

Perfusion Physiology II (PE-674)  
Winter Quarter '99-'00

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Hours: M & Tu-3 and Th-1 to 4 by appointment.  
Lecture: M, Tu & Th 3:00-3:50  
Course page: <http://www.msoe.edu/~tritt/pe672>

The following is a tentative outline of the topics to be covered in this course.

Fluid statics and dynamics [1 wk] - hydrostatic pressure  
dynamic pressure (Mechanical Energy Balance)  
osmotic and oncotic pressures  
vascular resistance  
pressures in the circulatory system

Fluid compartments [1 wk] - fluid compartments  
typical electrolyte concentrations and pH  
typical osmotic/oncotic solutions (volume expanders)  
specific effects: hemodilution & edema

Blood [2 wks] - plasma proteins - functions and sources  
formed elements - RBC structure and function  
WBC types and functions  
platelet structure and function  
formation of blood cells & platelets (hematopoiesis)  
mechanisms of hemostasis - clotting cascade and vitamin K  
heparin and protamine  
blood acid-base balance relationships - buffer systems, fixed versus volatile acids  
blood gas (O<sub>2</sub>, CO<sub>2</sub> and N<sub>2</sub>) content-partial pressure relationships -  
  
dissolved versus associated with Hb  
the Bohr & Haldane effects  
temperature effects  
Hb concentration and fetal Hb effects

donor blood products - whole blood  
packed cells  
fresh frozen plasma  
cryoprecipitate (platelet concentrate)

synthetic blood products - Hb solutions & fluorocarbon emulsions

Lungs [1 wks] - normal structure, function and operating mechanisms  
normal endocrine activity  
vascular resistance

Kidneys [1 wks] - normal structure, function and operating mechanisms  
impact on electrolyte and acid/base balance  
local control of perfusion  
hormonal control of excretion  
response to artificial perfusion  
abnormalities that effect perfusion techniques

Liver [1 wk] - normal structure and functions  
normal role in plasma protein formation  
normal role in clotting factor formation  
response to artificial perfusion  
abnormalities that effect perfusion techniques

Brain [1 wk] - normal blood supply and circulation  
normal role in controlling the vascular resistance  
normal role in control of respiration  
response to artificial perfusion

Immune system [1 wk] - humoral immunity  
cellular immunity  
complement system and inflammation

Final will be closed book, open notes or take home. There will be 2 or 3 homework assignments during the quarter.

There will be a term paper. Topics should be chosen by the second class meeting. Choose from the following topics:

- a. The effects of perfusion and hypothermia on the heart (reperfusion injury).
- b. The effects of perfusion and hypothermia on the distribution of body fluids.
- c. The effects of perfusion and hypothermia on hemostasis.
- d. The effects of perfusion and hypothermia on the kidneys.
- e. The effects of kidney disease on perfusion techniques.
- f. The effects of perfusion and hypothermia on the liver.
- g. The effects of liver disease on perfusion techniques.
- h. The effects of perfusion and hypothermia on the lungs.
- i. The effects of perfusion and hypothermia on the brain.
- j. The effects of perfusion and hypothermia on the immune system.
- k. The effects of perfusion and hypothermia on the complement system and inflammation.

Papers should be based on 1 or more general (text book) references and 2 to 5 specific (journal) references. Two or more of the specific references should be less than a year old. A outline a list of references is due 12/21. A draft is due 1/30. The final paper is due 2/8. You will be expected to present your papers to the rest of the class during the last week of the quarter.

Reading assignments will be made as the quarter progresses. The reading will be from a number of sources. Those that you do not have will be placed on reserve in the MSOE library. If you do not already own a copy of *Physiology* by Berne and Levy or Guyton and Hall's *Textbook of Medical Physiology*, I suggest that you purchase one. You will be expected to understand the relevant sections of these books.

Readings may also be taken from:

Gravlee, G. P., Davis, R. F. and Utley, J. R. Cardiopulmonary Bypass Principles and Practice. Baltimore: Williams & Wilkins 1993.

Cooney, D. O. Biomedical Engineering Principles. An Introduction to Fluid, Heat, and Mass Transport Processes. New York: Marcell Dekker, Inc. 1976.

Davenport, H. W. The ABC of Acid-Base Chemistry, 6<sup>th</sup> ed., revised. Chicago: University of Chicago Press 1974.

Honig, C. R. Modern Cardiovascular Physiology, 2<sup>nd</sup> ed. Boston: Little, Brown & Co. 1988.

Hensley, F. A. and Martin, D. E. The Practice of Cardiac Anesthesia. Boston: Little, Brown & Co. 1990.

Reed, C. C. & T. B. Stafford. Cardiopulmonary Bypass, 2nd ed. The Woodlands, TX: Surgimedics/TMP 1989.

and possibly other sources.

Tentative grade weights:	Participation & effort	5%
	Homework	15% (about 5% each)
	Term paper & presentation	30%
	Final exam	40%