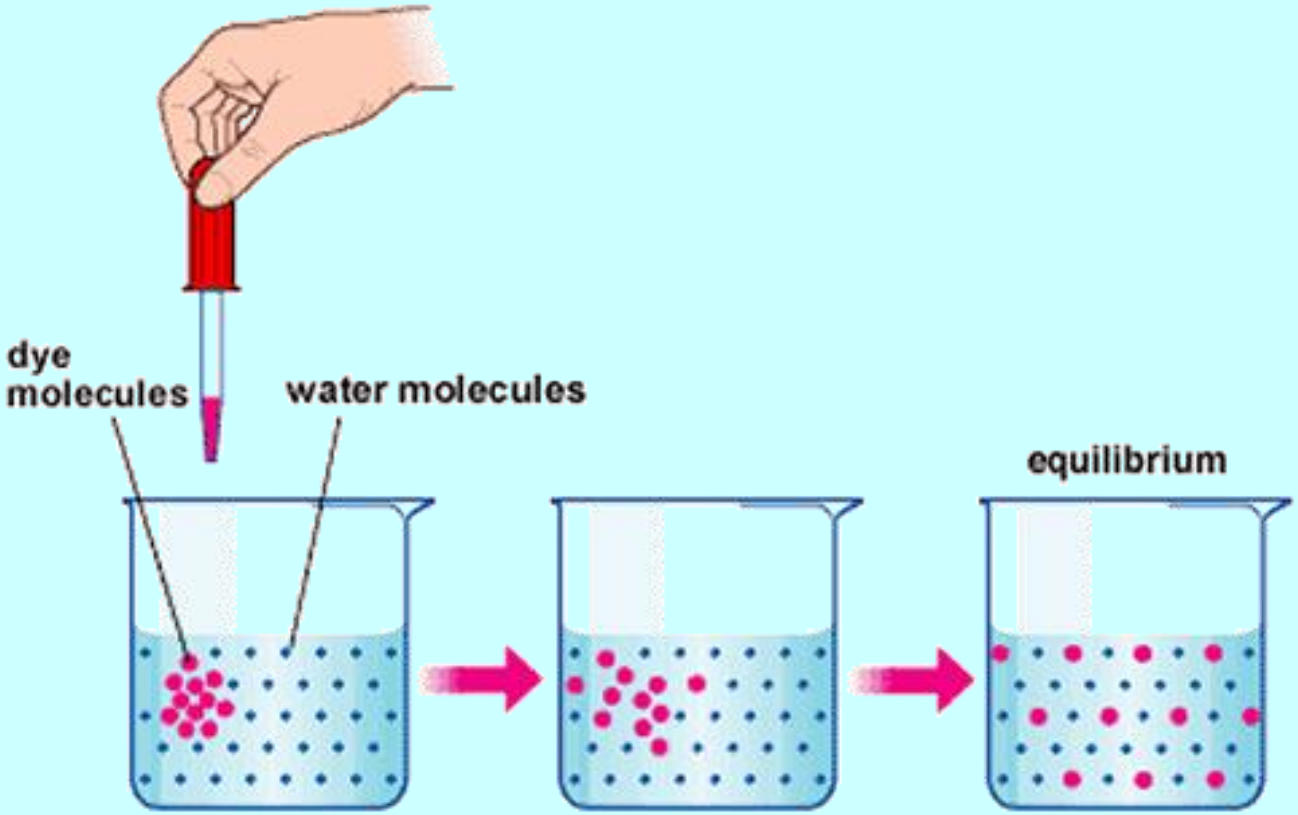
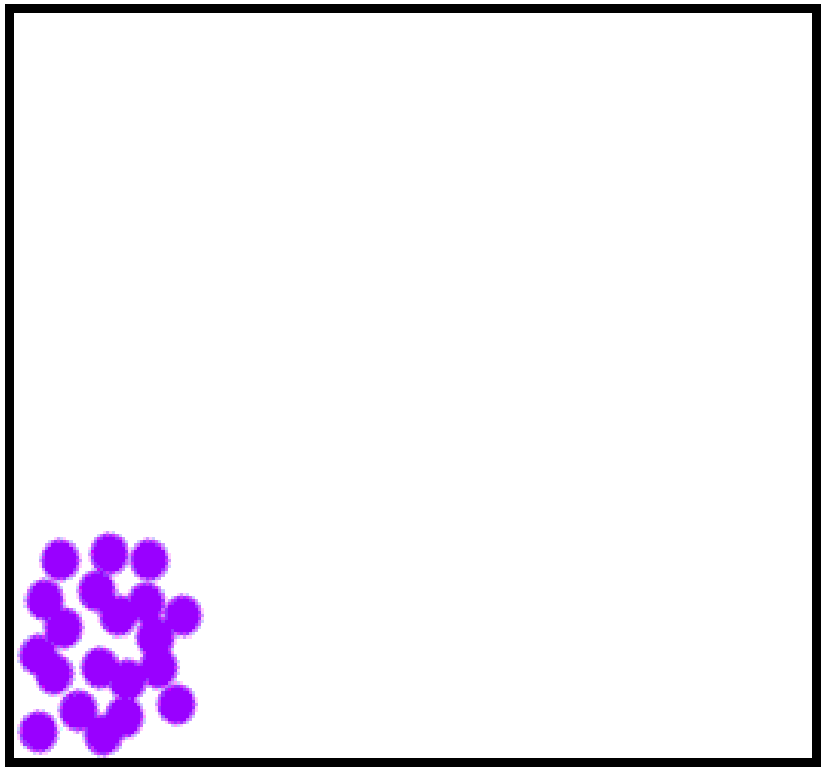
Diffusion



http://lhs.lps.org/staff/sputnam/Biology/U3Cell/diffusion_1.png

Animatioin from: http://www.biologycorner.com/resources/diffusion-animated.gif



Molecules move

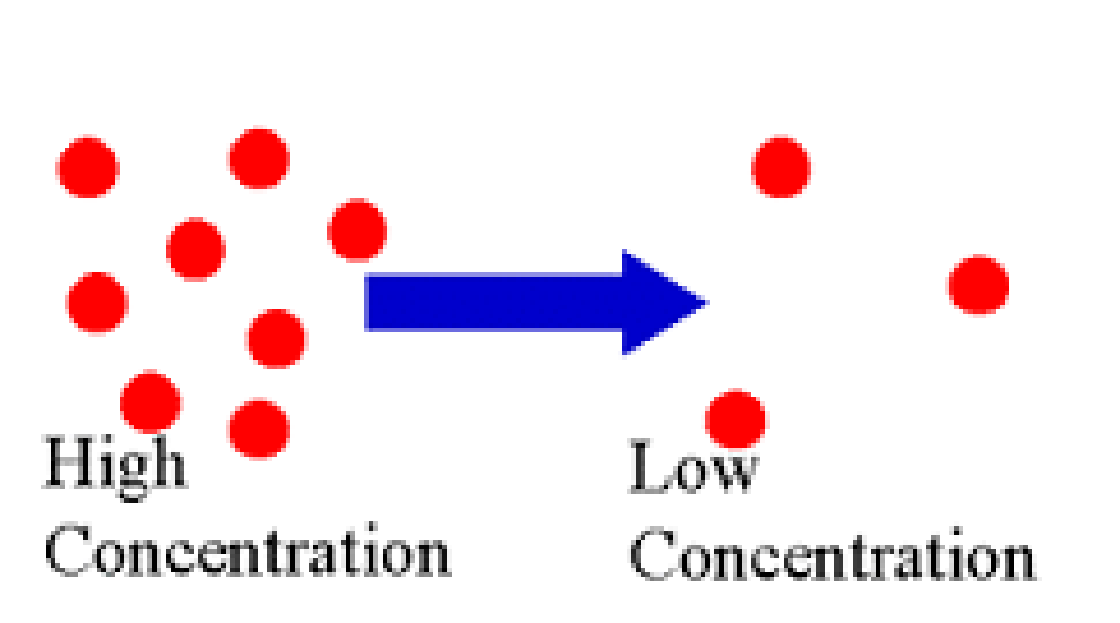
FROM "where there's A LOT"

to "where there's NOT"

DIFFUSION across a space

Happens anytime there is a DIFFERENCE in concentration in one place compared to another

= Concentration gradient



DIFFUSION across a SPACE

- Molecules move automatically _DOWN_ the concentration gradient _from_ an area of _Higher_ concentration _to_ an area of _Lower_ concentration
- EXAMPLES

Blue dye in beaker demo,
Someone making popcorn/grilling out
Strong perfume,
Bad smell in room

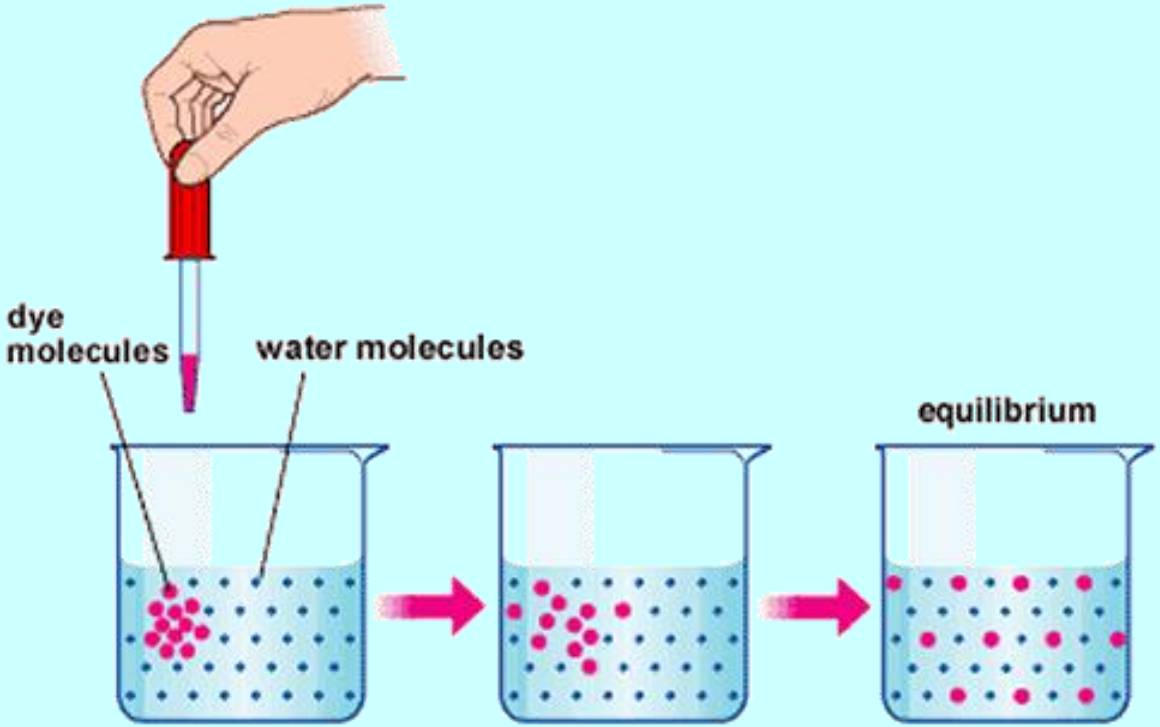
http://leighhouse.typepad.com/blog/images/kool_aid.jpg

