**Human Genetics BIOS 4545**

Instructor: Greg Gibson greg.gibson@biology.gatech.edu

**Required testbook:***Gibson, A Primer of Human Genetics, Oxford University Press 2014*

**Learning objectives:**This course explores how modern genomics technologies revolutionizes the study of human genetics. By the end of this course, students should be able to:.

1. Define heritability and how it is measured or quantified for complex human traits.

2. Describe the design and limitations of genome-wide association studies (GWAS).

3. Explain methods for transcriptome profiling and the influence of epigenetics on gene expression.

4. Analyze and evaluate recent literature applying genome-scale technologies to explore the relationship between human genetic variation, environmental factors, and complex pathologies such as diabetes, cancer, and neurological disorders.

**Grades:**

| 25% | Midterm exam |
| --- | --- |
| **25%** | Final exam |
| **20%** | Term paper |
| **20%** | Literature Critiques |
| **10%** | Participation in class discussions |

**Policy on collaboration and the Honor Code:** Discussion with peers is encouraged, especially during class group discussions of paper presentations. However, all work turned in must be of your own original efforts. Using the work of your peers (copying and pasting, even with alterations) or from any other sources, on-line or in print, without attribution is plagiarism. Plagiarism will result in zero credit for the assignment, and possible further penalties as an Honor Code violation. All students are expected to abide by Georgia Tech's [Honor Code](http://www.honor.gatech.edu/plugins/content/index.php?id=9).

**Learning Accommodations:** As needed, we will accommodate students with disabilities. These accommodations must be arranged in advance and in accordance with the Office of Disability Services ([disabilityservices.gatech.edu](http://disabilityservices.gatech.edu/)).

**Schedule of Topics: BIOL 4545 “HUMAN GENETICS” Fall 2018**

**4:30 – 5:45 ES&T L1125**

Tue Aug 21 Introductory Lecture

Thu Aug 23 Heritability and Genetic Models of Disease

Tue Aug 28 Structure and Content of the Human Genome – Ch 2

Thu Aug 30 Human Evolutionary Genetics – Ch 3

Tue Sep 4 Normal Human Variation – Ch 4

Thu Sep 6 Presentation 1:Genetic History of Iceland

Tue Sep 11 Genome-Wide Association Studies – Ch 6

Thu Sep 13 GWAS Practical Exercise

Tue Sep 18 Whole Genome Sequencing – Ch 7

Thu Sep 20 Gene Expression Profiling – Ch 8

Tue Sep 25 Presentation 2: Transcriptomics of Neuropathology

Thu Sep 27 Epigenetic Profiling – Ch 9

Tue Oct 2 Integrative Genomics and the Microbiome – Ch 10

*Thu Oct 4 3:00 – 4:30 Mid-Term Exam*

***Tue Oct 9******Fall Break***

Thu *Oct 11* Presentation 3: Environmental determinants of the Microbiome

Tue Oct 16 Predictive Health Genomics – Ch 5

Thu Oct 18 Inflammatory Disease – Ch 11

Tue Oct 23 Auto-immune Disease – Ch 11

Thu Oct 25 Presentation 4: Somatic neuronal mutations with age

Tue Oct 30 Metabolic Syndrome – Ch 12

Thu Nov 1 Type 2 Diabetes – Ch 12

Tue Nov 6 Cardiovascular Disease – Ch 13

Thu Nov 8 Presentation 5: Personalized organoid models of Colorectal Cancer

Tue Nov 13 Breast and Prostate Cancer – Ch 14

Thu Nov 15 Lymphoma, Lung, and Skin Cancer – Ch 14

Tue Nov 20 Presentation 6: Genetics of educational attainment

**Thu Nov 22** **Thanksgiving**

Tue Nov 27 Psychiatric Genetics - Ch 15

Thu Nov 29 Cognitive decline – Ch 16

Tue Dec 4 Ageing Final Exam Take-home due

Current Literature for **Human Genetics**, BIOL 4545 Fall 2016

1. Ebenesersdóttir et al *Science* **360**: 1028-1032 Jun 1, 2018

“Ancient genomes from Iceland reveal the making of a human population”

2. Gandal et al *Science* **359**: 693-697 Feb 9, 2018

“Shared molecular neuropathology across major psychiatric disorders parallels polygenic overlap”

3. Rothschild et al *Nature* **555**: 210-215 Mar 8, 2018

“Environment dominates over host genetics in shaping human gut microbiota”

4. Lodato et al *Science* **359**: 555-559 Feb 2, 2018

“Aging and neurodegeneration are associated with increased mutations in single human neurons”

5. Vlachogiannis et al *Science* **359**: 920-926 Feb 23, 2018

“Patient-derived organoids model treatment response of metastatic gastrointestinal cancers”

6. Lee et al *Nature Genetics* **50**: 1112-1121 August, 2018

“Gene discovery and polygenic prediction from a genome-wide association study of educational attainment in 1.1 million individuals”