

College of Osteopathic Medicine

Course Syllabus

Course Details & Information:

Course Name	Biochemistry/Molecular Genetics
Course Number	BIOC 1102
Graduating Class Year	2017
Discipline	Basic Sciences
Course URL	
Course Option Type	Required

Course Administration & Duration:

Department	Biochemistry	Method	Lecture, Written Exams
Chief Coordinator	Dr. Martin Schmidt	Co-Coordinator	Dr. Wayne Wilson
Credit Hours	4.5	Dates	8/12/13 – 11/01/13

Text or Required Readings:

I. REQUIRED	None
II. RECOMMENDED	<p>Baynes, J. and Dominiczak, M.H., Medical Biochemistry, Mosby, London, 3rd Edition, 2009.</p> <p>Nussbaum R., McInnes R., Willard, H., Thompson & Thompson Genetics in Medicine, Saunders, Philadelphia, 7th Edition, Revised and Reprint, 2007.</p> <p>COMPREHENSIVE REFERENCE FOR HUMAN BIOCHEMISTRY</p> <p>Devlin, T.M., Editor, Textbook of Biochemistry with Clinical Correlation, Wiley-Liss, Hoboken, N.J., 7th Edition, 2011</p>
II. OTHER RESOURCES	<p>Alberts, B. et al., Molecular Biology of the Cell, Garland Science, New York, 3rd & 4th Editions</p> <p>NCBI Website</p> <p>Valle et al. Editors, The Online Metabolic and Molecular Bases of Inherited Disease, McGraw-Hill, New York . Available electronically through the Access Medicine Collection.</p>
III. REFERENCE TEXT ON RESERVE IN DMU LIBRARY	<p>Korf, Bruce R., Human Genetics & Genomics, 4th Edition, 2012</p>

Description:

<p>Biochemistry provides a molecular description of biological structure and function. It is the molecular foundation for the basic medical sciences. Molecular structure, metabolic pathways, and gene expression will receive major emphasis in this introductory course. Several common genetic diseases and metabolic disorders serve to contrast normal and perturbed human biochemistry as well as demonstrate the clinical implications of human biochemistry.</p>

Course Goals & Objectives:	
<p>To provide a foundation of biochemistry and molecular genetics on which the student can build clinical knowledge.</p> <p>Upon completion of the Biochemistry course the student should be able to:</p> <ul style="list-style-type: none"> • Describe the physical and chemical properties of common biomolecules and cellular structures, and relate these properties to molecular function. • Describe and integrate metabolic pathways. • Describe gene expression in terms of replication, transcription and translation. • Describe selected diseases (e.g., gout, diabetes mellitus, and cancer) in molecular terms. • Describe the biochemical bases for common gene and chromosomal defects. • Apply knowledge of biochemistry and medical genetics to enhance understanding of material presented in subsequent courses and systems. 	
Requirements:	
LECTURES	TBD
EXAMINATIONS	TBD
Accommodations Policy	
<p>If you have a disability and need accommodations, you must request them by contacting the Accommodations Officer in Educational Support Services (accommodations@dmu.edu) and submitting an application with necessary documentation. Faculty members cannot provide accommodations directly. Please note that accommodations should be submitted well in advance of the date accommodations are needed.</p>	

Resources:

Chief Coordinator	Martin Schmidt, Ph.D.	Phone	515-271-1528
Office	Ryan Hall Rm 161	E-mail	Martin.Schmidt@dmu.edu
Office Hours	8 AM – 4:30 PM		
Co-Coordinator	Wayne Wilson, Ph.D.	Phone	515-271-1443
Office	Ryan Hall Rm 163	E-mail	Wayne.Wilson@dmu.edu
Office Hours	8 AM – 4:30 PM		
Academic Assistant	Brenda Swigert	Phone	515-271-1353
Office	Ryan Hall, 166	E-mail	Brenda.Swigert@dmu.edu
Office Hours	7:30 AM – 4:00 PM		

Attributes & Core Competencies:

<p>This course contributes to the following sections of the Core Competencies of the Osteopathic Student and Professional:</p> <p>A. *Medical Knowledge B. Interpersonal and Communication Skills C. Professionalism</p> <p>* The asterisk denotes the competencies that are assessed during the course.</p>
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Course Policies:

Lecture attendance is expected and necessary for an understanding of the material. Biochemistry maintains a course-related Angel site on the University intranet. Students should check this site for announcements and other useful information. Notices of change in lecture, lecturer or exam will be updated on the Portal and posted on the Biochemistry Angel site. The course faculty, in accordance with the policies and statements in the student handbook, must approve any exceptions to the policies stated in this syllabus.