http://www.swapmeetdave.com/Humor/Farts.htm

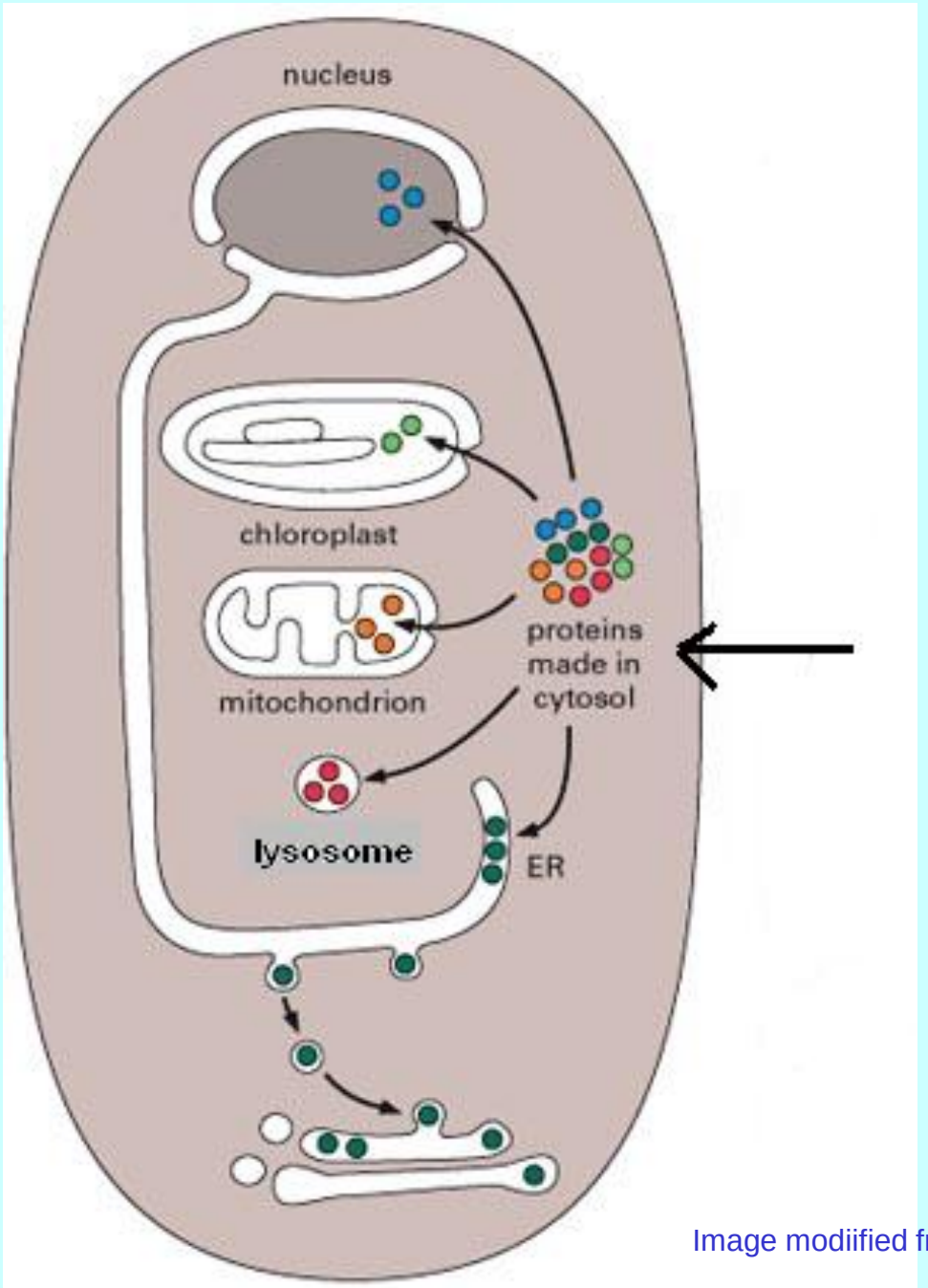
DIFFUSION across a space

Diffusion continues until the concentration is equal everywhere in space

= Equilibrium



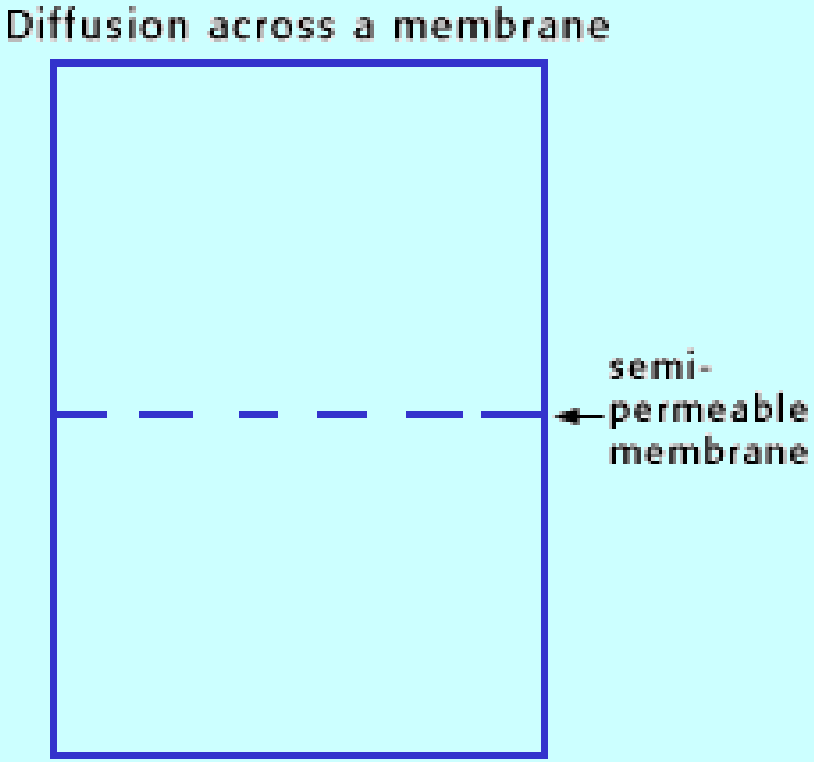
http://lhs.lps.org/staff/sputnam/Biology/U3Cell/diffusion_1.png



Molecules need to move across membranes in cells

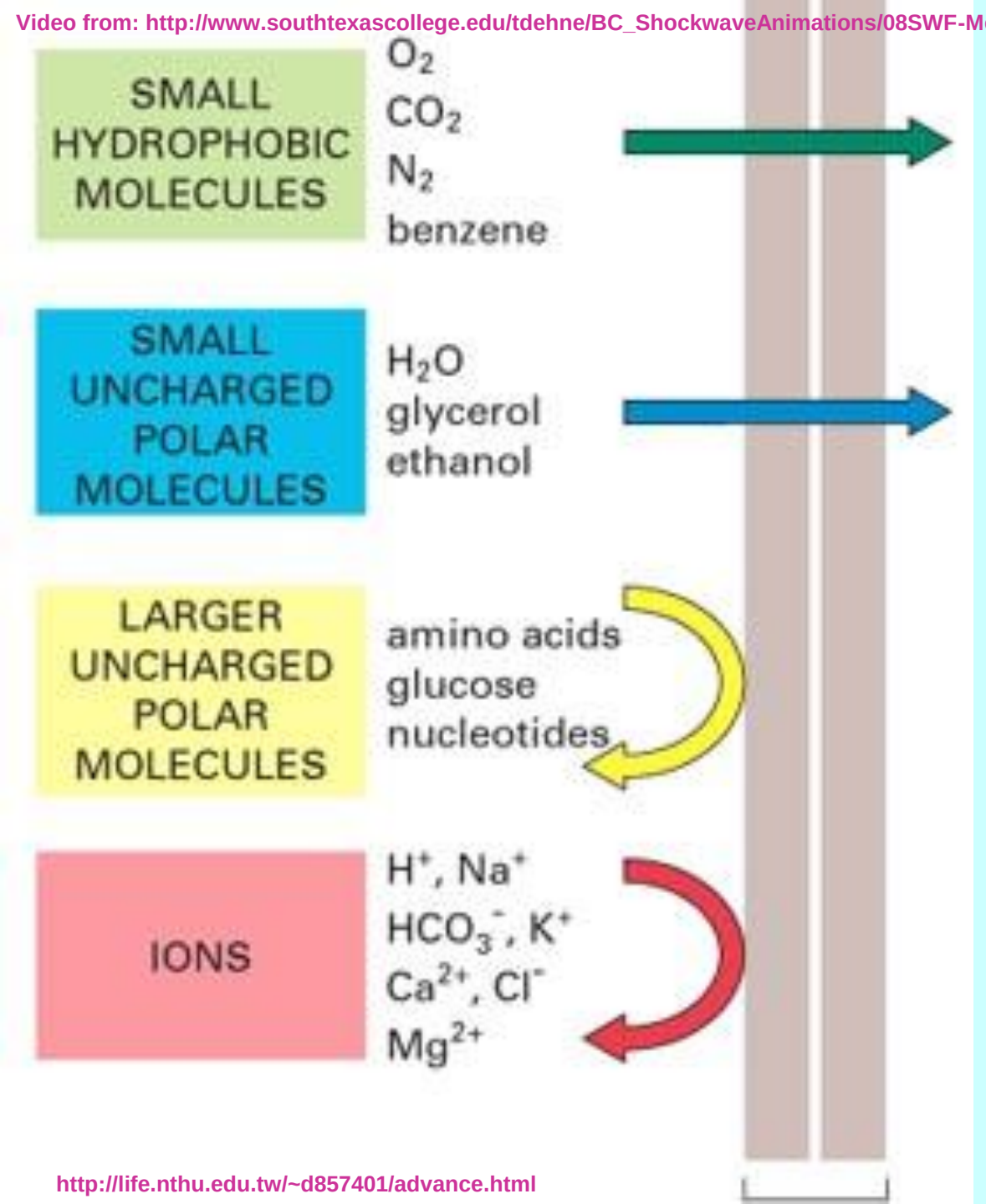
Image modiified from: http://www.accessexcellence.org/AB/GG/importProt.html

Diffusion can happen ___across___ a ___membrane___ in a cell, too



…as long as membrane will let the molecule ___pass through___

Video from: http://www.southtexascollege.edu/tdehne/BC_ShockwaveAnimations/08SWF-MembraneStructureAndFunct/08-02-MembraneStructure.swf



