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UNIVERSITY · CANADA

Tutorial 2
Sections 009/010

TA: Greydon Gilmore

Physiology 2130

Sep 17th, 2019

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Your TA reminding you…

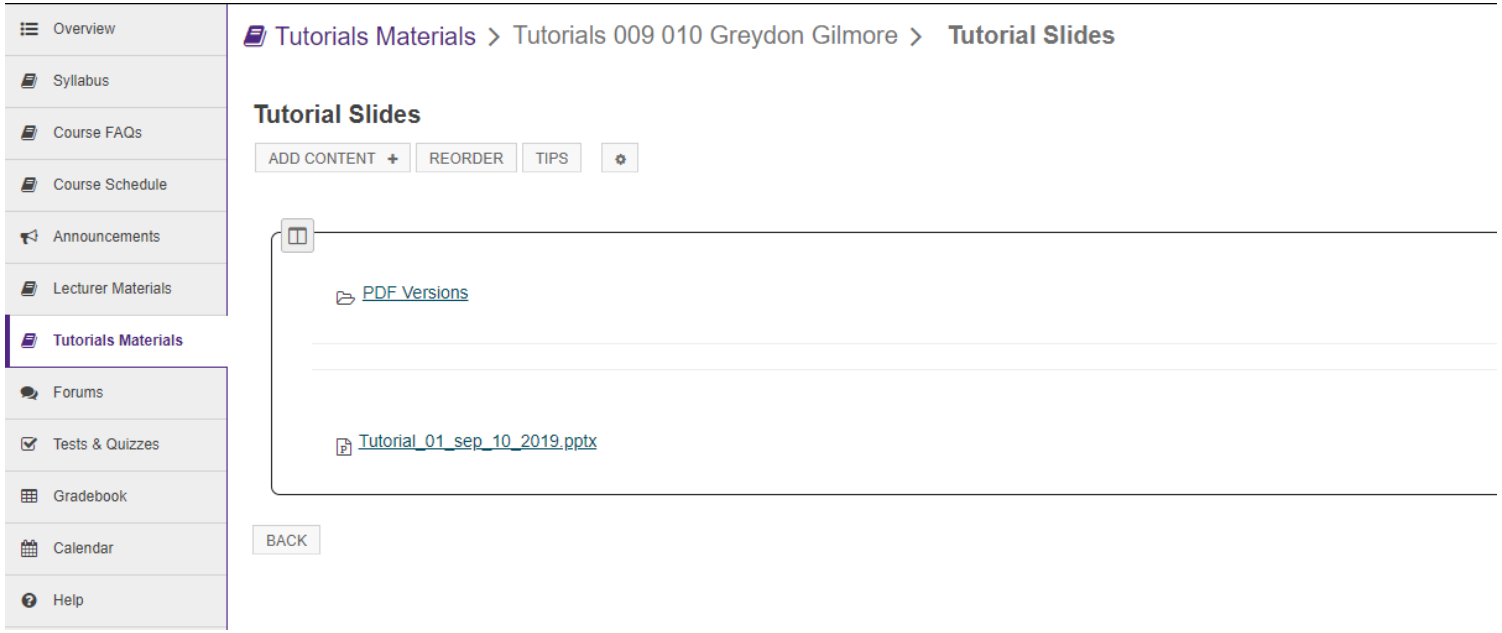
- **1st Peerwise assignment** (1.5%)
  - Post 2 MC questions: due Oct 16th @ midnight
  - Answer 5 MC questions: due Oct 18th @ midnight
- **1st Quiz** (1%)
  - Opens: Oct 21st @ 4pm
  - Closes: Oct 22nd @ 4pm
- **1st Midterm** - Oct 25th @ 6pm-7pm (15%)

Today

- Learning Catalytics Quiz
- Complete Survey on OWL
- Homeostasis and body fluid compartments
- Interaction of cell with environment
- Osmolarity and tonicity

Online Suggestion Box…

- Please post a pdf version of your ppt thank you :)
  - Done!



Student Poll Answers

- Worried about memorization (16 students)
- Too much detail – where to focus (8 students)
- Not a solid background in chemistry (6 students)
  - Very little theoretical chemistry in course
- Cumulative Final Exam (6 students)
  - Will provide more tips later on in the course
- Correct ways to study (5 students)
  - Will provide more tips during first review session
- Pace profs teach at (5 students)
  - Do readings before lecture to be prepared
- Lots of math? (Nope!)
- Excited about everything in course, heard great reviews! (4 students)

Learning Catalytics

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Q1: Glucose is moving across a membrane down a concentration gradient. However, it requires a protein which changes conformation to do so. What is its mode of transport?