Evaluation:

Examination and grading policies are as stated in this syllabus and the Student Handbook. The student is expected to review these policies and conform to them. **If electronic examinations are to be implemented, further detailed instructions will be amended to this course syllabus and posted to the course site.**

The Biochemistry Course will have six examinations. **Material covered by the guest lecturer will be tested.** There will be five section examinations each consisting of fifty (50) questions and a comprehensive final examination that also consists of fifty (50) questions. The question format will be objective, i.e., multiple-choice, completion, matching, etc. Examination grading will be based solely on the official answer sheets. The Biochemistry Department will retain all examinations.

In order to encourage retention of material and to facilitate integration of topics, a small number of questions on each exam will test objectives from preceding sections.

The **final examination** score will be counted **twice** if that score can replace a **lower** score from one of the five section exams. In the case of a single missed exam, the final also functions as a **make-up**. A student who misses two exams, unless for reasons detailed in the student handbook, will receive a grade of zero (0) on the second missed exam.

The final percentage grade for the Biochemistry Course will be determined by adding the examination scores, dividing the total number of points earned by the total number of possible points (300), multiplying by 100 and rounding to the nearest whole number. **A final average of $\geq 70\%$ is required to pass the course.**

(97-100)%	A+
(93-96)%	A
(90-92)%	A-
(87-89)%	B+
(83-86)%	B
(80-82)%	B-
(77-79)%	C+
(70-76)%	C
(<70)%	F

Make-up for the comprehensive final: Any student who misses the comprehensive final will take a make-up. This grade will be counted only once and cannot be used to replace a lower grade on a section exam. This make-up final may contain short answer, extended matching, etc., as well as multiple-choice questions.

Electronic Devices such as computers, calculators, cellular phones, digital cameras, iPods, etc. will NOT be permitted in the examination area or during the test question review sessions.

Test Question Review: Students may review their examinations and discuss questions with faculty at scheduled sessions. The Biochemistry Department believes that these forums provide a constructive mechanism to resolve perceived ambiguities through professional discourse.

The reviews shall **not** include copying of the examination questions or any information pertaining to examination questions. Attempting to copy questions from an examination will be considered an act of cheating.

If a student would like the course faculty to consider an alternative interpretation of a question, the student **must** turn in a written request to the Biochemistry Academic Assistant or a course coordinator within three class days after the test review session. The request should include the test form, question number and

reason with appropriate documentation for additional consideration. **Only** the following documentation will be accepted to support a requested test question review: (1) the lecture itself, (2) the recommended textbooks, (3) the lecturer's handout and references cited in the handout, and (4) blackboard assignments.

Remediation of course failure: A final average of < 70% is a failure in the Biochemistry Course and requires remediation. The Biochemistry Re-evaluation will be given during the following summer. See Student Handbook for details regarding, "Re-evaluation mechanism for Year I courses and systems". A grade of C is the maximum grade that may be earned by re-eval. The transcript will reflect a grade of F/C.

In the event that a student believes that exceptional circumstances not covered in the syllabus have caused a missed examination, the student should contact the chief coordinator of the course at extension 1528. The chief coordinator will make a determination on the merits of the exceptional circumstances.

Test Question Review:

There will be at least one, one-hour session scheduled for students to review each exam.

Course Schedule & Examinations:

	LECTURER	LECTURE TITLE	Keywords
		SECTION 1	
1.	Wilson	Introduction	
2.	Wilson	Biological Acids, Bases & Buffers	Henderson-Hasselbalch equation, Bicarbonate/carbon dioxide buffer, Acidosis, Alkalosis
3.	Wilson	Structure of Proteins 1	D- and L-amino acids, Peptide bond, Primary structure, Secondary structure, α -helix, β -sheet
4.	Wilson	Structure of Proteins 2	Protein folding, Tertiary structure, Quaternary structure, Prosthetic group, Hemoglobin, Bohr effect
5.	Wilson	Structure of Proteins 3	Hemoglobinopathies, Post-translational modification, Collagen, Scurvy
6.	Wilson	Introduction to Enzymes 1	Catalyst, Specificity, Enzyme classes, Cofactor, Coenzyme, Activation energy, Substrate binding, Saturation
7.	Wilson	Introduction to Enzymes 2	General acid-base catalysis, Covalent intermediates, Metal ion catalysis, Michaelis-Menten kinetics, V_{max} , K_m , Reversible inhibitor, Competitive inhibitor, Non-competitive inhibitor, Double-reciprocal plot
8.	Wilson	Introduction to Enzymes 3	Irreversible inhibitor, Suicide inhibitor, Rational drug design, Isozyme, Control of enzyme activity, Multienzyme complex, Multifunctional protein
9.	Wilson	Biomembranes	Intracellular fluid, Extracellular fluid, Fluid mosaic model, amphipathic, Phosphoglyceride, Sphingolipid, Cholesterol, Integral membrane protein, Peripheral membrane protein, Channel, Pore, Facilitated diffusion, Active transport