SELECTIVELY PERMEABLE (Semi-permeable)

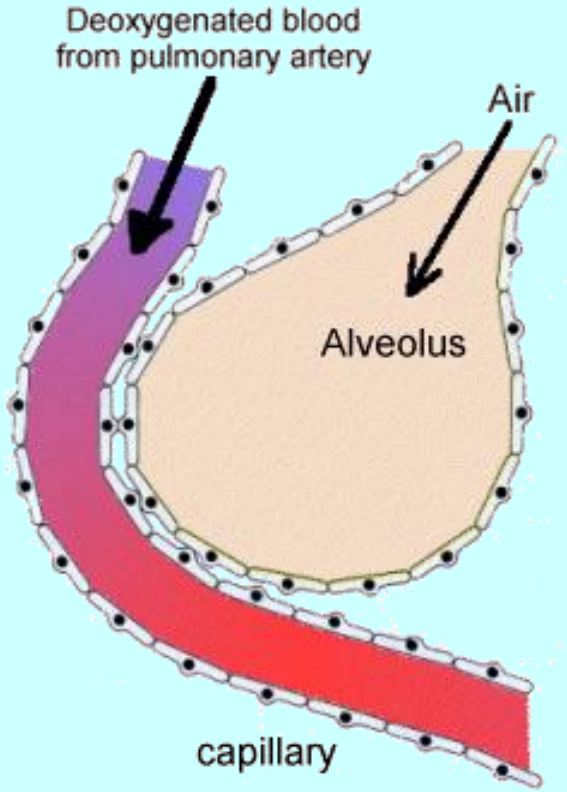
See a movie

http://life.nthu.edu.tw/~d857401/advance.html

CELL EXAMPLE:

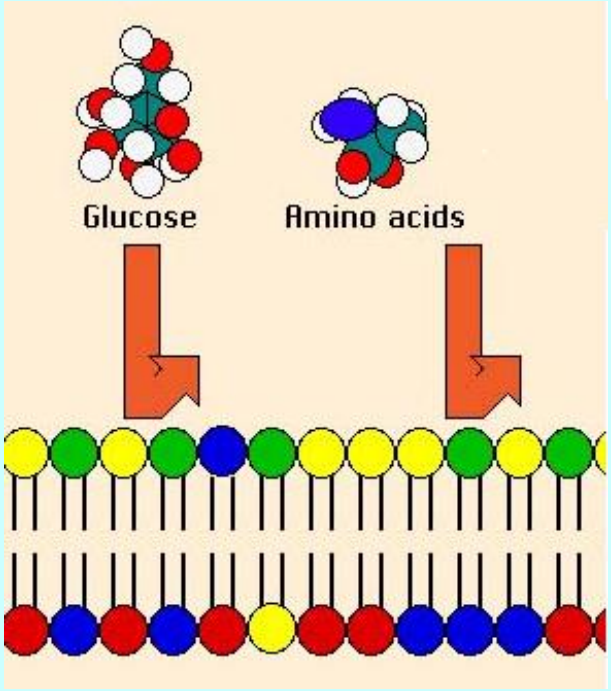
DIFFUSION automatically moves oxygen from HIGHER concentration (in lungs) to a LOWER concentration (in blood)

CO_2 automatically moves from where there is a HIGHER concentration (in blood) to where there is a lower concentration (in lungs)



http://www.le.ac.uk/pa/teach/va/anatomy/case2/2_2.html

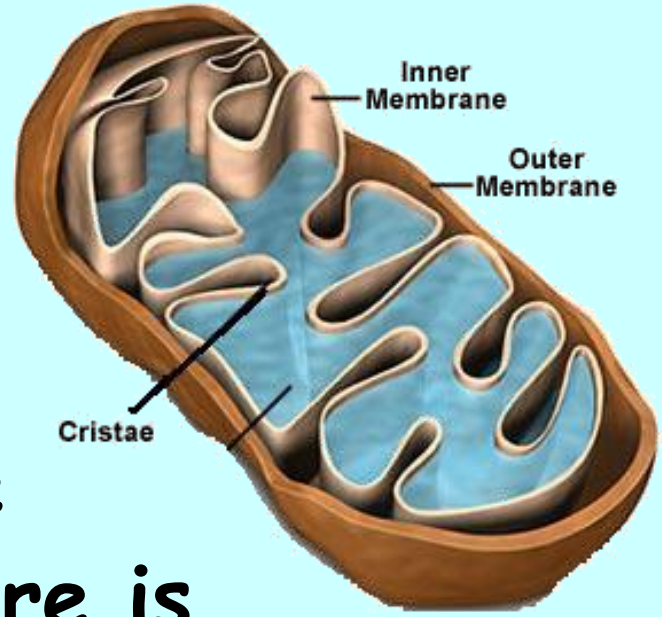
BUT….
What if a cell needs to move LARGE molecules?



http://www.d.umn.edu/~sdowning/Membranes/membraneImages/jpegimages/diffusionmedium.jpg

What if cell needs to move a molecule AGAINST the CONCENTRATION GRADIENT?

(LOWER → HIGHER)



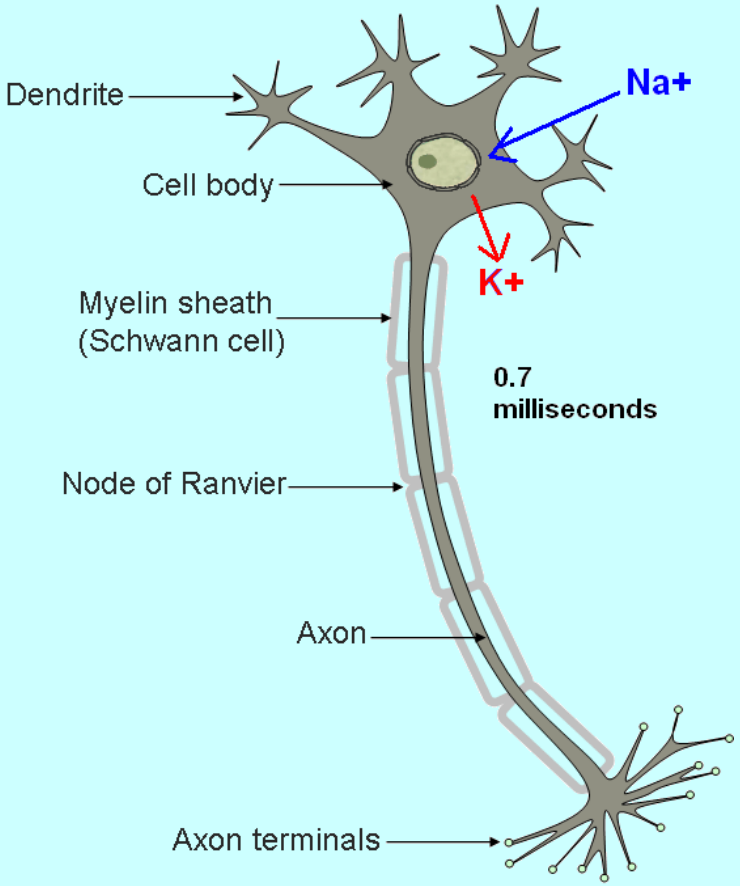
Cell example:
Want to put MORE glucose into mitochondria when there is already glucose in there

Image from: http://www.biologyclass.net/mitochondria.jpg

What if cell needs to move molecules really FAST ?
(can't wait for it to diffuse)

Cell example:

Movement of Na^+ & K^+ ions required to send nerve signals



http://www.steve.gb.com/images/science/neuron.png

We need a WAY to HELP molecules across cell membranes that can't go across by themselves

KINDS OF TRANSPORT

PASSIVE
(NO ENERGY required)

- DIFFUSION
  - Oxygen
  - Carbon Dioxide
- OSMOSIS
  - WATER
- FACILITATED DIFFUSION
  - GLUCOSE
- ION CHANNELS
  - Ca++
  - Na+
  - H+
  - K+

ACTIVE
(requires ENERGY)

- Na+ - K+ PUMP
  - Na+
  - K+
- ENDOCYTOSIS
  - Phagocytosis
    - Large molecules Whole cells
  - Pinocytosis
    - Small molecules Fluids
- EXOCYTOSIS

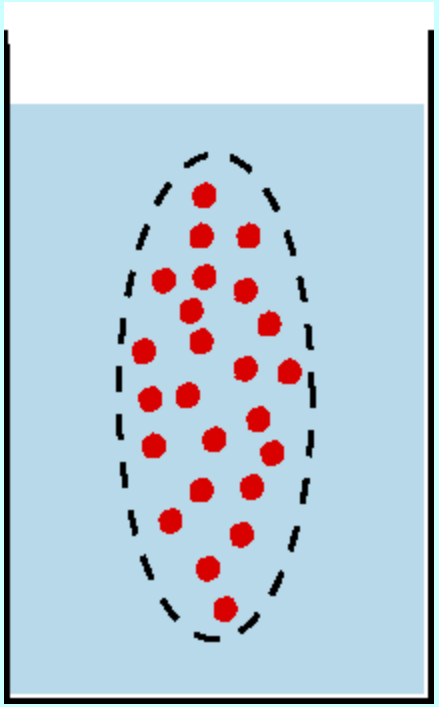
Kidspiration by: Riedell

Kinds of PASSIVE Transport

- Diffusion
- Osmosis

DIFFUSION across a membrane

Happens anytime there is a DIFFERENCE in concentration on one side of the membrane compared to the other



Molecules that move by diffusion across membranes in cells:

OXYGEN

CARBON DIOXIDE

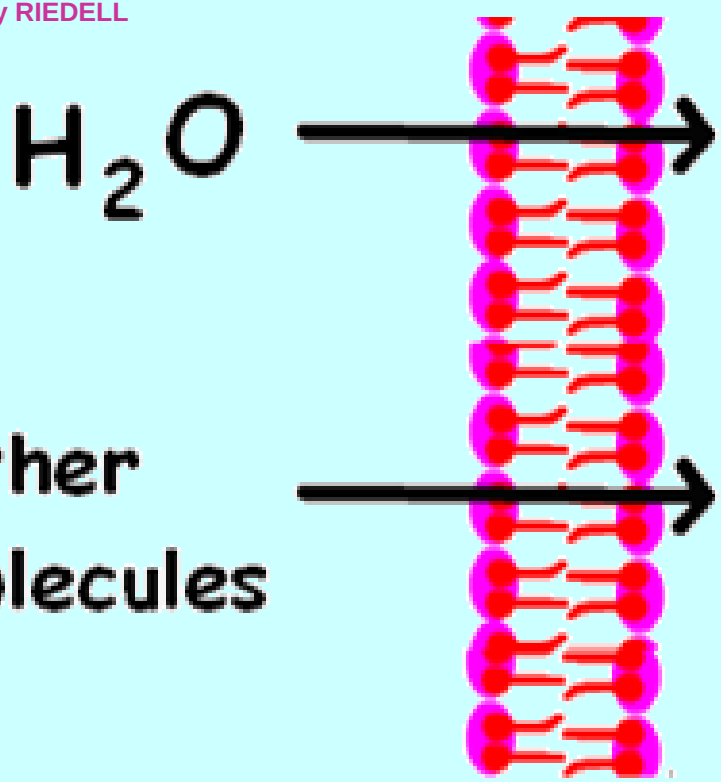
http://www.lionden.com/cell_animations.htm