A. A gap junction
B. Active transport
C. Facilitated diffusion
D. Movement into a hypertonic solution

Q2: If a protein is hydrophobic, which of the following is a false statement?

A. It would be soluble in the interstitial fluid
B. It would be found contained in the cell membrane
C. It would associate with lipids
D. It could be a gap junction

Q3: A cell signals by a paracrine mechanism. What would be true about this signaling?

A. The chemical will enter the interstitial fluid to signal the cell(s)
B. The chemical is a hormone
C. This chemical will be signaling the very same cell that produced it
D. This chemical will be a transmembrane glycoprotein and directly contact a neighbouring cell

Q4: If the extracellular fluid is hypertonic and the cell membrane is not permeable to solutes (eg. glucose, ions), which one of the following would occur?

A. Osmosis would not occur
B. Water would move out of the cell
C. The fluid inside the cell would have more solutes in it than the outside
D. Ions would move into the cell

Q5: Which of the following would not be an example that results in homeostasis?

A. sweating to restore normal body temperature
B. activation of a negative feedback loop
C. eating a meal when you've been fasting
D. drinking water when you are overhydrated

Online Survey

https://uwo.eu.qualtrics.com/jfe/form/SV_bylQS9AIvAXeIrr

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How To Write A MC Question

- **DO:**
  - Write questions that cover material that was taught in lecture
  - Be clear and brief in the question
  - Try to test understanding, not just simple recall
  - Provide 4 options, indicate 1 option that is correct in PeerWise
  - The other answer options (called distractors) should be incorrect
- **TIPS**
  - Make the distractors as believable as possible
  - Use distractors that are plausable
  - Use words that sound important or have associations with the question

How To Study For Phys

- **Notes:**
  - **Part 1:** before class, review notes from previous class and complete all readings
  - **Part 2:** Focus on prof. listen for key signals (most important, remember that, be sure to include etc.)
    - Use abbreviations in your notes, write quickly, put '?' beside things you want to review later
  - **Part 3:** re-write your notes, answer '?', combine workbook and your notes together

How To Study For Phys

- **Flashcards:**
  - Make them as you study
  - Organize into topics
  - Write words on one side and definitions on other (flip over the card and learn info both ways)
  - Add pictures to your cards (less boring!)
  - One piece of info per card
  - Shuffle them regularly (so you don't just remember which card comes next)
  - https://www.cram.com/

Homeostasis and Body Fluid Compartments

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Which of the following statements about homeostasis is FALSE?

A) Homeostasis is a dynamic process in which the body maintains a relatively constant internal environment.

B) Small ranges in blood pH and glucose are examples of normal fluctuations.

C) The pancreas secreting insulin (a hormone) in order to lower blood sugar levels after a meal is an example of our body maintaining homeostasis.

D) Positive feedback is the main mechanism used to maintain homeostasis.

Which of the following statements about homeostasis is FALSE?

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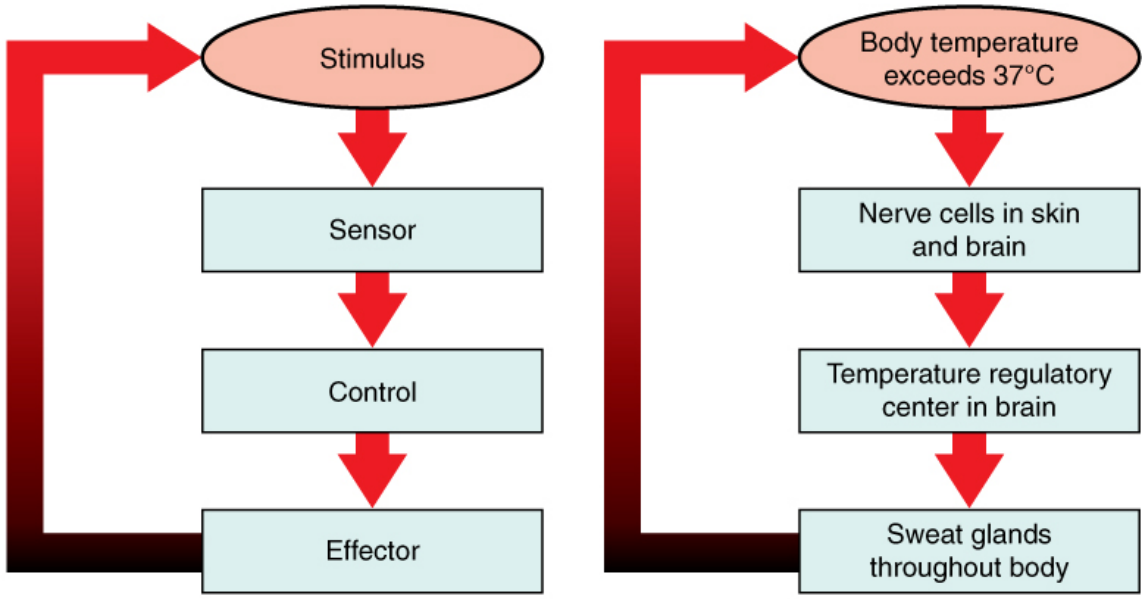
Negative feedback loops

