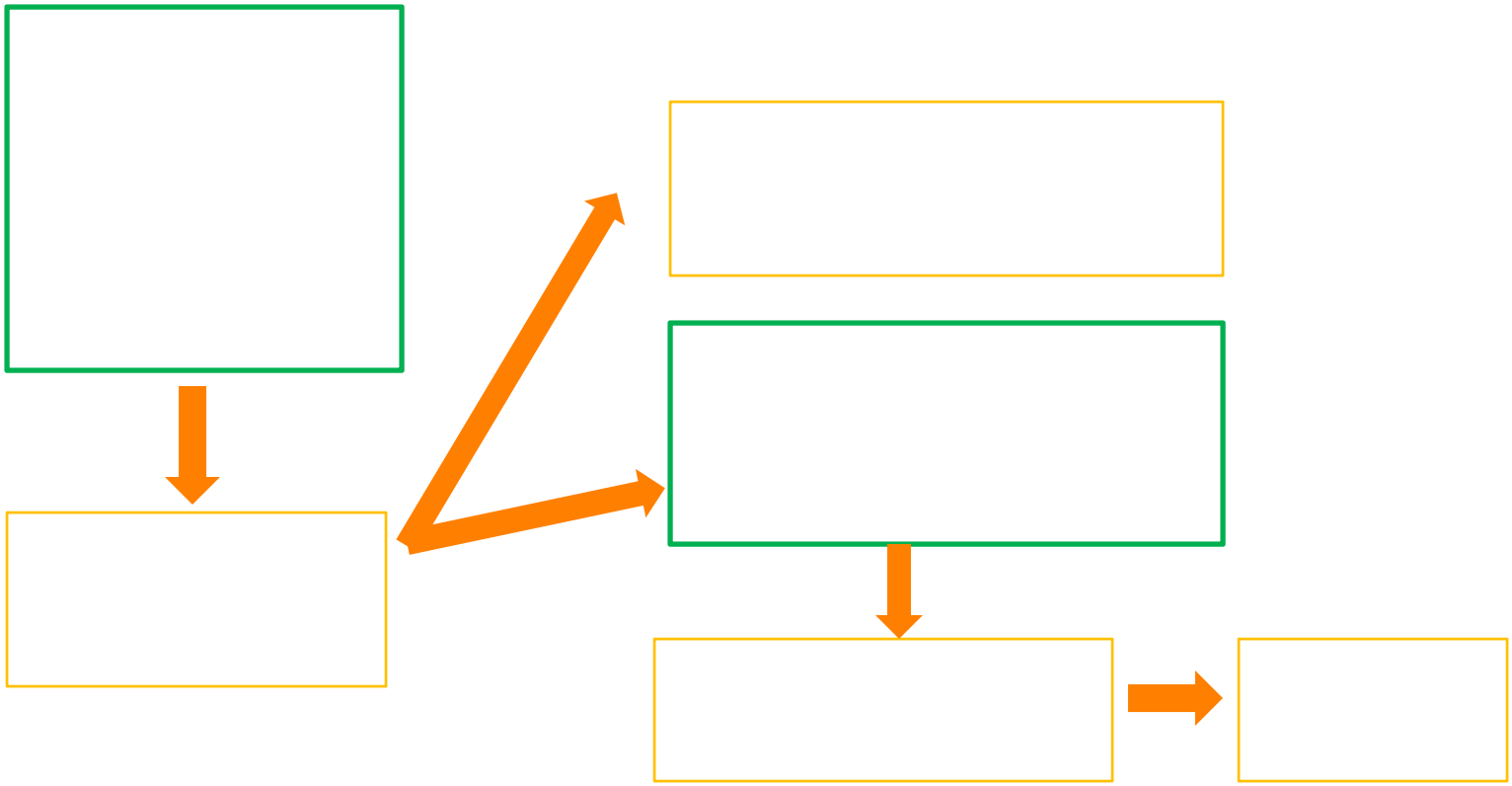
Cellular Respiration yields a total of up to 38 ATP

Compare…How efficient do you think a car engine is?