See diffusion animation

OSMOSIS

= SPECIAL KIND OF DIFFUSION

IMAGE by RIEDELL



Movement of molecules across a Semi-permeable membrane from Higher concentration to lower

KINDS OF TRANSPORT

PASSIVE
(NO ENERGY required)

- DIFFUSION
  - Oxygen
  - Carbon Dioxide
- OSMOSIS
  - WATER
- FACILITATED DIFFUSION
  - GLUCOSE
- ION CHANNELS
  - Ca++
  - Na+
  - H+
  - K+

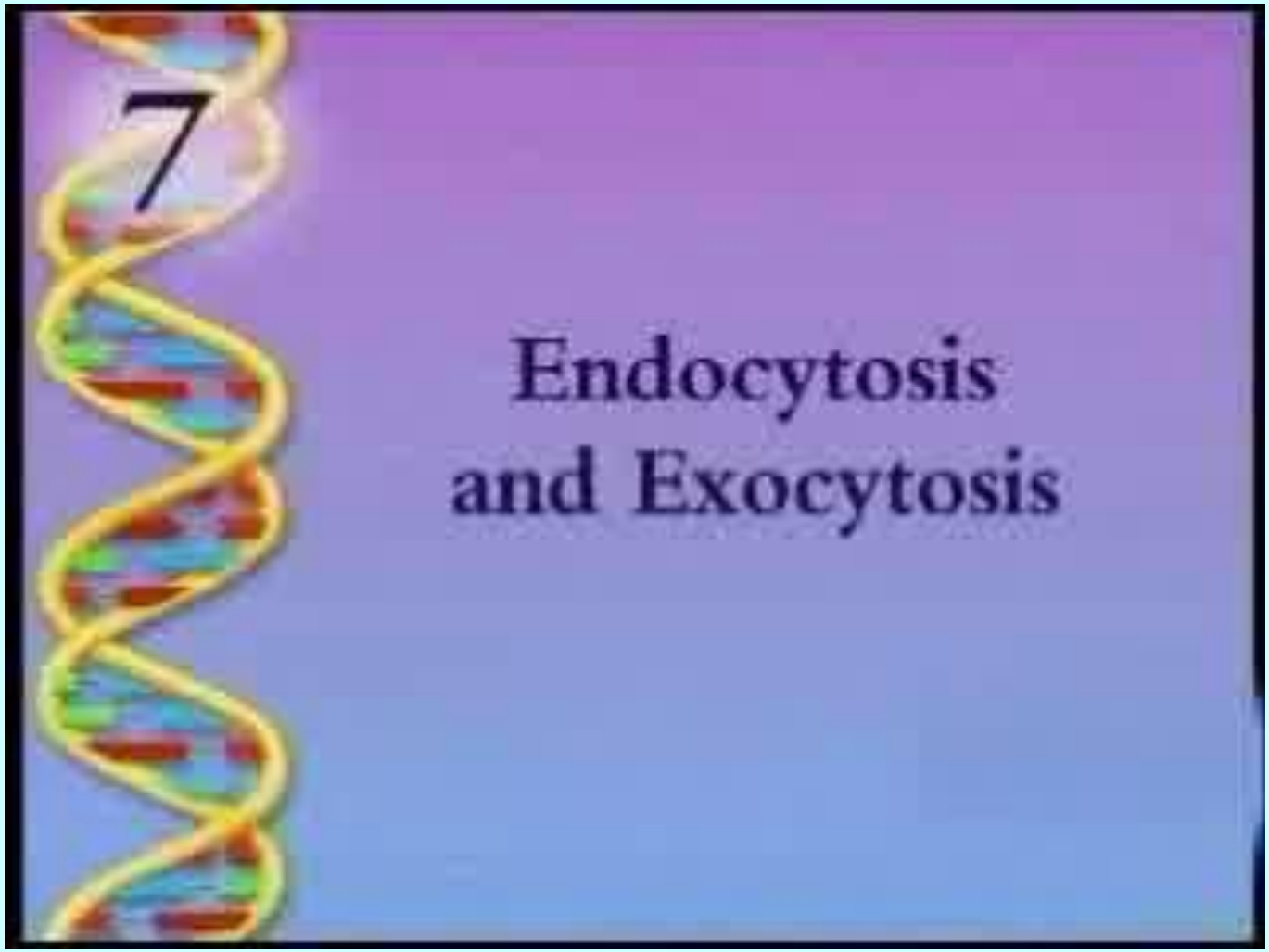
ACTIVE
(requires ENERGY)

- Na+ - K+ PUMP
  - Na+
  - K+
- ENDOCYTOSIS
  - Phagocytosis
    - Large molecules Whole cells
  - Pinocytosis
    - Small molecules Fluids
- EXOCYTOSIS

Kidspiration by: Riedell

Kinds of ACTIVE Transport

- Endocytosis
- Exocytosis



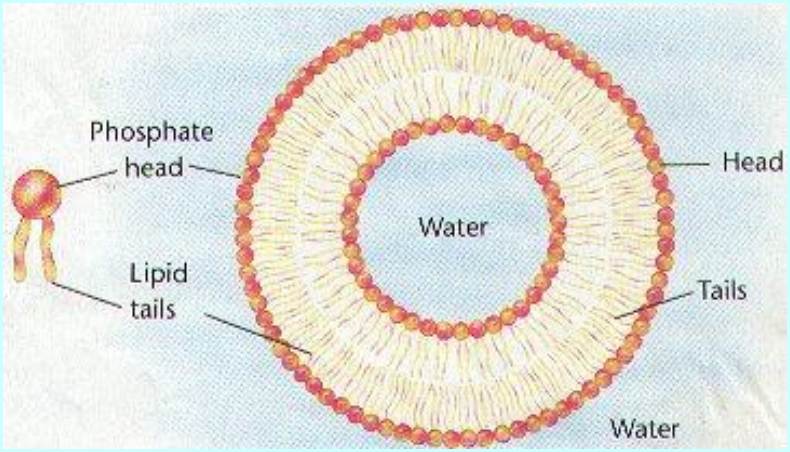
See a video clip about
Endo/exocytosis -7E

ENDOCYTOSIS

Takes substances into cell

- ACTIVE transport
  (requires energy from ATP)

- Uses small membrane sacs called VESICLES to carry substances



http://www.sirinet.net/~jgjohnso/cell.html

2 KINDS of ENDOCYTOSIS

Takes substances into cell

If taking in:

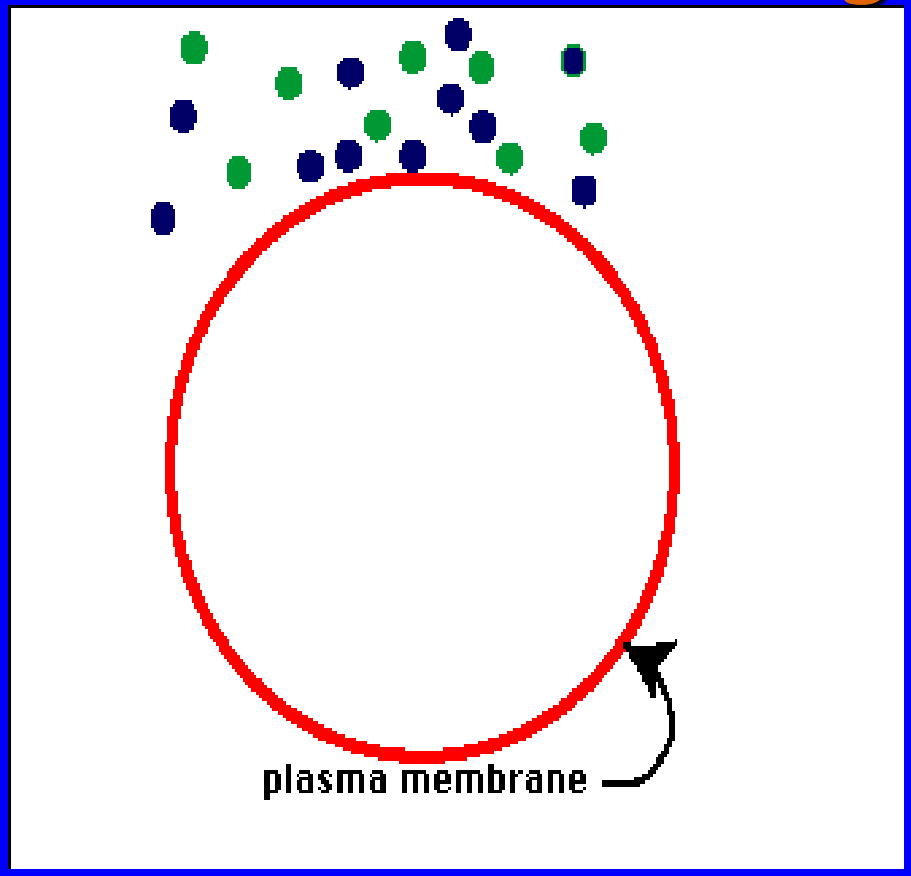
fluid or small molecules = PINOCYTOSIS

large particles or whole cells = PHAGOCYTOSIS

- Examples in cells:
  - one celled organisms eat this way
  - white blood cells get rid of bacteria this way