	LECTURER	LECTURE TITLE	Keywords
10.	Wilson	Second Messengers & Hormonal Regulation of Metabolism I	Hormone, Local mediator, Neurotransmitter, Growth factor, Endocrine, Paracrine, Autocrine, Lipophilic hormone, Hydrophilic hormone, Second messenger, G-protein, Cyclic-AMP, Protein kinase A
11.	Wilson	Second Messengers & Hormonal Regulation of Metabolism II	Inositol 1, 4, 5-trisphosphate, Diacylglycerol, Protein kinase C, Calcium, Calmodulin, Nitric Oxide, Tyrosine kinase, Insulin receptor, Transcriptional control
12.	Mueller	Introduction to Metabolism	Metabolism, Anabolic and Catabolic Metabolic Pathways, Oxidation/Reduction Reactions, Oxidative Phosphorylation vs. Substrate-level Phosphorylation, Metabolic Pathway Control, Central Metabolic Pathways
	August 22, 2013	Examination 1	
	8:15 – 9:45 AM	TBD	
		SECTION 2	
13.	Mueller	Acetyl CoA and the Citric Acid Cycle	Acetyl-CoA and Its Roles in Metabolism, Pyruvate Dehydrogenase (PDH) Complex, Citric Acid Cycle (CAC) and ATP Formation, Generation of Biosynthetic Precursors by the CAC, Metabolic Roles of B-vitamins,
14.	Mueller	Mitochondrial Electron Transport & ATP Generation	Mitochondrial Structure/Function, Electron Transport, Oxidative Phosphorylation, Inhibitors and Uncouplers
15.	Schmidt	Carbohydrate digestion and uptake	Carbohydrate chemistry, Carbohydrate digestion, Carbohydrate uptake
16.	Schmidt	Glycolysis	Glycolysis, Lactic acid fermentation, Utilization of fructose and galactose
17.	Schmidt	Gluconeogenesis	Gluconeogenesis, Pentose Phosphate Pathway
18.	Schmidt	Glycogen metabolism	Glycogen synthesis, Glycogen degradation, Glycogen storage diseases, Alcohol metabolism
19.	Schmidt	Pentose phosphate pathway, structural carbohydrates, glucuronation as means of detoxification	Glycosaminoglycans, Mucopolysaccharidoses, Glucuronic Acid

	LECTURER	LECTURE TITLE	Keywords
20.	Schmidt	Lipid Metabolism 1	Fatty Acid Mobilization, Fatty Acid Activation, β -Oxidation of Saturated Fatty Acids and ATP Yield, β -Oxidation of Unsaturated Fatty Acids, Ketone Bodies: Formation, Utilization and Roles
21.	Schmidt	Lipid Metabolism 2	Fatty Acid Biosynthesis
22.	Schmidt	Lipid Metabolism 3	Triacylglycerol, Glycerophospholipids & Sphingolipid Biosynthesis, Sphingolipidoses, Phospholipases, Eicosanoid Structure and Formation
23.	Schmidt	Lipid Metabolism 4	Cholesterol Biosynthesis & Roles
24.	Schmidt	Lipid Metabolism 5	Plasma Lipoprotein Structure & Function, Cholesterol, Plasma Lipoproteins & Atherosclerosis, Effects of Anti-hypercholesterolemic Drugs
	September 13, 2013	Examination 2	
	8:15-9:45 AM	TBD	
		SECTION 3	
25.	Wilson	Protein and Amino Acid Metabolism 1	Zymogen, Pepsin, Enteropeptidase, Nitrogen balance, Essential amino acid, Non-essential amino acid, Aminotransferase
26.	Wilson	Protein and Amino Acid Metabolism 2	Glutamate dehydrogenase, Folate, Tetrahydrofolate, S-adenosylmethionine, Tetrahydrobiopterin, Phenylalanine hydroxylase, Phenylketonuria
27.	Wilson	Protein and Amino Acid Metabolism 3	Glucogenic amino acid, Ketogenic amino acid, Pyruvate, Oxaloacetate, Propionyl-CoA, Cobalamin, Homocysteine
28.	Wilson	Protein and Amino Acid Metabolism 4	Branched-chain amino acid aminotransferase, Branched-chain alpha-ketoacid dehydrogenase, Urea cycle, Hyperammonemia, Inter-organ relationships
29.	Wilson	Protein and Amino Acid Metabolism 5	Creatine, Creatinine, Dopamine, Norepinephrine, Epinephrine, Thyroid hormone, Melanin, Serotonin, Melatonin, Niacin, GABA, Histamine, Glutathione
30.	Schmidt	Nutritional Status and Utilization of Metabolic Pathways	Well fed state, postprandial state, Early starvation, Late starvation