- Monitor and respond to changes in the internal environment in order to maintain homeostasis



(a) Negative feedback loop

(b) Body temperature regulation

An individual suffers from severe hemorrhage (blood loss) following a car accident. They would exhibit:

A) A decrease in intracellular fluid
B) An increase in intracellular fluid
C) A decrease in extracellular fluid
D) An increase in extracellular fluid

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Body Fluids (42L TBW)

- Intracellular fluid (67%) : Fluid inside the cell
  - Cytoplasm
- Extracellular fluid (33%): Fluid outside the cell
  - Interstitial fluid AND plasma (blood)

Interaction of the cell with its environment

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Functions of Membrane Proteins

1. Ion Channels
2. Enzymes – catalyze reactions
3. Receptors
4. Membrane carriers

Mechanisms of Membrane Transport

1. Endo/exocytosis
    - of small molecules
2. Diffusion through lipid bilayer
    - fat-soluble
3. Diffusion through protein channels
    - water soluble
4. Facilitated diffusion
    - large/bulky
5. Active transport
    - Against concentration gradient

Membrane Transport: True/False

- Diffusion is a passive process
  - True
- Molecules move from area of lower concentration to an area of higher concentration
  - False: High concentration to low concentration
- The larger the concentration gradient, the faster the diffusion rate
  - True
- Once molecules reach equilibrium, the diffusion and movement of molecules stop
  - False: Still movement but not overall net movement
- Smaller molecules diffuse slower than larger molecules
  - False: Smaller is faster

Membrane Transport: True/False (page 16)

- The diffusion rate of a molecule is affected by its lipid solubility
  - True
- The hydrophobic core of the cell membrane prevents water soluble molecules from passing through
  - True
- The membrane composition can affect diffusion
  - True
- The larger membrane's surface area, the less molecules can diffuse through
  - False: increase in SA means increase in diffusion
- The thicker the membrane, the harder for the molecules to diffuse through
  - True

Comparison chart (p.20)

	Simple Diffusion	Diffusion	Facilitated Transport	Active Transport
Selective?				
Competitive inhibition?				
Goes with concentration gradient?				
ATP required?				

Comparison chart (p.20)

	Simple Diffusion	Diffusion	Facilitated Transport	Active Transport
Selective?	No (still needs to be small & hydrophobic)			
Competitive inhibition?	No			
Goes with concentration gradient?	Yes			
ATP required?	No			

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Selective?	No (still needs to be small & hydrophobic)	Yes	Yes	Yes
Competitive inhibition?	No	No	Yes	Yes
Goes with concentration gradient?	Yes	Yes	Yes	No
ATP required?	No	No	No	Yes

Osmosis, tonicity and the resting membrane potential

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Osmosis

- Osmosis is the net movement of WATER down its concentration gradient
- It is affected by:
  1) permeability of the membrane
  2) concentration gradient of solutes
  3) pressure gradient across the cell membrane
- Osmolarity is concerned only with the NUMBER OF PARTICLES in solution (NOT size or type/composition)

Tonicity

- Tonicity: the ability of a solution to cause osmosis across biological cell membranes
- Isotonic: same osmolarity as body fluids
- Hypotonic: lower osmolarity than body fluids
- Hypertonic: higher osmolarity than body fluids
- Chemical Gradient: molecules move from high concentration to low concentration
- Electrical Gradient: electrically charged molecules (ions) move to areas of opposite charge

A red blood cell is placed in a 200 mM $BeCl_2$ solution. The cell will _____ because the solution is _____.