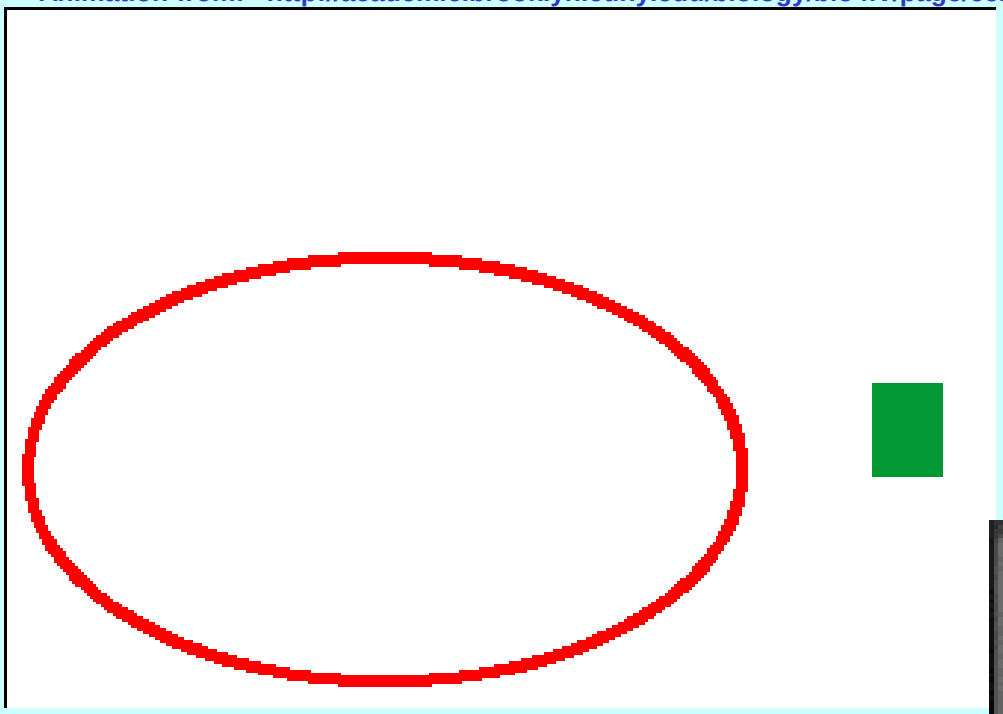
Pinocytosis

- Called "Cell Drinking"



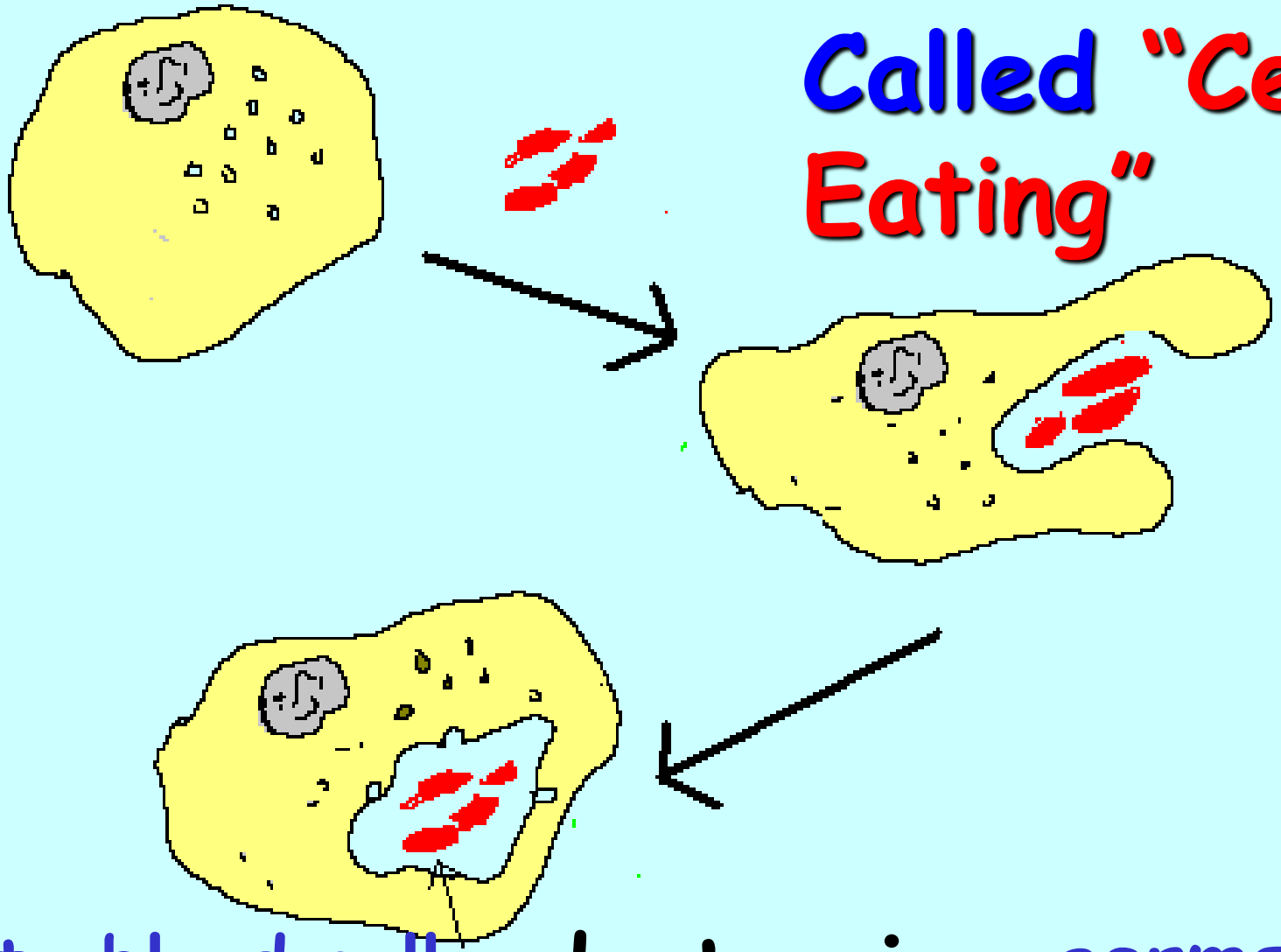
ENDOCYTOSIS

Animation from: http://academic.brooklyn.cuny.edu/biology/bio4fv/page/cell-movement.html



http://www.accs.net/users/kriel/chapter%20nine/

PHAGOCYTOSIS



Called "Cell Eating"

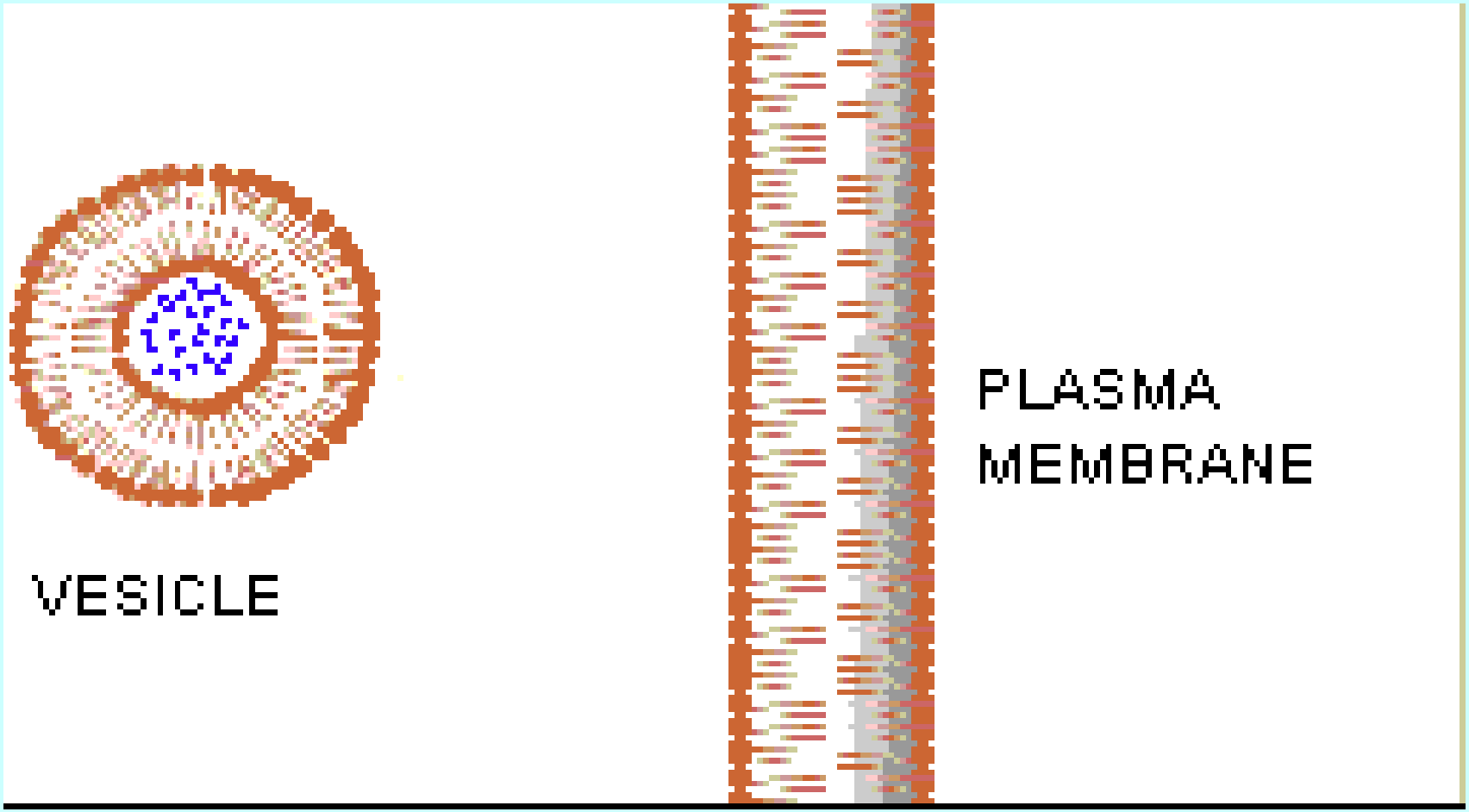
White blood cell destroying germs

EXOCYTOSIS

Substances released outside of cell

- ACTIVE transport (requires energy)
- Substances move in VESICLES
- Examples in cells:
  - GOLGI release packaged proteins this way

