

## CHAPTER 1 – INTRODUCTION TO GENETICS

### I. SYLLABUS

- A. General info
- B. Grading
  - 1. Homework
  - 2. Exams
  - 3. Labs

### II. GENETICS

- A. What is genetics???  
Definition-often defined as the science that deals with heredity and variation.  
Genetics really is a study of genes, the fundamental physical and functional unit (a section of DNA) that carries information to the next generation.
- B. Three main subdivisions
  - 1. Transmission/Mendelian/Classical: focuses on the transmission of traits from generation to generation.
  - 2. Molecular: focuses of the genetic material itself (genes, gene products, and expression of genes)
  - 3. Population: focuses of the extent of genetic variation within and among populations
- C. Why is the study of genetics important and interesting???
  - 1. Transmission of genetic information serves as a link between generations in every species.
  - 2. Genetics is central to human affairs (food, health).
  - 3. Genetic information is the basis for every process and structure in an organism.
  - 4. The three main approaches to studying genetics unify the study of biology.
  - 5. The doubling time for general scientific knowledge is 10 years – for genetics 5 years.
- D. Organization of this class  
Present transmission genetics before molecular genetics because (1) easiest for most students to understand transmission genetics because traits can be see (2) transmission genetics developed first and everyone likes a good story.

### III. HISTORY

- A. Prehistoric
  - 1. 5000 – 1000 B.C. : Archeological evidence that documents the domestication of animals and the cultivation of plants. For example, Assyrian carving reflects the pollination of the date palm. This suggests that the people must have known that traits were passed down and that they could select for hardier varieties.
  - 2. Biblical times: (Genesis Chapter 30) Jacobs's herds of goats. Jacob kept goats for his father-in-law. In return, he only asked that he keep the spotted goats in the solid herd. The spotted goats were removed from the herd. However , the

solid goats still produce spotted progeny. Thus, Jacob's spotted flock continued to grow and he became very rich.

3. Hindu's observed that certain diseases "ran in the family". This led to the belief that children inherited ALL their parents' traits. In fact, the law of man says that "a man of base descents can never escape his origins". Hence, the basis for the caste system.

#### B. The Greeks

1. 500-400 B.C. Hippocrates thought that male semen carried the heredity material. He also proposed that there was a similar fluid in the female.

Specifically, he proposed that the fluids contained "humors" that were the barers of heredity that had been collected from all portions of the body. At conception, a sort of battle of the humors ensued and whichever won determined the traits of the progeny.

2. 384-322 B.C. Aristotle thought that only the male was responsible for contributing to heredity. The female's contribution was just to provide the raw material. He proposed that the male semen contained a "vital heat" capable of producing an offspring in the same form as the parent but NOT because it contained preformed parts.

C. The Roman's and the Middle ages – no real advances. In fact, many wrong ideas like spontaneous generation prevented any real theories from emerging.

#### D. The Dawn of Modern Biology

##### 1. 1600's

a) Prevailing theory was the theory of preformation (sex cells contained complete miniature adults).

b) In contrast, William Harvey put forth the theory of epigenesis (new structures are not present originally but instead arose de novo during development)

##### 2. 1700's

a) Prevailing theory was the fixation of species (organisms remain unchanged from their moment of appearance on earth).

b) Joseph Gottlieb Kolreuter showed that when he crossed two distinct lines of tomatoes, he got a new, hybrid line. However, he did not realize the significance of these findings due to the prevalence of the fixation of the species theory.

##### 3. 1800's

a) John Dalton: The atomic theory (all mater is composed of small, indivisible units called atoms)

b) Matthias Schleiden and Theodor Schwann: The cell theory (all organisms are composed of basic units called cells which are derived from preexisting cells)

c) Charles Darwin: The theory of natural selection (those organisms with heritable traits that better adapt them to their environment are better able to survive and reproduce; therefore, over a long period of time, slight variations will accumulate). The theory met with much criticism partially because Darwin could not provide a theory for how variation occurred and was transmitted.

- d) August Weismann: Proposed that there were two kinds of materials in the body. Somatoplasm made up the body tissues and such, while germplasm was the material that provided the continuity among succeeding generations of individuals. This emphasis on the genetic material was a major advance in thinking about heredity.
- e) Mendel – Father of modern genetics (discussed in more detail later)
- 4. Early 1900's
  - a) Carl Correns, Hugo de Vries, and Erik von Tschermak rediscover Mendel's work.
  - b) Chromosome theory of inheritance (discussed in more detail later)
- E. The Dawn of Molecular Biology (1940's-present)

#### **IV. BASIC GENETIC CONCEPTS**

- A. Genetics
- B. Gene
  - 1. Chemical: DNA that encodes gene products whose expression (or lack of) results in certain traits
  - 2. Functional: unit of heredity/ information storage unit
- C. Chromosome
  - 1. long DNA molecule associated with proteins that contains genes in a linear array at a location known as a locus
  - 2. different species on plants and animals have different numbers of chromosomes; most have homologous pairs because one comes from mother and one from father
- D. How is genetic information transmitted?  
Genotype → DNA → mRNA → protein → function → phenotype