

# Goldstein — Human Pathophysiology (BME 500)

## HUMAN PATHOPHYSIOLOGY — FALL 2009

Lee E. Goldstein, M.D., Ph.D. *Associate Professor in Psychiatry, Neurology, Ophthalmology, Pathology & Laboratory Medicine, and Biomedical Engineering*

4 lecture hours/week with discussion

This course will provide an in-depth introduction to basic concepts and fundamental principles of human pathophysiology for advanced undergraduate and graduate engineering students. The aim of the course is to provide the student with a systematic approach for understanding disease and rational therapeutic design. Pathophysiology bridges basic science and clinical practice with an emphasis on integrated mechanistic understanding of the molecular, structural, and functional alterations in cells, tissues, and organ systems that underlie human disease. The course will follow the classical division between general pathology (molecular, cellular, and tissue reactions) and systemic pathology (integrated tissue and organ system responses). An organizing didactic framework will emphasize integrative cause (etiology), mechanistic sequence (pathogenesis), structural derangement (morphology), and clinical manifestation. The first half of the course will focus on fundamental concepts of cellular homeostasis; general cellular responses (adaptation, injury, cell death) induced by stress, injurious stimuli, and disease. The second half of the course will follow an integrative systemic approach to illustrate the pathophysiology underpinnings of the 10 leading causes of death in the US. Cardiac, neoplastic, cerebrovascular, traumatic, neurodegenerative, diabetic, pulmonary, renal, and infectious diseases will be presented and explored in detail. Fundamental concepts and principles of molecular disease will be introduced and emphasized throughout the course. Application of quantitative approaches and methods in bioengineering, physics, chemistry, molecular cell biology, physiology, and biostatistics will be emphasized with reference to disease-specific examples throughout the course.

### PREREQUISITES

BE 209, CH102, PY 212. BI 315 is strongly suggested.

### TEXTBOOKS

**Robbins & Cotran Pathologic Basis of Disease**, Eighth Edition (Hardcover with CD)

Vinay Kumar (Author), Nelso Fausto (Author), Abul Abbas (Author)

Pages: 1464 Publisher: Saunders ISBN-13: 978-1416031215

Amazon New: ~\$100 Used: \$63

**The Structure of Scientific Revolutions** (Paperback)

by Thomas S. Kuhn (Author)

Pages: 226 pages Publisher: University Of Chicago Press ISBN-10: 0226458083

Amazon New: \$10

### OPTIONAL REFERENCES

**Harrison's Principles of Internal Medicine**, 17th Edition (Hardcover)

by Anthony S. Fauci (Author), Eugene Braunwald (Author), Dennis L. Kasper (Author), Stephen L. Hauser (Author), Dan L. Longo (Author), J. Larry Jameson (Author), Joseph Loscalzo (Author)

Pages: 2958 pages Publisher: McGraw-Hill Professional ISBN-10: 0071466339

Amazon New: \$140 Used: \$120

**Martindale Web Collection** (Medical Pathology)

[http://www.martindalecenter.com/MedicalPath\\_6\\_SMi](http://www.martindalecenter.com/MedicalPath_6_SMi)

A list of selected papers and reviews will be provided as a supplementary resource

GRADING	Project	30%
	Mid-Term	30%
	Final	40%
		<hr/> 100%

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## COURSE OBJECTIVES

1. Understand general homeostatic and pathologic principles underlying human health and disease.
2. Understand specific integrative principles of systemic (tissue and organ system) pathology.
3. Integrate and apply these concepts and principles to specific disease states (leading causes of US deaths).
4. Appreciate the relevance of basic and applied science to the study of human disease.
5. Emphasis will be placed on:
  - Establishing a conceptual framework for understanding human disease,
  - Formulating and testing mechanistic pathophysiological hypotheses, and
  - Understanding rational therapeutic design and clinical intervention strategy

## PROPOSED COURSE OUTLINE

Introduction	1 Paradigm & Scientific Revolution (Kuhn)	
General Principles	2 Cellular Pathology	
	3 Inflammation	
	4 Tissue Responses & Repair	
	5 Hemodynamic Disorders	
	6 Thrombosis & Shock	
	7 Genetic Diseases	
	8 Immunopathology	
	9 Neoplasia	
	10 Infection	
	11 Molecular Disease-I	
	12 MID-TERM EXAM	
Systemic Pathology	13 Cardiovascular Disease	Cause of US Deaths*
	<i>Myocardial infarction*, congestive heart failure</i>	1
	14 Cancer & Neoplastic Disease	2
	<i>Lung cancer*; glioblastoma multiforme (brain)</i>	
	15 Cerebrovascular Accidents	3
	<i>Thrombotic stroke*, hemorrhagic stroke</i>	
	16 Accidents & Trauma	4
	<i>Burns*, motor vehicle accidents, penetrating trauma</i>	
	17 Chronic Pulmonary Disease	5
	<i>Asthma*, emphysema, bronchitis</i>	
	18 Neurodegenerative Disease	6
	<i>Alzheimer's disease*; Parkinson's disease</i>	
	19 Diabetes Mellitus	7
	<i>DM Type I and II*; microvascular sequelae</i>	
	20 Pneumonia & Influenza	8
	<i>Viral, bacterial, aspiration pneumonia*</i>	
	21 Renal Disease	9
	<i>Acute nephropathy; chronic renal failure*</i>	
	22 Septicemia	10
Contextual Pathology	23 Treatments, Trials & Tribulations	
	24 FINAL EXAMINATION	
Project Suggestions	Blinding Disorders (Cataracts, Macular Degeneration)	
	Degenerative Joint Disease	
	Environmental and Nutritional Disease	
	Diseases of Infancy & Childhood	

\* Melonie P. Heron, et al., National Vital Statistics Report 56, Vol 16 (2008)