

Science Strand 3: Characteristic and Interactions of Living Organisms	
CLE: 3.2 Living organisms carry out life processes in order to survive.	
Health Profession:	Physician
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Reference: Science of eggs: Experimenting with naked eggs activity. Retrieved on January 1, 2008, from http://www.exploratorium.edu/cooking/eggs/activity-nakedexperiment.html	
Objectives: At the completion of this presentation the high school student will be able to: <ol style="list-style-type: none"> 1. Explain how water moves across a semi-permeable membrane from an area of lower solute concentration to an area of higher solute concentration in an attempt to equalize and maintain homeostasis within the human body. 2. Demonstrate the concept of osmosis by setting up an experiment and/or an activity. 3. Identify the importance of this information as it relates to physicians. 	
Background Summary of Information as Related to Physicians and CLE: <p>The human body is approximately 60% water; therefore, any degree of dehydration can severely impact the body's natural balance. In the below scenario, Trevor is experiencing a relatively severe case of dehydration. Dehydration can occur from a lack of fluid intake, excessive fluid loss or a combination of both. Since Trevor is trying to lose weight for wrestling, the physician must include Trevor's recent behaviors and activities that could have led to his dehydration such as crash diets, withholding fluids, and any use of diuretics and/or laxatives.</p> <p>Trevor is experiencing all the signs of dehydration such as fatigue, sweating, cool and pale skin. He also experienced loss of consciousness which occurs when the brain cells lose water.</p> <p>During dehydration, a patient will exhibit increased thirst, increased but weak heart rate, low blood pressure due to low blood volume and laboratory work will have an increased hematocrit (% of red blood cells in plasma) indicating a higher proportion of red blood cells compared to water in the blood. A patient may also lose skin elasticity and have decreased urine output. These are all very critical assessments to accurately diagnosis Trevor's condition.</p> <p>Before leaving Trevor, Dr. Smith must explain to him what dehydration is while giving him healthier ways to achieve his weight goals.</p> <p>CLE 3.2 addresses the fact that living organisms carry out life processes in order to survive. The human body is composed of millions of living cells with each having a particular structure and function. The cell membrane is made of phospholipids, protein, and cholesterol which forms the outer boundary of the cell and selectively</p>	

allows substances to enter or leave the cell. In osmosis, water moves from an area of lower concentration of solutes to an area of higher concentration of solutes in an attempt to equalize the concentration. Essentially, this is what happens to our cells during dehydration. The water in our cells moves across the cell membranes to keep homeostasis.

Scenario:

Trevor, a 16-year old boy, is running with a buddy trying to make weight for wrestling. He suddenly feels tired, nauseated and is experiencing leg cramps. He is sweating profusely and is pale but he continues running. Trevor collapses and his buddy calls "911" for help. The young man is rushed to the nearest hospital where you, Dr. Smith, must assess his condition STAT! Trevor is now awake but is very weak, cool and pale.

- **What is your first response as to what could be wrong? Explain why.**
(The correct response should be dehydration. Nausea, fatigue, exhaustion, profuse sweating, cool and pale extremities are all indicative of dehydration.)
- **What kinds of testing would you order?**
(There are many clinical tests for dehydration. The first and most common are done by blood and urine sampling. The physician may also test the skin for hydration by pulling upward on the skin and seeing how quickly it returns to normal or if it stays in the pinched position.)
- **What further information from this patient might be beneficial to accurately diagnose this patient?**
(Other important information from this patient might include use of any laxatives or diuretics to increase weight loss, how much has he ate or had to drink and in what time period, is he on a crash diet, and is he taking any other medications or drugs. The physician might even consider the time of year and outdoor humidity and temperature factors. Does this patient have any other health problems that could exacerbate the problems such as a heart or kidney disorder?)
- **As a physician, teaching your patients about his/her condition is imperative. How would you explain to Trevor what physically happens to the body's cells with (dehydration) and what would you teach as preventative measures for the future?**
(The human body is approximately 60% water; therefore, any degree of dehydration can severely impact the body's natural balance. Dehydration can occur from a lack of fluid intake, excessive fluid loss or a combination of both. In the event that the body is not adequately hydrated, water leaves the cells and the cells shrink while the body tries to compensate for the fluid loss. The physician must teach the patient the importance of keeping the body's cells hydrated to maintain homeostasis and cellular function. The physician should

