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### A&P workshop summary—Uniting Anatomy and Physiology through case studies

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## Q2S: A&P workshop summary—Uniting Anatomy and Physiology through case studies

We spent one full day combining the previously separate topics of Human Anatomy and Human Physiology (each 1 quarter in duration) into a combined 2-semester course, BIOL 4630 and 4640. We outlined topics week by week, tentatively scheduled lab topics, and outlined a year long syllabus. The next days of the workshop were spent strategizing methods to engage students, utilizing techniques such as case studies. Traditional anatomy pedagogy is largely lecture based, with students expected to learn basic identification in laboratory settings and structure/function from context provided in lecture. However, using clinical, problem-based learning (PBL) approaches in anatomy and physiology has been shown to improve student outcomes at all levels of learning, including medical students. We propose to convert the traditional lecture/lab course model into a partial flipped classroom, using directed clinical case studies and peer learning to enhance traditional pedagogy.

Introducing problem-solving based methods of pedagogy is one approach to engage students early in their careers with developing analytic and diagnostic skills. PBL approaches in anatomy and medical teaching are a logical extension of clinical case studies, wherein an example of a pathology or clinical procedure is provided, and students must ascertain the anatomical and/or physiological basis for it. Students report a deeper understanding of material presented in clinical case studies, as the ‘real world’ relevance and importance is immediately clear (Cliff and Wright, 1996).

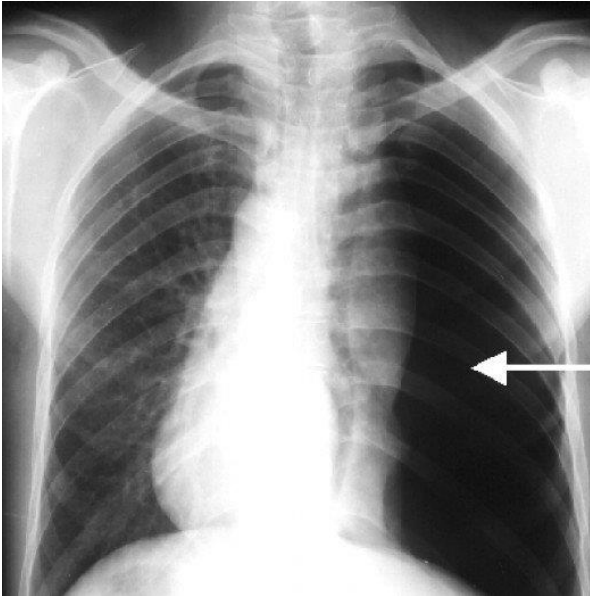
Some approaches allow open-ended small group work for case studies, but in the case of anatomy for advanced undergraduate students, there is precedent for employing directed case studies. Due to the usual size of this course (48 enrolled in 2019, waiting list of 5-10), the level of oversight required for directed group learning case studies presents a challenge. However, the use of online discussion boards may be used to enhance students’ access to instructor oversight. Using directed case studies in A&P will encourage students to review and apply material they have only recently been exposed to, and will aid in gaining mastery over the subject matter. Students previously reported feeling overwhelmed by the material, and most appreciated times when the instructor paused to relate something back to a clinical issue. Furthermore, **case studies are a logical and organic connection between Anatomy and Physiology**. All case studies will require that students recognize the basic anatomy and function of a given region or system, and apply their knowledge to 10-15 directed questions. We will give students time outside of class to first read and familiarize themselves with the material and discuss in groups (Piazza.com), as well as in-class small group time to utilize ‘jigsaw’ strategies of piecing together separate groups’ findings.

We will deploy **Directed Case Studies** into the novel course offering, Human Anatomy and Physiology (BIOL 4630 & 4640). All case studies will require that students **recognize** the basic anatomy of a given region or system, and **apply** their knowledge to provide a detailed diagnosis and description of a presented problem. We will give students time outside of class to first read and familiarize themselves with the material and discuss in groups, as well as in-class small group time to utilize ‘jigsaw’ strategies of piecing together separate groups’ findings. We will compare test scores by anatomical region/system in this year’s course (specifically those explored in case studies) to last year’s test questions involving the same region. Our expectation is that students who are actively engaged in case study research will have stronger recall and foundational understanding of an anatomical region, and the associated functionality of other systems in the same region.

Below is an example Case Study that requires knowledge of anatomy and physiology applied in a clinical context. Students will complete the assignments in groups of 4-5 and have time in class and out of class to complete the analysis and discussion.

## Sample Case Study

A 24 year old man arrives at the ER following a head-on car collision. He is awake and responsive, but appears restless and agitated. He states he is experiencing 9/10 pain. His airway is patent, but breathing is fast, labored, and asymmetric. His left chest appears enlarged and doesn't move with breathing; breath sounds are absent in left thorax with auscultation. No open wounds are discovered. Chest x-rays are ordered and reveal almost total radiolucency in left thoracic cavity.



What is the diagnosis of this man's injury?

**Tension pneumothorax caused by chest trauma**

(200-400 words) Discuss your findings—be anatomically detailed and thorough!

- What are the prevailing symptoms associated with the injury?
- What is the prognosis if left untreated?
- What other structures are impacted by this type of injury?

A pneumothorax is an abnormal collection of air in the pleural space between the lung and the chest wall. Symptoms typically include sudden onset of sharp, one-sided chest pain and shortness of breath. In a minority of cases the amount of air in the chest increases when a one-way valve is formed by an area of damaged tissue, leading to a tension pneumothorax. This condition can cause a steadily worsening oxygen shortage and low blood pressure. Unless reversed by effective treatment, it can result in death. Very rarely both lungs may be affected by a pneumothorax. It is often called a collapsed lung, although that term may also refer to atelectasis. A traumatic pneumothorax may result from either blunt trauma or penetrating injury to the chest wall. The most common mechanism is due to the penetration of sharp bony points at a new rib fracture, which damages lung tissue. Traumatic pneumothorax may also be observed in those exposed to blasts, even though there is no apparent injury to the chest.

They may be classified as "open" or "closed". In an open pneumothorax there is a passage from the external environment into the pleural space through the chest wall. When air is drawn into the pleural space through this passageway it is known as a sucking chest wound. A closed pneumothorax is when the chest wall remains intact.

Generate 5 test questions based on this clinical case study.

- 1) What is a pneumothorax?
- 2) What are the symptoms of a tension pneumothorax?
- 3) What will the pressure be in the thoracic cavity of a pneumothorax (greater than, equal to, or less than atmospheric pressure)?
- 4) How could you identify a pneumothorax from imaging alone?
- 5) How does a tension pneumothorax impact the cardiovascular system?