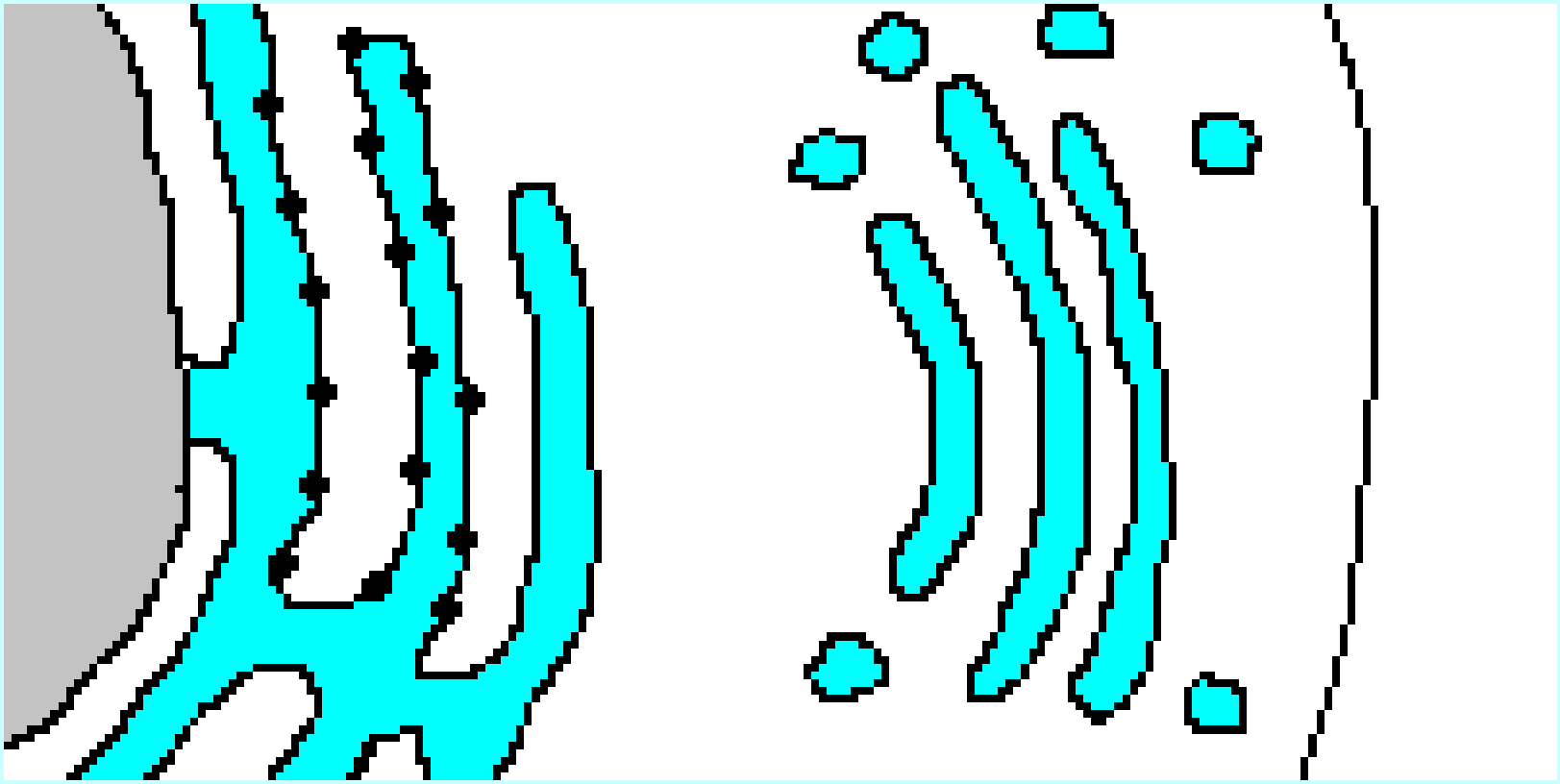
Exocytosis



http://www.emc.maricopa.edu/faculty/farabee/BIOBK/BioBooktransp.html

Video: http://www.southtexascollege.edu/tdehne/BC_ShockwaveAnimations/07SWF-TourOfTheCell/07-16-EndomembraneSystem.swf

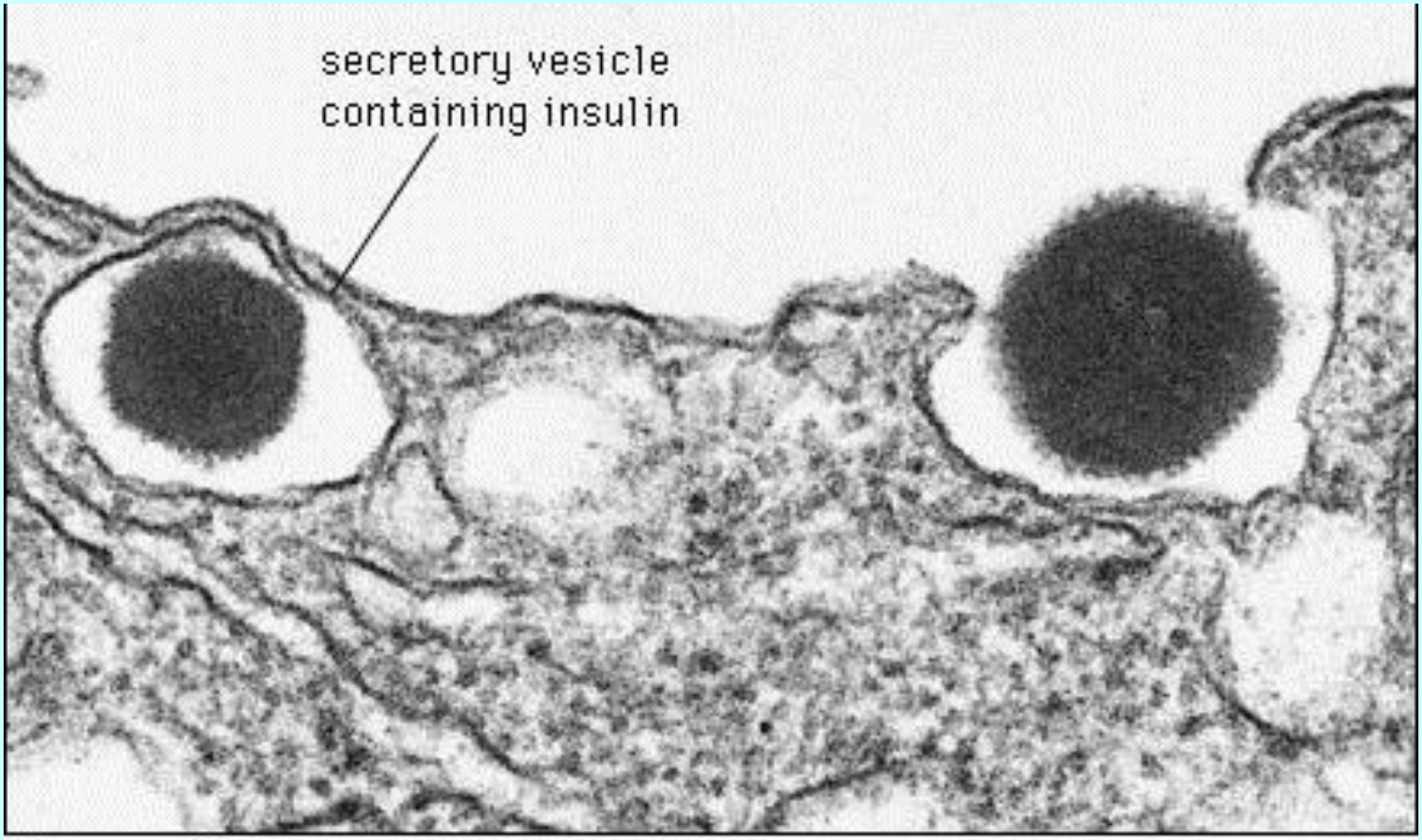
GOLGI BODIES USE EXOCYTOSIS



Animation from: http://www.franklincollege.edu/bioweb/A&Pfiles/week04.html

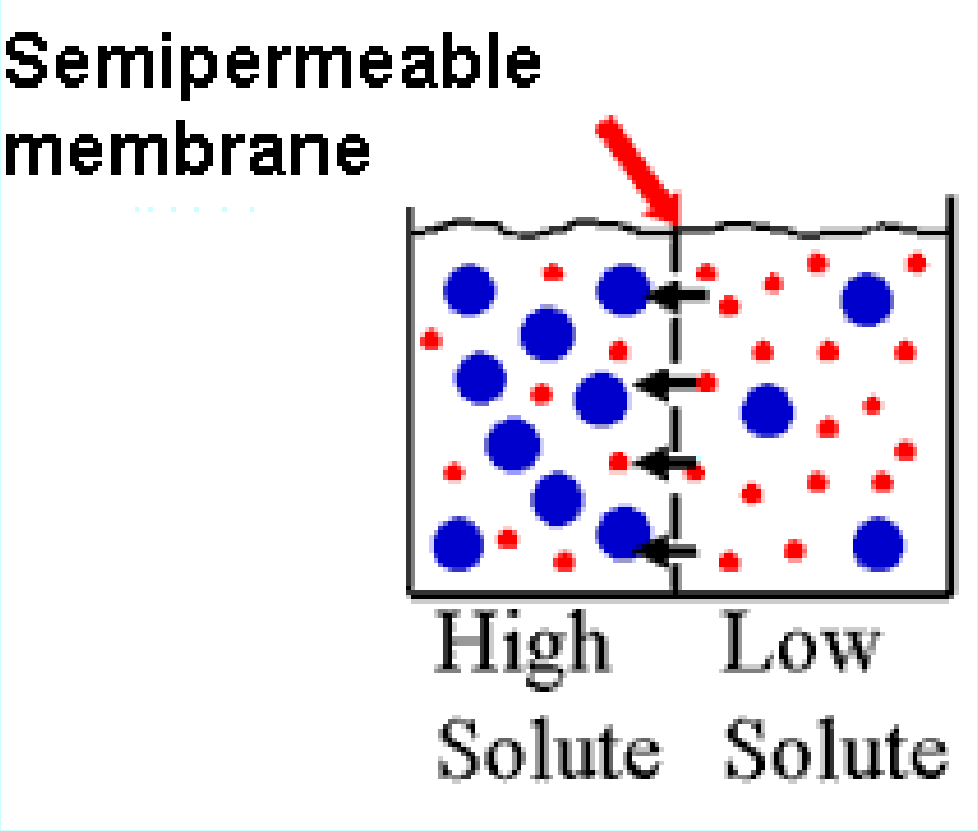
See a Golgi movie

INSULIN being released by pancreas cells using exocytosis



http://fig.cox.miami.edu/~cmallery/255/255ion/fig14x26.jpg

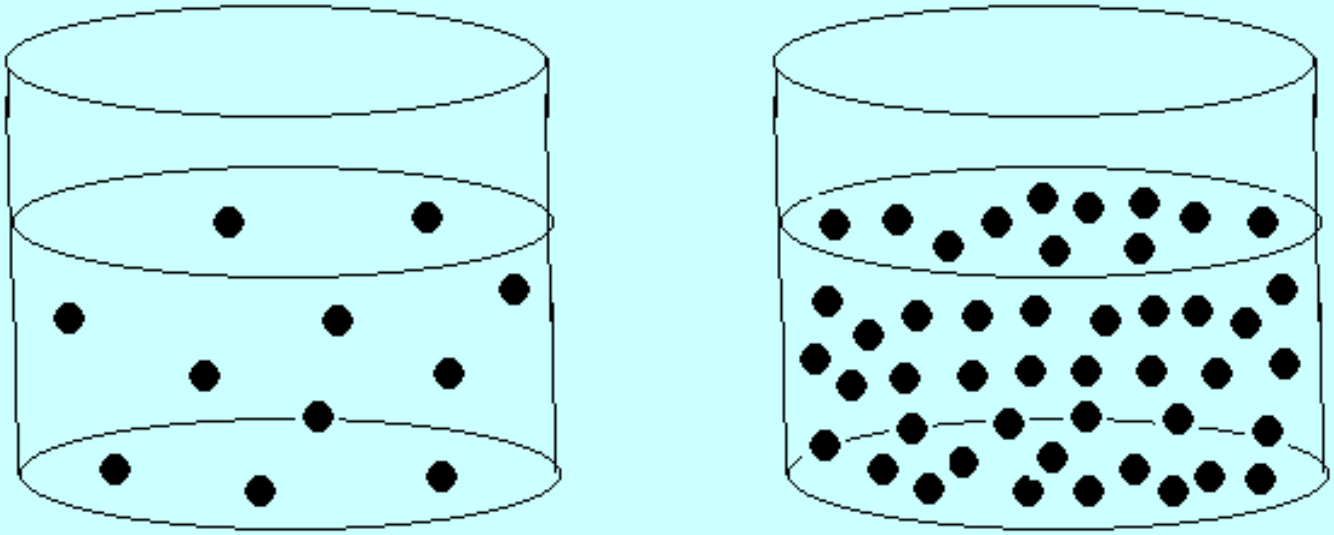
What if there is a difference in concentration but solute molecules can't move across a membrane?