With or Without OXYGEN…
Here's What Happens:

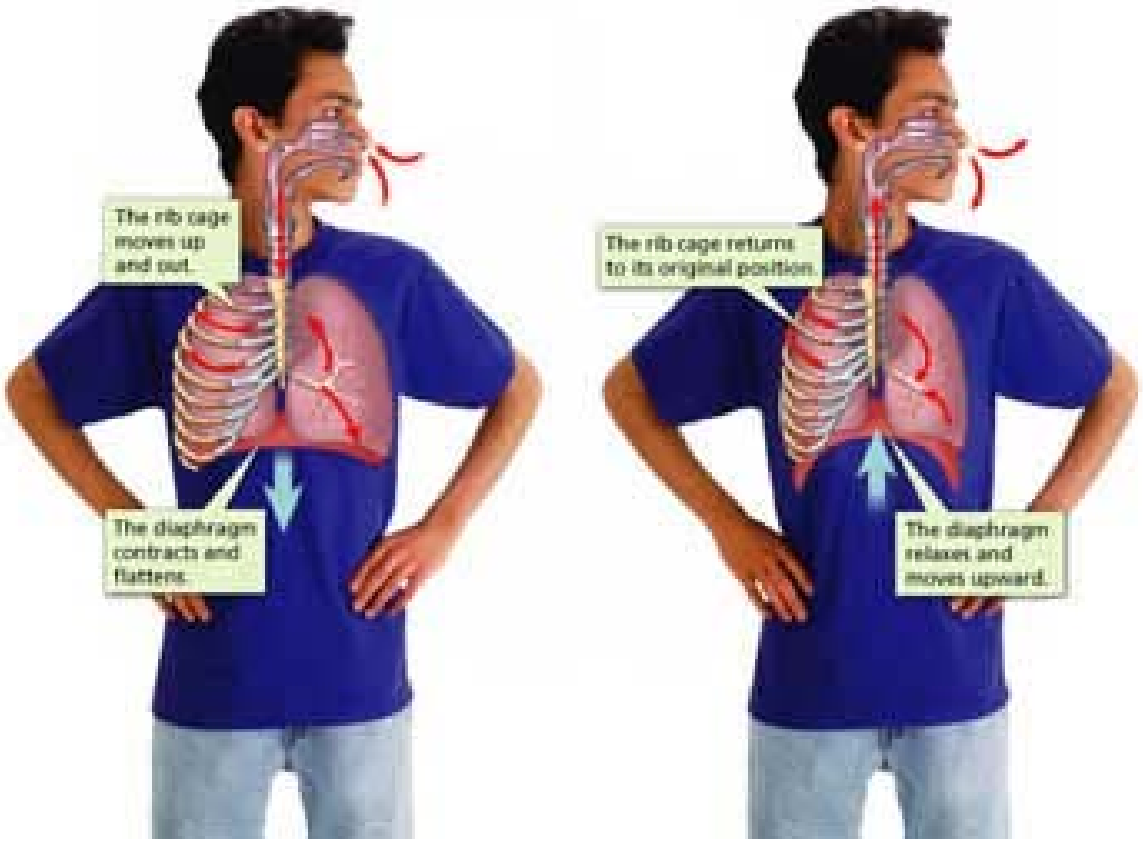


