|  |  |
| --- | --- |
| **Title of Unit** | Human Cardiovascular System  |
| **Date and** **Location of SI** | Gulf Coast Summer Institute, LSU, Baton Rouge, LA Summer 2013  |
| **Unit Developers & Contact Information** | *Melody Danley, University of Kentucky, mlda227@uky.edy**Mary Miller, Baton Rouge Community College, millerm2@mybrcc.edu**Russell Nolan, Baton Rouge Community College, nolanr@mybrcc.edu**Laura Laynes, Baton Rouge Community College, laynesl@mybrcc.edu**Heather Ketchum, University of Oklahoma, heather.r.ketchum-1@ou.edu**Ali Azghani, University of Texas at Tyler, Tyler, Texas aazghani@uttyler.edu*  |
| **Context** | *This unit is designed for sophomore-level students with prior introductory biology courses already completed.* *How long is unit?* This unit (learning goal number 2 below) is 3 hours is duration. *When will the unit be used in the course?* This unit will be used within the Cardiovascular System Unit of the course, usually mid-semester. |
| **Abstract**(< 200 words) | Three learning goals, along with the learning outcomes, were developed to address the Cardiovascular System Theme. Goal 2: Students will have basic knowledge of the structures and functions of the blood and hemodynamics was addressed during this activity. Four learning outcomes were developed. Learning outcome 2: Students will be able to describe the flow of blood through the heart and to all parts of the body was addressed. A strip sequence was developed to outline the flow of blood through the heart. Formative and summative assessments were developed to measure students understanding of the content. The formative assessment consisted of clicker questions and a summative assessment was described as a follow up exam question.  |
| **Rationale** | ***How did the idea for the unit arise?*** *The cardiovascular system is a topic covered in both lower and upper level undergraduate physiology and anatomy courses (large audience). Thus, it was a teachable unit our group members (with a broad range of backgrounds and interests) had in common.* ***Why was this topic chosen?****It is a topic with an abundance of opportunities to use active learning. It is also a topic with many layers of complexity that students often struggle learning. It has an abundance of student misconceptions. This unit also has direct applications to real life scenarios that students would find interesting.* ***Some Common Misconceptions:***1. Incorrect = Electrocardiograms are a direct measure of the contractile (tension development) of the heart. Correct = ECGs measure the electrical activity of the heart; the contractile events are implied via the electrical events).
2. Incorrect = Higher absolute pressures are more important than pressure gradients to determine blood flow. Correct = higher pressure gradients result in greater flow (all other variables held constant), higher absolute pressures may not result in higher flow especially if the gradient remains unchanged.
3. Incorrect = The entire volume of blood is ejected from the heart each time it contracts. Correct = The volume of blood that has entered the heart is ejected from the heart, but it is not the entire volume of blood in the heart. Under normal conditions, there is a reserve volume of blood in the heart at the end of contraction.
4. Incorrect = All valves in the heart can be open simultaneously.
5. Incorrect = Deoxygenated blood is blue. Correct = Deoxygenated blood is darker shades of red. Oxygenated blood is brighter shades of red.
 |
| **Learning Goals:** what students will know, understand, and be able to do; includes content knowledge, attitudes, & skills | **Students will have basic knowledge of the structures and functions of the:** 1. **Blood Vessels**
2. **Blood and Hemodynamics**
3. **Heart**
 |
| **Learning Outcomes:** Student behaviors or performances that will indicate they have successfully accomplished the goals | 1a. Students can recognize the five types of blood vessels.1b. Students can identify how blood vessel structure affects transport of materials to/from the blood.1c. Students can identify how blood vessel structure affects flow of blood through the vessels.1d. Students analyze data and use it to assess type of blood vessel damage and potential consequences.2a. Students will be able to state the components of blood.2b. Students will be able to describe the flow of blood through the heart and to all parts of the body.2c. Students will evaluate the role of blood as it relates to temperature regulation.2d. Students will identify medical disorders of blood as it relates to homeostasis.3a. List and identify the chambers, major vessels, and valves of the heart.3b. Compare and contrast cardiac muscle from skeletal muscle.3c. Explain the anatomical and physiological basis for autoregulation.3d. Infer how environmental factors will affect heart rate.  |