WATER will move until concentration reaches equilibrium

Images by Riedell

CONCENTRATION = mass of a solute in a given volume of solution



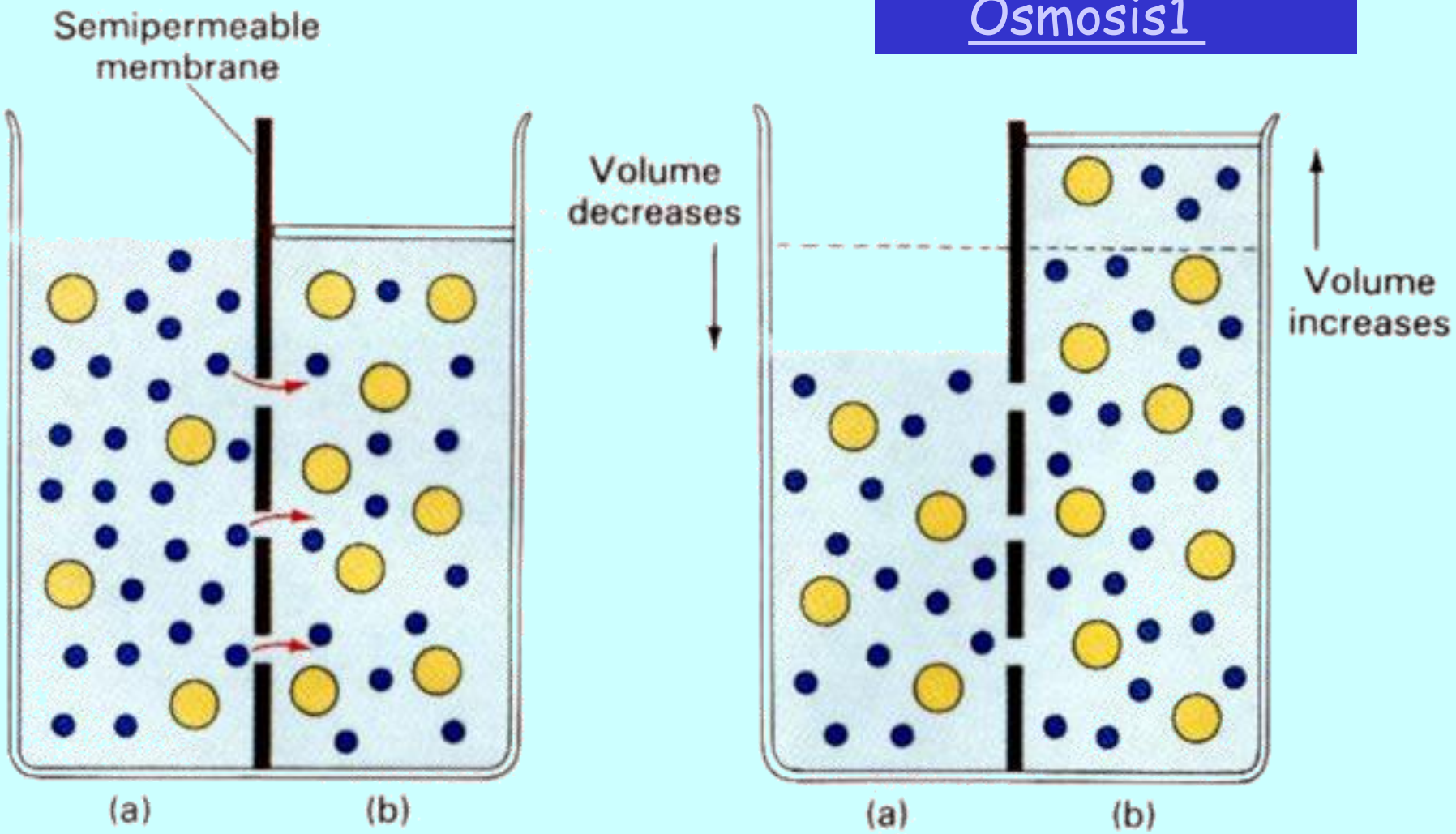
The MORE molecules there are in a given volume the GREATER the concentration

See a video clip about

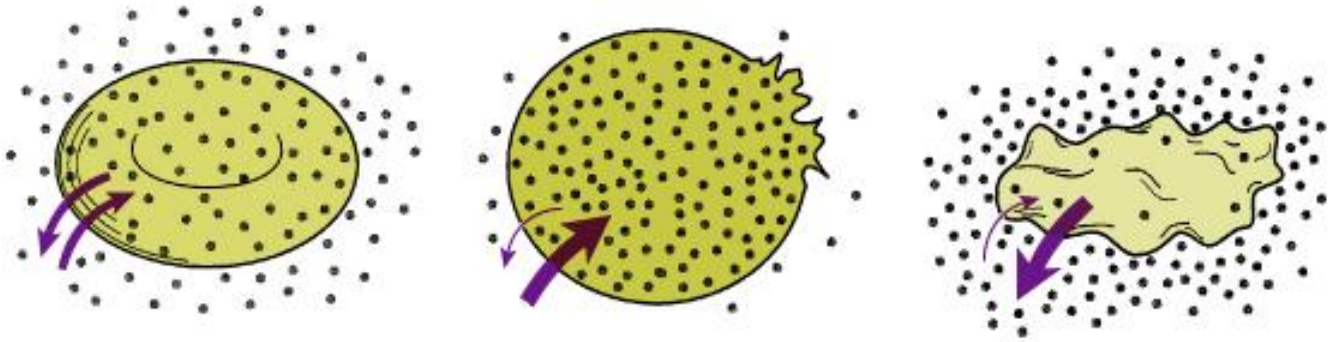
OSMOSIS -7B

Animation: http://www.ouhscphysio.org/humanphys/animations/osmosis1.swf

See an animation
Osmosis1



http://faculty.etsu.edu/currie/images/osmosis1.jpg



Isotonic Solution

↓

NO NET MOVEMENT OF H_2O (equal amounts entering & leaving)

