

This Module for Interactive Teaching (MINT) may be found online at  
<https://ivv.rit.edu/wd-mint.php>

### **Osmosis**

- Osmosis is a specialized diffusion resulting from the presence of a semi-permeable membrane

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### **MINT Learning Objectives**

- Make a line graph demonstrating the change in volume over time due to osmosis
- Correctly predict the direction of solute and solvent movement across a semi-permeable membrane
- Explain that molecular motion is random, but overall movement goes in a particular direction due to entropy
- Explain that motion is continual in all directions, before and after equilibrium is reached
- Correlate concept of osmosis to biological function (such as transpiration, kidney function)
- Problem-solving in the lab: Constructing a hypothesis and testing it by setting up an experiment, collecting data, graphing it, and analyzing the graph to draw conclusions.


### **National Standards Alignments:**

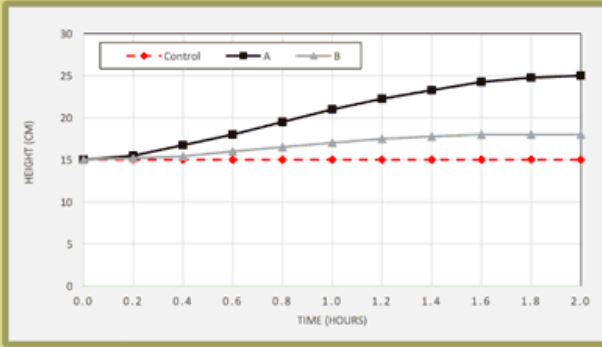
- Vision and Change Core Concepts and Competencies (<http://visionandchange.org>)
  - Core Concept:
    - Structure and Function: Basic units of structure define the function of all living things.
  - Core Competencies:
    - Ability to apply process of science: Biology is evidence based and grounded in the formal practices of observation, experimentation, and hypothesis testing.
- Biocore Guide (Brownell et al., <https://doi.org/10.1187/cbe.13-12-0233>)
  - Structure and Function: The structure of a cell--its shape, membrane, organelles, cytoskeleton, and polarity--impacts its function.

- Process of Science Skills, Pelaez, N, *et al.* "The Basic Competencies of Biological Experimentation: Concept-Skill Statements" (2017). PIBERG Instructional Innovation Materials. Paper 4. <http://docs.lib.purdue.edu/pibergiim/4>
  - Hypothesis generation & testing
  - Identification of proper controls
  - Comparison requires holding all but the queried variable constant
  - Transfer of knowledge from other subjects/classes
  - Visual representations used for interpretation of data

### Interactive Video Vignette Information

WHY DIDN'T YOU WRITE THAT DOWN?
INTERACTIVE VIDEO VIGNETTES



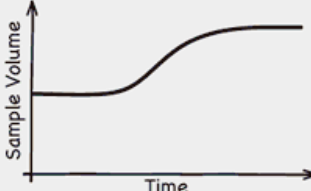


Time (Hours)	Control (cm)	A (cm)	B (cm)
0.0	15	15	15
0.2	15	16	16
0.4	15	17	17
0.6	15	18	17
0.8	15	19	17
1.0	15	20	17
1.2	15	21	17
1.4	15	22	17
1.6	15	23	17
1.8	15	24	17
2.0	15	25	17

When asked "If we put the media in a dialysis membrane bag and submerge it in water, what will happen?" you answered,

"D. Water will enter the bag, making it larger."

When asked what the graph would look like, you chose: A.



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**IVV Title:** *Why didn't you write that down?*

**IVV URL for students:** <https://ivv.rit.edu/WD/2/>

Copy the URL to the Clipboard. Either paste it into an email to your students, or use it to create a link in your course management system.

**IVV description:**

Students forgot to write concentrations of sugar on bottles of media needed for a laboratory experiment. Unable to make more media, the students are able to utilize equipment in the laboratory and set up a diffusion experiment to determine which bottle contains which solution.

## **Novice Ideas and IVV Learning Goals**

### Novice ideas:

- Solute rather than water is the basis of osmosis
- Failure to recognize water as having relative concentration
- Sugar concentration could be measured with a spectrophotometer
- A solution can be separated by centrifugation
- Sugar changes the pH of a solution
- Water moves because it is attracted to the solute

### Ideas addressed in the IVV:

- Osmosis is movement of water across a semi-permeable membrane
- Osmosis is a form of diffusion, which means a substance moving down its concentration gradient (in this case of water, not solute)
- Osmosis can be observed using a dialysis membrane, which allows passage of water but not solute: volume will increase on the higher solute concentration side (lower relative water concentration side) as water moves in
- A solute cannot be separated from its solvent by centrifugation
- Sugar does not affect the pH of an aqueous solution
- Sugar does not absorb light (cannot be detected with a spectrophotometer)
- Water can be represented as particles (molecules) that have concentration

## **Recommended In-class Curricular Material**

Please see the MINT FAQ (<https://ivv.rit.edu/FAQ.php>) for general information on the use of MINTs and IVVs with your class. The following curricular materials are provided as examples of resources that may be used in class to further student learning towards IVV and MINT learning objectives.

- Exploratorium Teacher Institute. Naked Egg. <https://www.exploratorium.edu/snacks/naked-egg>
- El Paso Community College Biology at Transmountain, Diffusion and Osmosis lab, [http://www.epcc.edu/Biology/Documents/Diffusion and Osmosis/Osmosis and Diffusion Lab.pdf](http://www.epcc.edu/Biology/Documents/Diffusion%20and%20Osmosis/Osmosis%20and%20Diffusion%20Lab.pdf)
- Transpiration- Water Movement through plants – Introduction. Interactive Animation. <http://croptechnology.unl.edu/pages/informationmodule.php?%20id=informationmodule=1092853841&topicorder=2&maxto=8&mintto=1>

## **Assessment Question Information:**

The research team has developed multiple select questions for assessing IVV effectiveness. Please contact the research team (<https://ivv.rit.edu/about.php>) if you are interested in assessing IVV use in your course.

## **Acknowledgement**

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