

## BMED 2110 Project Phase 1 Product

Due by Monday 3/8/2021 @8pm (for all sections)

Work with your partners to identify a historical case of bias (whether apparent or unconscious) in design or analysis within medicine, biomedical engineering or engineering from reputable resources, such as public media, books, or journal articles. Examples of such categories are below:

<u>Affected Demographics</u>	<u>Possible Categories of Areas to Look for Biased Process Designs</u>
<ul style="list-style-type: none"><li>• Gender</li><li>• LGBTQ identity</li><li>• Race or ethnicity</li><li>• Age (Elderly, Infants, Teenagers, etc.)</li><li>• Body mass index</li><li>• Socioeconomic status</li></ul>	<ul style="list-style-type: none"><li>• Medical Devices</li><li>• Pharmaceuticals<ul style="list-style-type: none"><li>○ Drug design</li><li>○ Drug delivery/effectiveness</li></ul></li><li>• Epidemiology</li><li>• Diagnosis/prognosis</li></ul>

### Initial questions to explore:

1. What health disorder (disease, injuries or infection ...) was solved by the design/process you selected?
2. What assumptions did the designers make, or not make, that impacted the design?
3. What design decisions did they make that significantly influenced who was impacted by, or who had access to, the final design? Were multiple demographic groups accounted for?
4. Are there basic anatomical and physiological differences that should have been considered but were not? (e.g. in height, strength, range of motion, etc.)?
5. In thinking about the engineering diagrams, such as those you've learned about in this course, do the systems that are being designed differ among people in terms of their structure? Or in terms of their parameter values (e.g. flow rates, compositions, reactions, extents of reactions, etc)?

### Overview

In this phase you will create a 1) case study which includes 2) a conceptual model. The purpose of a conceptual model is to explain the basic functions and principles of a system, device, or process. It should involve the basic principles and essential framework of your system including explanations of what it does and how it does it. Conceptual models are usually presented in the form of one or more easy-to-understand illustrations. Note that a conceptual model is not an engineering diagram. It has a different purpose which, is to help readers who are new to a subject understand the basics of how a system or process works.

### Example Case and Conceptual Model

Liquid cooling ventilation garments pump water around astronauts in order to cool them and maintain a comfortable environment when in the space suits. Both men and women wear the same garment, however, the sweat patterns of men and women are different. It has been shown

1- Smith CJ, Havenith G. Body mapping of sweating patterns in athletes: a sex comparison. Med Sci Sports Exerc. 2012 Dec 1;44(12):2350-61.

that men sweat more than women overall and the most sweat distribution for men is at the torso, whereas, it's at the arms, feet, hands and central upper back for women [1]. This reality indicates that different flow rates and configurations of tubes would be required to address the needs of women compared to the current design of the garment.

If this were the subject of your case study, an illustration with multiple subparts could be used to help the reader understand how sweating works and how it differs between men and women (see below). The first would be similar to the “establishment shot” you often see in Hollywood movies, an illustration that sets up the context for the scene ahead, that shows the relationship between people and objects and provides the overall context, In this case, the first figure on the left shows that we’re talking about spacesuits and that women and men, in general, have different sweat rates at different parts of their bodies. The middle figure “zooms” into to show the main structures of the organ that produces sweat. The figure on the right shows what is happening at the cellular/molecular level. Conceptual model illustrations:

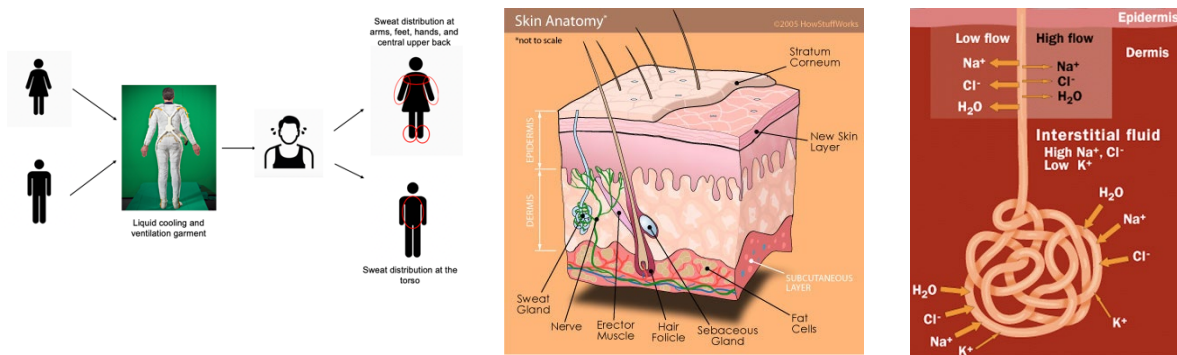


Figure 1: a conceptual model representing the bias in the design for astronauts.

An example of an engineering model of thermoregulation is shown below (figure 2). Note the differences between the engineering diagram and the conceptual model diagrams.

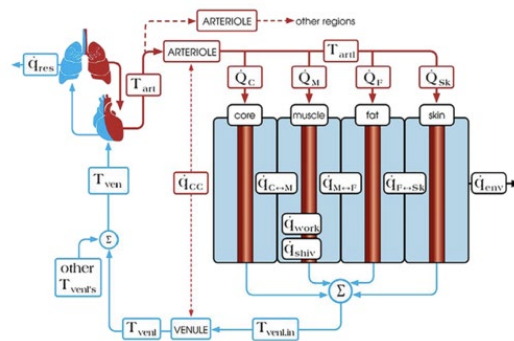


Figure 2: An engineering diagram of thermoregulation system

### How to Proceed

Reference the Rubric for more detailed information on the Phase 1 product. After you have collected notes about the case, create a case study and conceptual model and upload the PDF to Canvas.