Hypotonic Solution

↓

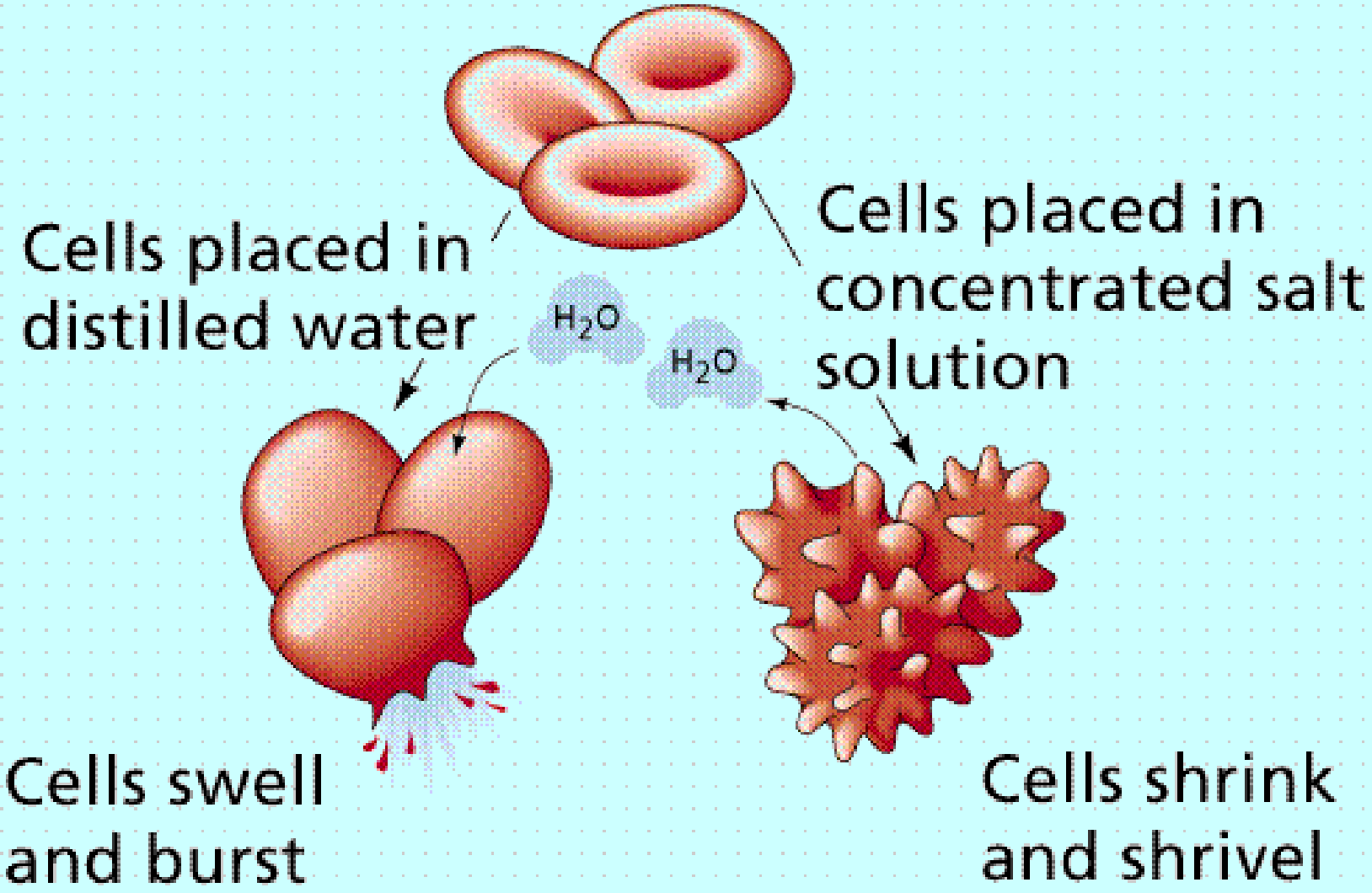
Cell Swells & may burst

Hypertonic Solution

↓

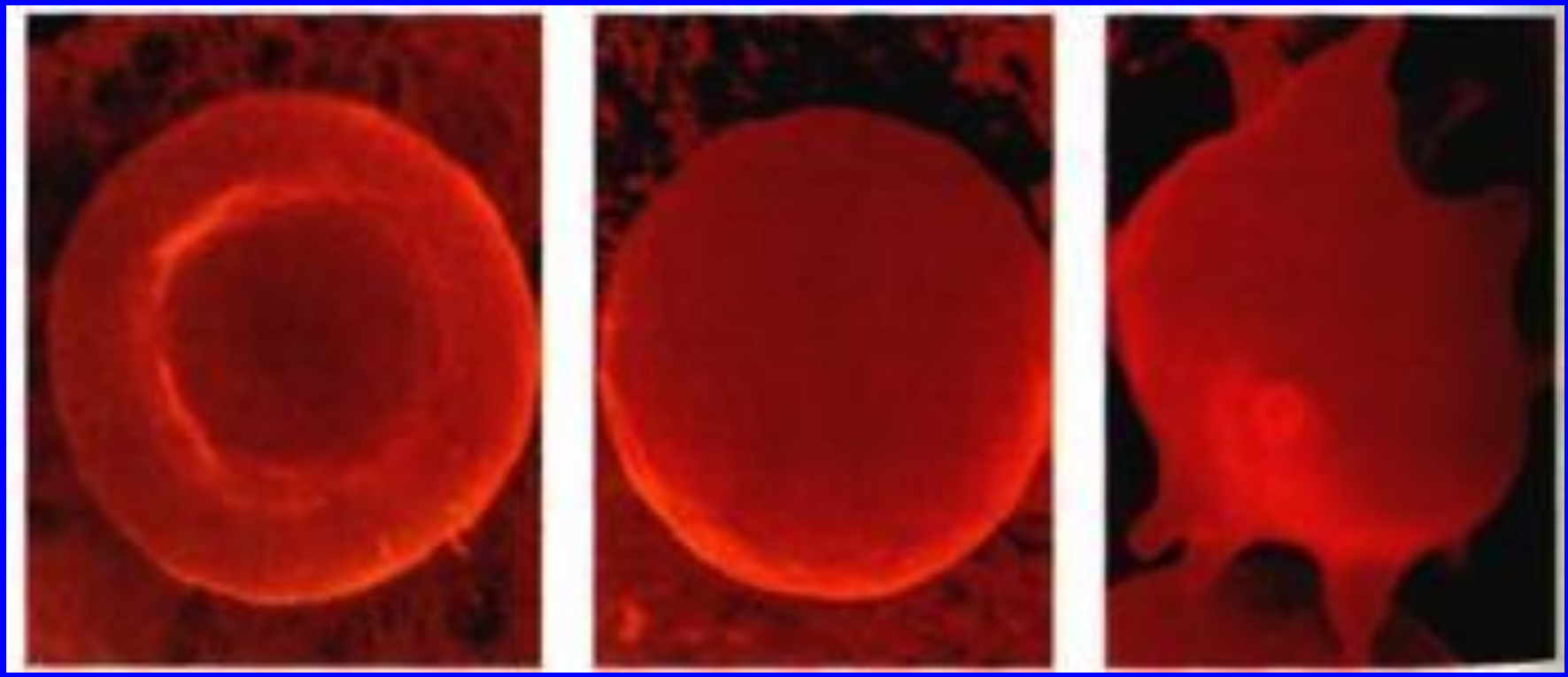
Cell shrivels up

Animal cells



http://www.stchs.org/science/courses/sbioa/metenergy/bloodcells.gif

Osmosis in Red Blood Cells



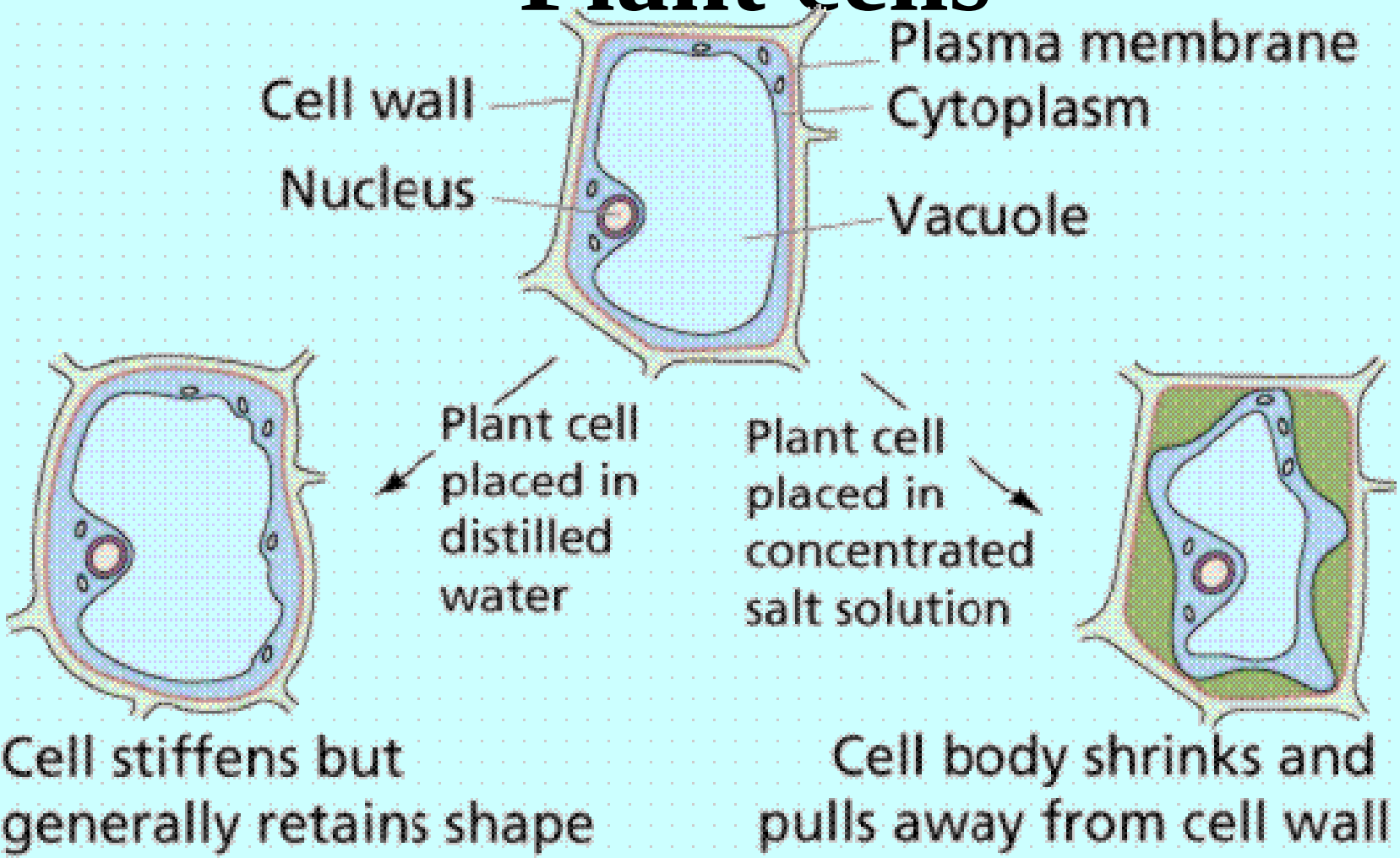
Isotonic

Hypotonic

Hypertonic

http://www.stchs.org/science/courses/sbioa/metenergy/aplantturgor.gif

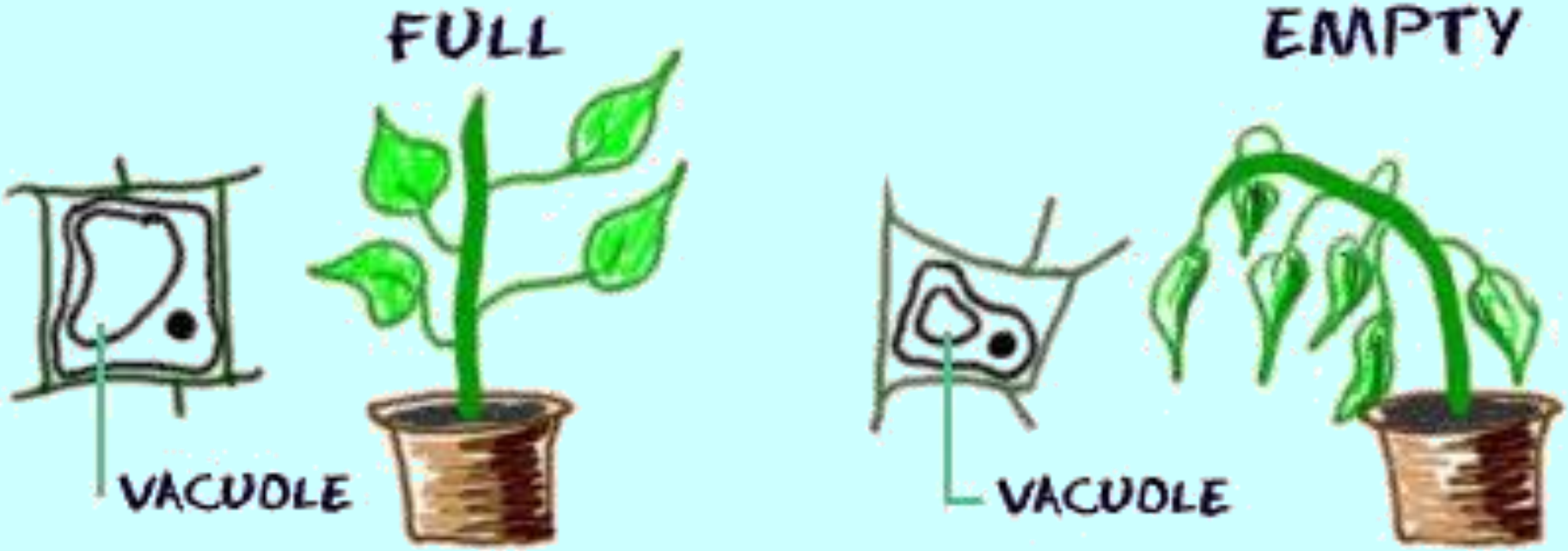
Plant cells



CELL WALL _____ keeps

Plant cells from bursting

VACUOLES store WATER



http://www.biology4kids.com/files/cell_vacuole.html

OSMOTIC PRESSURE =

Pressure exerted by water during osmosis

SO WHAT?

Bath water is

___hypotonic___

compared to you

Sitting in the bathtub causes your fingers and toes to wrinkle up when water

__enters__ your skin cells by osmosis

Grocery stores spray water on their veggies to “plump them up”

http://www.painetworks.com/photos/gt/gt0461.JPG