A) shrink; hypotonic
B) shrink; hypertonic
C) swell; hypotonic
D) swell; hypertonic

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A) shrink; hypotonic

B) shrink; hypertonic

C) swell; hypotonic

D) swell; hypertonic

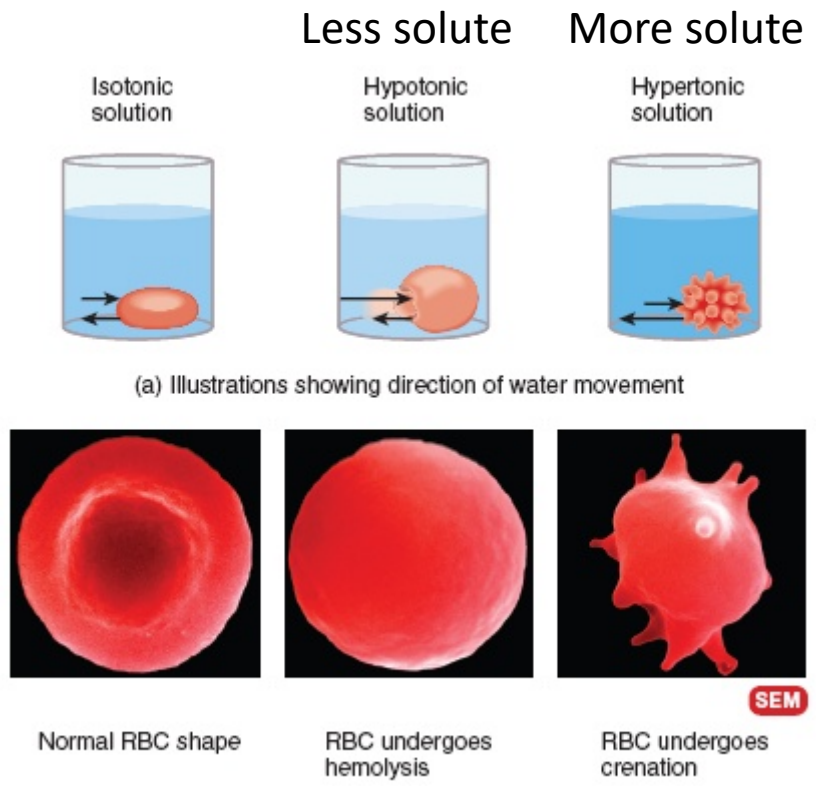
RBC = 300 mOsm

Solution = 200 mM x 3 ions
= 600 mOsm

The solution is hypertonic

Water moves out of cell into the solution, causing the cell to shrink

Tonicity: Review



Compartment Question

Compartments 1 and 2 are separated by a membrane that is permeable to H_2O but not permeable to $CaCl_2$ or glucose. Initially, compartment 1 contains 200 mM of $CaCl_2$ and compartment 2 contains 100 mM of glucose. After osmotic equilibrium is reached, which compartment will have increased in volume?

Compartment 1	Compartment 2
200mM 100 mM $CaCl_2$	100 mM Glucose

Compartment Question

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Compartment 1	Compartment 2
200mM 100 mM $CaCl_2$ **= (200 mM x 1 Ca^{2+}) +** **(200 mM x 2 Cl^-)** **= 600 mOsm**	100 mM Glucose **= 100 mOsm**

Terms you should know

- Active transport: moves molecules against their concentration gradient and requires an outside source of energy
- Extracellular fluid: body fluid compartment found outside of cells
- Facilitated diffusion: a mediated-transport process that moves molecules from higher to lower concentrations across a membrane by means of a transporter until the two concentrations become equal.
- Gap junctions: allow chemical and electrical signals to pass directly from cell to cell
- Glycoprotein: protein with sugar groups attached
- Homeostasis: the maintenance of a relatively constant internal environment
- Hydrophobic: molecules that do not dissolve easily in water
- Hypertonic: a fluid bathing a cell that would cause a cell to shrink
- Interstitial fluid: extracellular fluid surrounding cells, excludes plasma
- Paracrine: a chemical that is secreted and communicates locally with a neighbouring cell
- Plasma: the liquid portion of blood, a component of extracellular fluid

Next Tutorial (Sep 24th)

- The action potential!

What Questions Do You Have?

You can ask in the **Owl forums** as well!

Also anonymously ask questions in the **online dropbox**!!

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