	LECTURER	LECTURE TITLE	Keywords
31.	Schmidt	Biochemistry of Diabetes Mellitus	Insulin, Diabetic ketoacidosis, Hyperglycemia, Diabetic angiopathy
32.	Schmidt	Heme Metabolism	Heme synthesis, Porphyrin, Jaundice, Bilirubin
33.	Wilson	Nucleotide Metabolism 1	Purine synthesis, Purine degradation, Uric acid
34.	Wilson	Nucleotide Metabolism 2	Pyrimidine synthesis, thymine synthesis, Ribonucleotide
35.	Schmidt	Clinical Biochemistry	Basic metabolic panel, Electrolytes, Blood, Urea and nitrogen
36.	Schmidt	Free Radicals, Anti-oxidants	Reactive oxygen species, Antioxidants, Lipid peroxidation
	September 27, 2013	Examination 3	
	8:15 – 9:45 AM	TBD	
		SECTION 4	
37.	Wilson	Organization of the Genome	Gene, Genome, Chromosome
38.	Wilson	Mutations, Replication & Repair	DNA replication, DNA repair, Mutations
39.	Wilson	Transcription, RNA Processing & Regulation 1	Translation, Methylation, Transcription factors
	LECTURER	LECTURE TITLE	Keywords
40.	Wilson	Transcription, RNA Processing & Regulation 2	Promoters, Repressors, Silencing
41.	Schmidt	Translation & Protein Processing 1	Genetic code, Aminoacyl-tRNA, Peptidyl transferase, Chaperone, Mitochondrial protein translocator complexes, Signal recognition particle, Glycoproteins, Proteasome, Ubiquitination
42.	Schmidt	Translation & Protein Processing 2	Genetic code, Aminoacyl-tRNA, Peptidyl transferase, Chaperone, Mitochondrial protein translocator complexes, Signal recognition particle, Glycoproteins, Proteasome, Ubiquitination
43.	Wilson	Cell Cycle	Cyclin-dependent kinase, Growth factor, Tyrosine kinase, Retinoblastoma protein (Rb), Restriction point, p53, Apoptosis
44.	Wilson	Cancer 1	Oncogene, Tumor suppressor, Myc, Ras, Metastasis, Retinoblastoma, Li-Fraumeni syndrome, Familial adenomatous polyposis, Lynch syndrome, Imatinib (Gleevec)
45.	Wilson	Cancer 2	Oncogene, Tumor suppressor, Myc, Ras, Metastasis, Retinoblastoma, Li-Fraumeni syndrome, Familial adenomatous polyposis, Lynch syndrome, Imatinib (Gleevec)

	LECTURER	LECTURE TITLE	Keywords
	October 11, 2013	Examination 4	
	8:15 – 9:45 AM	TBD	
		SECTION 5	
46.	Schmidt	Single-Gene Disorders 1	Autosome, Inheritance, Zygosity
47.	Schmidt	Single-Gene Disorders 2	Anticipation, Expressivity, Penetrance
48.	Schmidt	Common Chromosomal Aberrations	Balanced translocations, Unbalanced translocations, Clinical cytogenetics
49.	Schmidt	Epigenetic Phenomena	Methylation, Histone, Acetylation
50.	Schmidt	Genetics of Development	Axis formation, Pattern formation, Dysmorphology
51.	Schmidt	Genetics of Birth Defects	Morphogen signaling, Homeobox genes, Pseudohermaphroditism
52.	Schmidt	Population Genetics	Genetic polymorphisms, Hardy-Weinberg principles, Linkage disequilibrium
53.	Schmidt	Multifactorial Diseases	Multifactorial inheritance, Threshold model, Heritability
54.	Schmidt	Molecular Medicine - Diagnostics	Diagnostics, PCR, Antibodies
55.	Schmidt	Molecular Medicine - Therapy	Gene therapy, Cell replacement therapy, Therapeutic antibodies
56.	Noble	Case Studies in Cytogenetics	Trisomies of the autosomes 21/18/13, Sex chromosome abnormalities
	October 25, 2013	Examination 5	
	8:15 – 9:45 AM	TBD	
	November 1, 2013	Final Examination	
	8:15– 9:45 AM	TBD	

Faculty, Guest Faculty, & Guest Lecturers:

Tom Mueller, PhD
Professor of Biochemistry
Academic Center
Room 107, Ext. 1442

Wayne Wilson, PhD
Associate Professor of Biochemistry
Ryan Hall
Room 163, Ext. 1443

Martin Schmidt, PhD
Associate Professor of Biochemistry
Ryan Hall
Room 161, Ext. 1528

Nathan Noble, D.O.
Blank Children's Developmental Pediatrics
1206 Pleasant Street
Des Moines, IA 50309
NobleNR@ihs.org