|  |
| --- |
| **Incorporation of Scientific Teaching Themes** |
| **Active Learning** | **Assessment** | **Diversity** |
| How students will engage actively in learning the concepts | How teachers will measure learning; how students will self-evaluate learning | How the unit is designed to include participants with a variety of experiences, abilities, and characteristics |
| *Activities outside of class:*1. Pre-reading assignment (website, video, etc.)
2. Cardiac system coloring worksheet of blood flow through the cardiac cycle including anatomical structures (before or after).

*Activities in class:*For each learning objective covered during the class, it would include both formative (during the formation of knowledge) and summative (after the formation of knowledge) assessments, as well as a series of mini-lectures and active learning activities. For example, one sequences may include:1. Pre-lecture Formative Assessment: Clicker Question
2. Identification of learning objectives for unit
3. Strip sequence of blood flow through the heart (cardiovascular system), combined with intermittent and selective revealing of correct placement of strips.
4. Peer-review of class work
5. Discussion of active learning results
6. Post-lecture clicker question
7. Summary of how activity aligns with learning objectives for unit

*Activities during tidbit*:1. Same as the individual sequence identified above.
 | *Pre-assessments:*1. Pre- or post- clicker question.

*Post-tidbit assessments:* Success of meeting the learning objective can be identified by asking students to identify structures and functions on diagrams of structures (lower level Bloom). Higher level Bloom’s taxonomy questions can include questions directed at the functional effects of a variety of structural defects with the heart. This could include the effects on the body if an individual is missing parts of the heart or if blood oxygen levels in the body drop. | 1. Content is delivered in a variety of formats (visual, hand-outs, orally, and audio-visual videos).
2. Content has been reviewed/revised to minimize use of slang, culturally specific analogies (not all students may understand), and negative stereotyping.
3. Groups are formed randomly to encourage more diverse interactions and discussions.
 |

**Sample** Presentation Plan (general schedule with approximate timing for unit)

|  |
| --- |
| **Session 1** |
| **Time (min)** | Learning Outcome(s) | Activity/assessment | Explanation, notes, suggestions, tips |
| *Preclass* | 30 minutes – 1 hr to preparation |  Development of idea and preparation of materials (writing worksheet, preparing accompanying powerpoints, and printing copies of worksheets for the students. |  |
| *Enter approx. class time for learning activity**preparatory**material presentation* | 2 min introduction | Brief instructor introduction identifying objectives and directions of activity (verbal). Instructions also written on complimentary powerpoint slide. |  |
| *Enter approx. class time for learning activity #1* | 20 – 30 minutes to complete the strip sequence activity. | 10 min for students to organize the strip sequence, and 5-10 minutes for students to discuss results with other groups.  |  |
| *Enter approximate time for additional learning activities and associated class**Work/preparatory materials*  | 5 – 10 minutes  | Coordinated peer-to-peer discussion of results (one member from each group checks group results with those from a different group). |  |
| *Enter approximate time for post-activity summing up or transition* | 2 minutes active learning summary5 minutes transition | Instructor reviews correct sequence of strips in activity, followed by students revoting on previous clicker question.Instructor to preview how topic leads into next class’s topic. |  |

*Add additional activities information as needed for the unit.*

Resources for Teaching the Unit

*Powerpoint presentation with embedded Turning Point clicker questions. Worksheet for writing down order of events in sequence activity. Strip sequence papers.*

Effectiveness of unit (if you have used it in your own teaching)

This specific teachable tidbit has not yet been tested by its developers.

Acknowledgements

Beth Beason and David Caprette, Rice University.

Participants from GCSI 2013 who gave anonymous feedback.

Howard Hughes Medical Institute

National Academies of Sciences