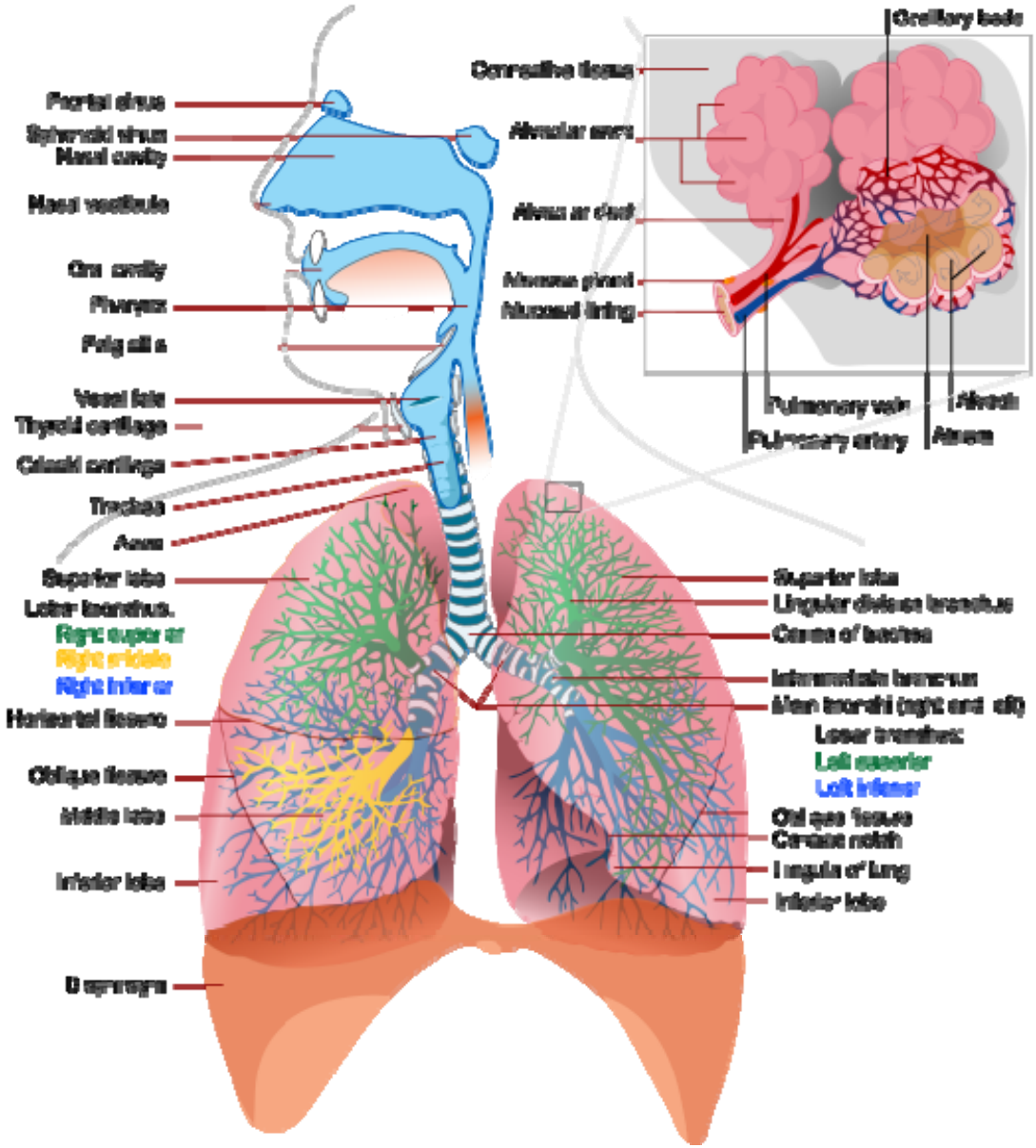
Summing it all up…

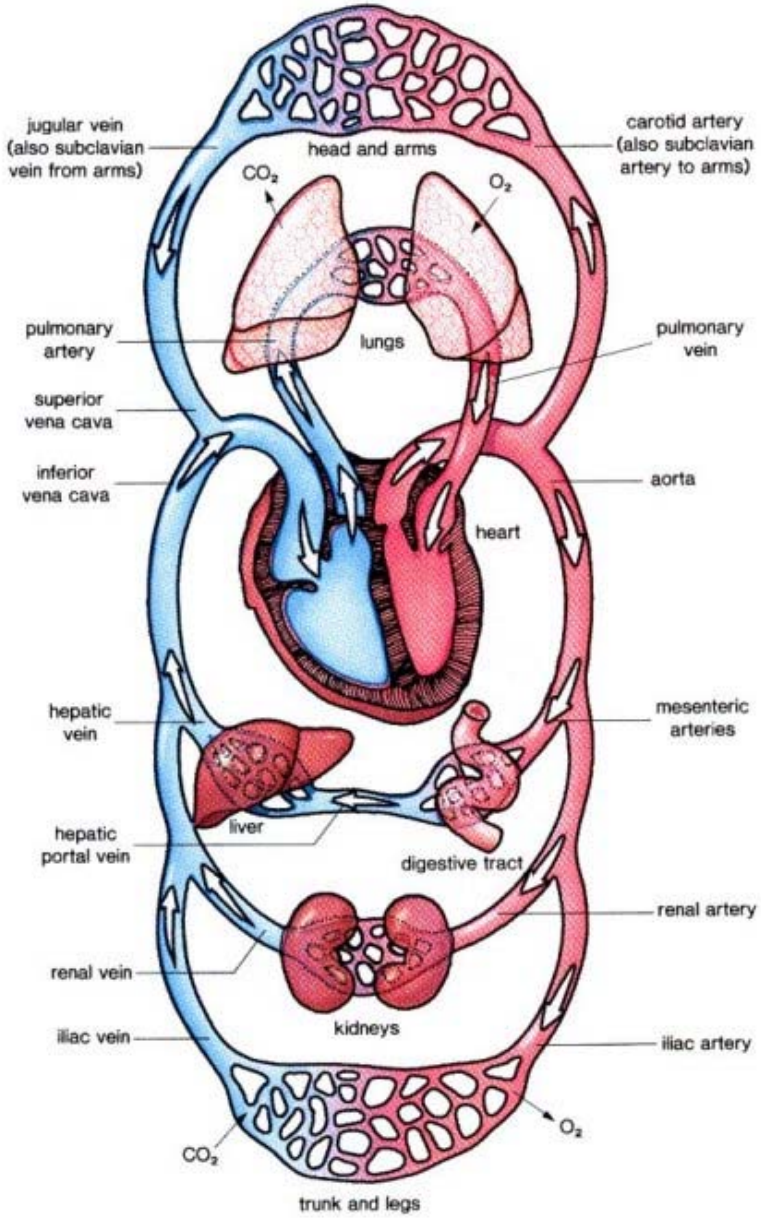