recommend to the patient that there are healthy ways to lose weight and discuss those options with the patient. It may need to be recommended that the wrestler consider a heavier weight class.)

Activities:

Role Play:

Choose three students. One student will be Dr. Smith (the physician), another student will role play as Trevor and another student will play the part of Trevor's buddy. The remainder of the class will split up into two groups. After viewing the scenario, they must work as a team while applying the knowledge they already know while using critical thinking skills to acquire new learning. Each group will take a turn discussing the above proposed questions.

Experiment:

Science of eggs: Experimenting with naked eggs activity. Retrieved on January 1, 2008, from <http://www.exploratorium.edu/cooking/eggs/activity-nakedexperiment.html>. See attached print out for experiment details.

Needed Supplies for first step (making the naked egg):

- 1 dozen eggs (uncooked)
- Vinegar (white)
- 12 glass containers with a cover for the container
- Approximately 48 hours prep time

Needed Supplies for second step (experimenting with the naked egg):

- 1 dozen shell less eggs (uncooked)
- Corn Syrup
- Water
- 12 glass containers with a cover for the container (you can use the same containers as above)
- Approximately 24 hours prep time

First Step: Place the egg in enough vinegar to cover the egg. Cover and refrigerate for 24 hours. Carefully dump out old vinegar and replace with new vinegar for another 24 hours. This removes the shell from the egg and leaves a translucent membrane.

Second Step: Remove shell less egg from the vinegar and place 6 of the shell less eggs in corn syrup for 24 hours and the remaining 6 shell less eggs in tap water to show the difference and what happens during osmosis.

Explain that the egg represents one cell of our body and the corn syrup (glucose) and water represent different solutes in our body. Approximately 3 days later (or set up in advance), the egg in the corn syrup shrivels and the egg in the water plumps due to osmosis (water moves from an area of lower concentration of solutes to an area of higher concentration of solutes in an attempt to equalize the concentration).

Essentially, this is what happens to our cells during dehydration. The water in our cells move across the cell membranes to keep homeostasis.

Several Missouri Universities offer medical degrees for physicians (M.D. and D.O.):

<http://www.kchealthcareers.com/asp/Schools/Medical.asp>

<http://www.nwmoahec.org>

<http://www.healthresource.org>

- University of Missouri-Kansas City (M.D.) 816-235-1700
- University of Kansas School of Medicine (M.D.)
913-588-5200 (This is a Kansas City, Ks. University)
- University of Missouri – Columbia (M.D.) 573-882-6333 or 1-800-856-2181
- Saint Louis University (M.D.) (314) 977-2222
- Washington University in St. Louis, Mo. (M.D.) 314-935-6400
- A.T. Still University, Kirksville College of Osteopathic Medicine (D.O.)
660.626.2121
- Kansas City University of Medicine & Biosciences (D.O.) 800-234-4847

If interested in a curriculum sample, please contact the college at the above listed number. They can also advise on any specific admission requirements particular to that college.

Academic Requirements: Students seeking a medical degree usually obtain a bachelor's degree and must submit Medical College Admission Test (MCAT) scores, along with transcripts from undergraduate institutions. Competition is fierce for admission and the bachelor's degree of a four-year curriculum is followed by a four year professional medical degree program then a three to eight year residency, depending on the physician's area of specialization. Physicians are licensed by the state after passing an examination.

Medical Doctor (M.D.)

Doctor of Osteopath (D.O.)