

# *American University of Antigua*

## *College of Medicine*

### **Medical Genetics**

**January – April 2009**

**Andreas Lück, D.N.Sc., M.Sc.**

Professor and Chair, Department of Medical Biochemistry and Genetics  
Office Hours: Mon, Tue, Thu, Fri 11 a.m. – 12 p.m. and 3 p.m. – 4 p.m. by appointment only

**Marcus Merrin, PhD**

Associate Professor of Biochemistry and Genetics  
Office Hours: Mon – Fri 11a.m. – 12 p.m. and 3 p.m. to 4 p.m.

**Class Hours:**

Mon – Fri 10 a.m. – 10:50 a.m. (Section B)  
Mon – Fri 4:00 p.m. – 4:50 p.m. (Section A)

### **Course Description and Purpose**

Medical genetics is one of the most rapidly advancing areas of modern medicine, and molecular genetics is now integral to all aspects of biomedical sciences. In order to be able to successfully practice medicine nowadays, in-depth knowledge of the principles of human genetics and their application to a wide array of clinical problems is paramount. During the course we will discuss the following topics: principles, mechanisms and patterns of inheritance (including genetic diseases), genetic diversity, population genetics, cytogenetics, molecular basis of genetic diseases (including application of recombinant DNA techniques), pharmacogenetics, immunogenetics, molecular biology and genetics of cancer, and genetic counselling.

### **Goal**

The goal of this 4 credit course is to provide a solid understanding and foundation of the principles of human genetics relevant to clinical medicine, with emphasis on disease mechanisms, diagnosis and treatment..

### **Course Objectives**

Upon completion of this course, you should

- Understand and be able to explain how genetic factors predispose to genetic diseases and their implications on diagnosis, treatment/disease management, and prevention;
- Understand and be able to explain the clinical manifestations of common genetic diseases;
- Understand and be able to explain how knowledge of a patient's genotype can be used to develop effective approaches to diagnosis and treatment for that individual;
- Understand and be able to explain the indications for prenatal diagnosis and the procedures that are employed for such testing;
- Understand and be able to explain the existence of and justification for screening programs and the difference between screening and individualized testing;
- Understand and be able to explain the differences in goals and approaches regarding screening programs in

newborns, pregnant women, and other groups;

- Understand and be able to explain treatment of genetic diseases and the present state of gene-based therapies;
- Understand and be able to explain indications and methods for referral of individuals to medical geneticists;
- Understand and be able to explain how medical practice is affected by legal and ethical issues; and
- Be able to deal with genetics questions on the **USMLE Step I Exam** with ease, confidence, and competence

## Format

Course material will be presented in a lecture and discussion format.

## Required Texts

- Nussbaum, R.L., McInnes, R.R., and Huntington, F.W.: **Thompson & Thompson – Genetics in Medicine**, latest edition, WB Saunders Company

## Recommended Texts

- Gelehrter, T.D., Collins, F.S., and Ginsburg, D.: **Principles of Medical Genetics**, latest edition, Lippincott Williams & Wilkins
- Strachan, T., and Read, A.: **Human Molecular Genetics**, latest edition Garland Press
- Turnpenny, P., and Ellard, S: **Emery's Elements of Medical Genetics**, latest edition, WB Saunders
- Lodish et al., **Molecular Cell Biology**, latest edition, Freeman and Company Publishing
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## Supplemental Resources

- The Internet provides a number of web pages that can be found easily with a search engine.
- Detailed Course Outline of Genetics. (2006). This detailed course outline is about 40 pages in length and describes the learning objectives, reading assignments and contents of lectures for each day in the course.

## Examinations and Grading System

- Four “mini” exams and the final exam will assess your ability to master the course material.
- Material to be covered in exams and weight of the individual exams: see below.
- The format of the exams is multiple choice. Each question will be assigned an average of 72 seconds. The “mini” exams will have 30 questions; the final exam will have 100 questions. Thus, the allocated time for the mid-term exam will be 36 minutes and for the final exam 120 minutes.
- Every attempt possible will be made to phrase exam questions clear and unambiguous.