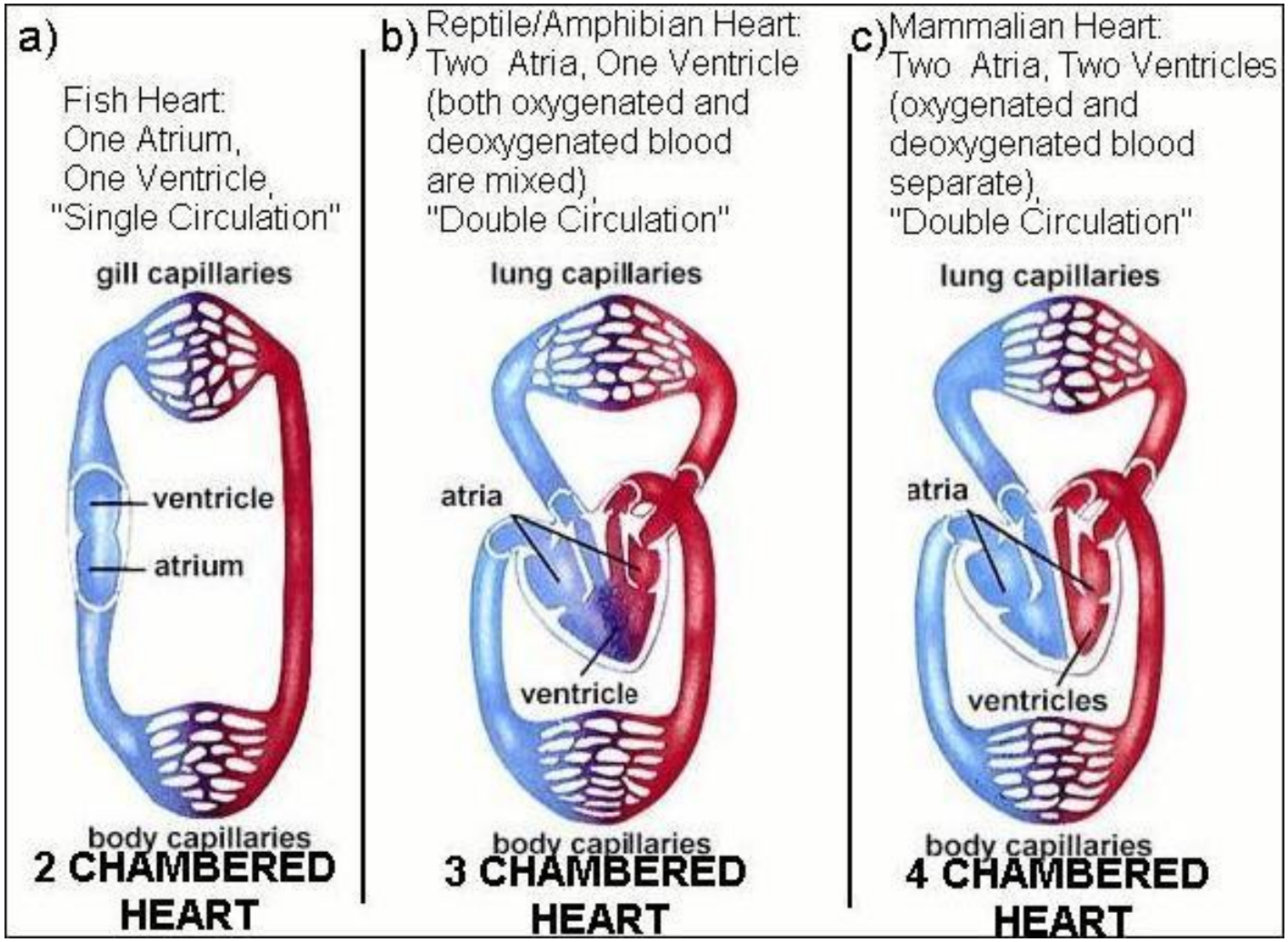
Summing it all up…

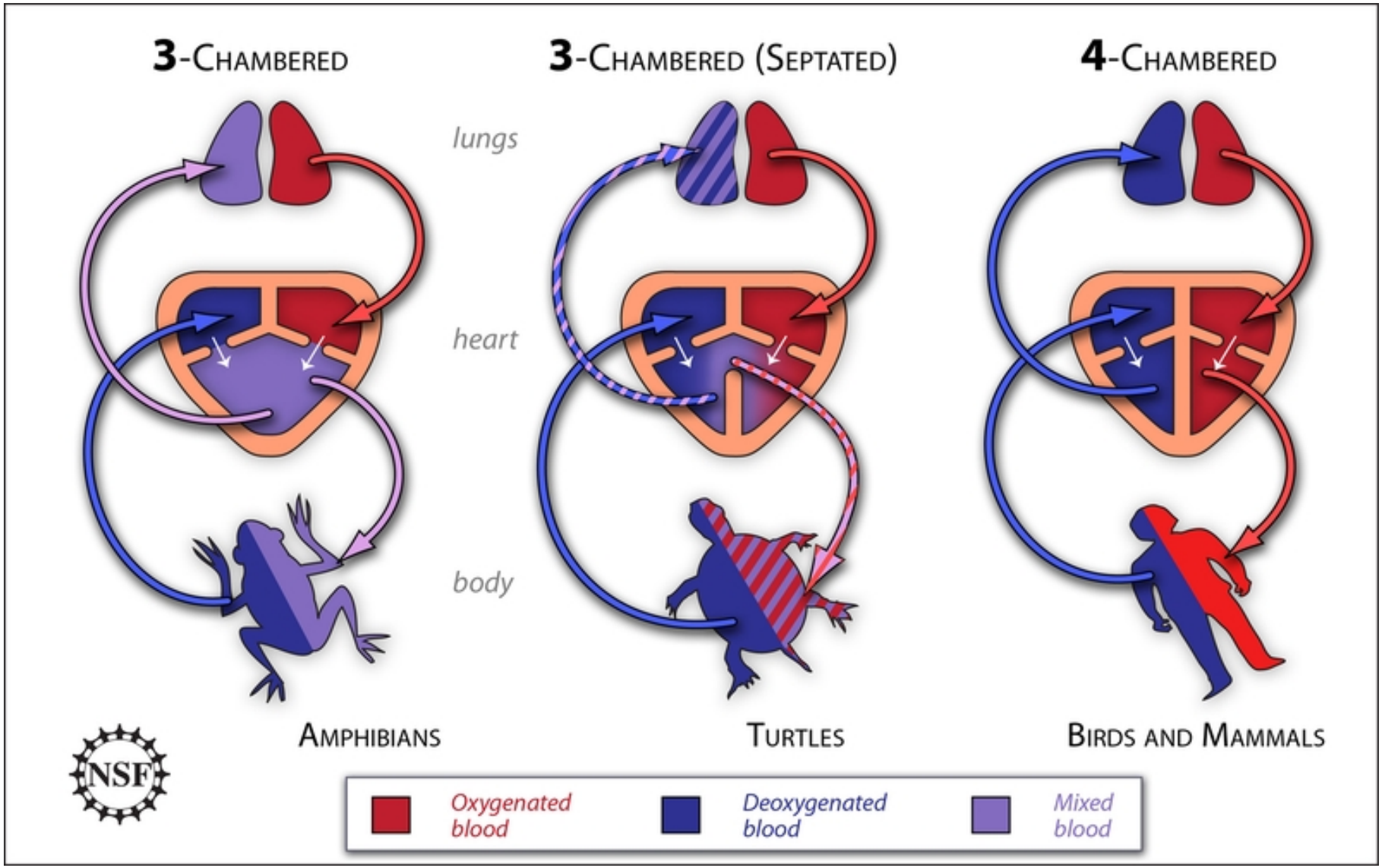
The equation that summarizes the complete oxidation of one glucose molecule:


The rib cage moves up and out.
The diaphragm contracts and flattens.
The rib cage returns to its original position.
The diaphragm relaxes and moves upward.


Frontal sinus
Sphenoid sinus
Nasal cavity
Nasal vestibule
Oral cavity
Pharynx
Epiglottis
Vocal fold
Thyroid cartilage
Cricoid cartilage
Trachea
Aorta
Superior lobe
Lobar bronchus
Right superior
Right middle
Right inferior
Horizontal fissure
Oblique fissure
Middle lobe
Inferior lobe
Diaphragm
Ciliary body
Connective tissue
Alveolar sacs
Alveolus or duct
Mucous gland
Mucosal lining
Pulmonary vein
Pulmonary artery
Alveoli
Atrium
Superior lobe
Lingular division bronchus
Carina of trachea
Intermediate bronchus
Main bronchi (right and left)
Lower bronchus
Left superior
Left inferior
Oblique fissure
Cardiac notch
Lingula of lung
Inferior lobe


jugular vein
(also subclavian
vein from arms)
head and arms
carotid artery
(also subclavian
artery to arms)
CO_2
O_2
pulmonary
artery
lungs
pulmonary
vein
superior
vena cava
inferior
vena cava
aorta
heart
hepatic
vein
mesenteric
arteries
liver
hepatic
portal vein
digestive tract
renal artery
renal vein
kidneys
iliac vein
iliac artery
O_2
CO_2
trunk and legs


a)
Fish Heart:
One Atrium,
One Ventricle,
"Single Circulation"
gill capillaries
ventricle
atrium
body capillaries
2 CHAMBERED HEART
b)
Reptile/Amphibian Heart:
Two Atria, One Ventricle
(both oxygenated and
deoxygenated blood
are mixed),
"Double Circulation"
lung capillaries
atria
ventricle
body capillaries
3 CHAMBERED HEART
c)
Mammalian Heart:
Two Atria, Two Ventricles
(oxygenated and
deoxygenated blood
separate),
"Double Circulation"
lung capillaries
atria
ventricles
body capillaries
4 CHAMBERED HEART


3-Chambered
3-Chambered (Septated)
4-Chambered
lungs
heart
body
Amphibians
Turtles
Birds and Mammals
NSF
Oxygenated blood
Deoxygenated blood
Mixed blood