- Exams will focus on but may not be limited to the material that has been explicitly covered in class.

### Note:

- **All material covered by the reading assignments plus all of the additional material supplied during the course is testable!**
- **The required text book includes 43 cases. These cases are integral part of the course and will be either discussed in detail in class or referred to in lectures. These cases are still testable even if they were only referred to but not discussed in class.**
- **Exams 2, 3, and 4 will contain comprehensive bonus questions. The allocated time for these exams will be adjusted according to the number of bonus questions.**
- Exams will not be curved.
- During exams all electronic devices such as cell phones, laptop computers, walkman, portable CD players, iPods, etc. are to be turned off and stowed away in bags that are stored in the back of the examination room. During exams students are further **NOT** allowed to wear caps or hats.
- Performance grades from each exam will be directly communicated to you on an individual and confidential basis as quickly as possible following examination days 1 to 4. The grades for the final exam and the final course grades will be communicated after the final exam.
- The final exam will be comprehensive
- A failing grade (“zero”) will be normally assigned for a missed exam. The only accepted exceptions are **documented** medical or family emergencies. **Make-up exams are not given.** Instead, in approved cases of a missed exam the course score will be averaged out of the remaining exams. Missing of the final exam will result in the grade of “incomplete” and the student must complete the course within two semesters.

- Re-take of exams will not be possible.

Exam	Content
Exam 1	Chromosomal Basis of Heredity, Gene Structure and Function; Tools of Molecular Genetics;; Single Gene Inheritance: Concepts; Autosomal Dominant; Autosomal Recessive; X-linked Inheritance; Atypical and Mitochondrial Inheritance; Genetics of Common Disorders with Complex Inheritance
Exam 2	Principles of Cytogenetics; Clinical Cytogenetics; Genetic Variations in Populations, and Individuals – Mutations, Polymorphisms; Hemoglobinopathies;
Exam 3	Human Gene Mapping; Biochemical Genetics: Introduction; Enzymopathies; Lysosomal Storage Diseases; Familial Hypercholesterolemia; Cystic Fibrosis; Muscular Dystrophies; Collagen Disorders
Exam 4	Biochemical Genetics: Triplet Repeat Disorders; Mitochondrial Disorders; Alzheimer Disease and others; Pharmacogenetics and Pharmacogenomics; Treatment of Genetic Disease; Developmental Genetics and Birth Defects; Prenatal Diagnosis; Cell Cycle; Apoptosis; Cancer Genetics and Genomics
Final Exam	Comprehensive: all of the above plus: Developmental Genetics and Birth Defects; Prenatal Diagnosis; Personalized Genetic Medicine; Counseling and Risk Assessment; Ethical Issues

### Weight of exams:

Exam 1	20%
Exam 2	20%
Exam 3	20%
Exam 4	20%
Final Comprehensive Exam:	20%

### Grading:

<b>A:</b>	> 89.5%
<b>B:</b>	79.5% – 89.4%
<b>C:</b>	69.5% – 79.4%
<b>F:</b>	<69.5%

### **Note:**

- A score of **64 or better** on the final exam is considered a pass of the exam and will result in passing the course. Any score lower than 64.0 on the final exam is considered failing the exam. In such cases the mini exams will be factored in with their full weight.
- Be aware that the Shelf exam in **biochemistry** will most likely contain a substantial number of questions concerning **molecular genetics, cytogenetics and molecular cell biology**.

## Course Policy on Attendance

- The general University policy regarding absences applies. American University of Antigua - College of Medicine - allows 20% absences (**14 days**) per semester during the basic science program. The 'twenty percent rule' specifically includes unanticipated emergency leaves, for any reason, from the basic science campus.
- Students who have a persistent tendency to come late and thus disrupt the teaching process may be subject to notification to administration.
- Attendance will be taken daily. No student will fail the course purely based on lack of attendance. However, be aware that attendance of those students whose final numerical grades are borderline between the grades C and F will be closely looked at. Those borderline students who have 80% or more of **recorded** class attendance may receive a passing grade.

## Rules of Conduct

See Student Handbook for University policy. University policy will be enforced

## Recording of Lectures

You are allowed to audiotape lectures. University policy prohibits video taping of lectures

## DETAILED OUTLINE OF COURSE:

### Block 1

<u>Date</u>	<u>Topic</u>	<u>Reading Assignment</u>
Jan 7, 8	Introduction to the Course; Human Genome, Chromosomal Basis of Heredity	5 - 23
9, 12	Human Genome – Gene Structure and Function	25 - 39
12 - 14	Tools of Human Molecular Genetics	41 – 58
14, 15	Patterns of Single Gene Inheritance (Concepts)	115 - 149
15	Patterns of Single Gene Inheritance (Concepts, Autosomal Dominant)	115 - 149
16	Patterns of Single Gene Inheritance (Autosomal Dominant and Recessive)	115 – 149
19	Patterns of Single Gene Inheritance (X-Linked)	115 - 149
20	Patterns of Single Gene Inheritance (Atypical, Mitochondrial)	115 - 149
21, 22	Genetics of Common Disorders with Complex Inheritance	151 - 174
23	Review Block 1	

**January 26, 2009      Exam 1 (20%)**

### Block 2

Jan. 27, 28	Principles of Clinical Cytogenetics	59 – 88
29, 30	Clinical Cytogenetics: Disorders	89 - 113
Feb. 2 - 4	Principles of Molecular Diseases – Lessons from Hemoglobinopathies	323 - 343
5, 6	Genetic Variations in Individuals and Populations: Mutations, Polymorphisms	175 - 205
9 - 11	Genetic Variations in Individuals and Populations: Mutations, Polymorphisms	175 - 205
12	Buffer Day	
13	Review Block 2	

**February 16, 2009      Exam 2 (20%)**

### Block 3

Feb. 17 – 19	Human Gene Mapping and Disease Gene Identification	207 – 230
20	Biochemical Genetics – Introduction	345 – 392, 139 - 144
23, 24	Biochemical Genetics – Enzymopathies	345 – 392, 139 - 144
25	Biochemical Genetics – Enzymopathies, Lysosomal Storage Diseases	345 – 392, 139 - 144
26, 27	Biochemical Genetics – Lysosomal Storage Diseases	345 – 392, 139 - 144
March 2	Biochemical Genetics – Familial Hypercholesterolemia	345 – 392, 139 - 144
3	Biochemical Genetics – Cystic Fibrosis, Muscular Dystrophies	345 – 392, 139 - 144
4	Biochemical Genetics – Muscular Dystrophies	345 – 392, 139 - 144
5	Biochemical Genetics – Collagen Disorders	345 – 392, 139 - 144
6	Review Block 3	

**March 9, 2009      Exam 3 (20%)**

## Block 4

March	10	Biochemical Genetics – Triplet Repeat Diseases	345 – 392, 139 - 144
	11	Biochemical Genetics – Mitochondrial Diseases	345 – 392, 139 –
144			
	12	Biochemical Genetics – Alzheimer Disease and others	345 – 392, 139 - 144
	13	Pharmacogenetics and Pharmacogenomics	497 - 505
	16, 17	Pharmacogenetics and Pharmacogenomics	497 - 505
	17 – 19	Treatment of Genetic Disease	393 - 418
	20	Cell Cycle and Apoptosis	
	23	Apoptosis	
	23 - 26	Cancer Genetics and Genomics	461 - 484
	27	Review Block 4	

**March 30, 2009                      Exam 4 (20%)**

## Block 5

March	31	Developmental Genetics and Birth Defects	419 – 442
April	1, 2	Developmental Genetics and Birth Defects	419 – 442
	2, 3	Prenatal Diagnosis	443 - 459
	6	Personalized Genetic Medicine	485 - 495
	7, 8	Counseling and Risk Assessment	507 - 522
	9, 10	Ethical Issues	523 - 530

13 – 17 Shelf Exam Week – No Class

**April 20 - 22, 2009:                      Final Exam Week: Comprehensive Final Exam (20%)**