INTRODUCTORY GENETICS
BIOL 153

Dr. Kwadwo Boampong (BSc, MSc, MSc, PhD)

Kwadwo.boampong@knust.edu.gh

nanab300@gmail.com

General Comments

- Lateness to class is not entertained under any circumstances. You may be turned away once the lectures get under way.

- Lectures and labs are formal sessions and students are advised to dress properly. Would not allow baseball caps, hats, track suits, sleeveless T-shirts, improper attire, etc.

- ***Mobile phones MUST stay switched off or in silence mode during the entire period of a class. If a phone bells to cause a distraction, it will be confiscated till the end of the semester.***

- Getting to the end of the semester, you would be given the opportunity to ***candidly evaluate in confidence*** how the course had impacted on your scholarship.

- Plagiarism and cheating in any form by either copying from a fellow student or copying verbatim from internet sites and textbooks would ATTRACT THE SEVEREST FORM OF SANCTIONS. THE CANDIDATE SHALL LOSE ALL CONTINUOUS ASSESSMENT MARKS.

Midsemester Exams and Continuous Assessment

- Both the mid-semester and the continuous assessment will make up 30% semester mark.
- The final paper (end of semester) will also make up 70%.
- Mid-semester exams will be organized in …….

Recommended Textbooks

- Principles of Genetics; 8th Edition (1991). Gardner, E. J.; Simmons, M. J. & Snustad D. P.
- Principles of Genetics; 4th Edition (1993). Tamarin, R. H.
- Modern Genetics; 2nd Edition (1984)Ayala, F. J. & Kiger Jr, J. A.
- Concepts of Genetics; (1983). Klug, W. S. & Cummings, M. R.

Course Objectives

- This introductory course in Genetics is run over two semesters as BIOL 153 (Introductory Genetics) and BIOL 154 (Population Genetics and Evolution)

- The two will introduce students to the science of genetics and provide a broad overview of the entire scope of genetics.

- Students will appreciate the scope of the course through lectures, laboratory work and assignments that ensure that students read substantially on their OWN.

Course Outline

- The Course will focus on the introduction to heredity:
  - Preformation
  - Epigenesis
  - Pangenesis and Lamarckism
  - Mendelism: Independent assortment, factors which influence Mendel ratios

- Cellular basis of inheritance
  - Mitosis and meiosis
  - Meiosis and gene segregation with examples of human genetic disorders

Course Outline cont'd

- Variations in chromosome number
- Chromosomal abnormalities and human diseases
- Sex determination, sex linkage and pedigree analysis
- Gene interaction
- Multiple alleles
- DNA structure and function

What is Genetics?

- It is the branch of biology that deals with *heredity* and *variation*.

- The hereditary units that are transmitted from one generation to the next (i.e. inherited) are called *genes.*

- Genetics is concerned with the *transmission*, *expression*, and *evolution* of genes (*i.e. the molecules that control the function, development and the ultimate appearance of individuals*).

Early Ideas About Heredity

- The existence of biological heredity is obvious in the resemblance of children to their parents.

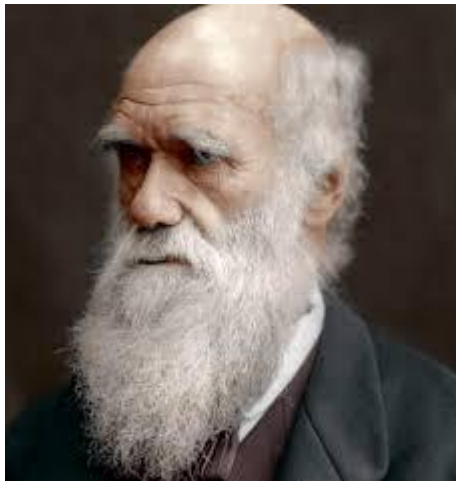
- It was long known that in humans and animals, the sexual act was involved in procreation.

- It was therefore natural to assume that semen was the carrier of heredity, but how this was accomplished proved difficult to establish.

Genetics Theories

- Pangenesis
- Lamarckism
- Preformation
- Epigenesis

Jean-Baptiste Lamarck



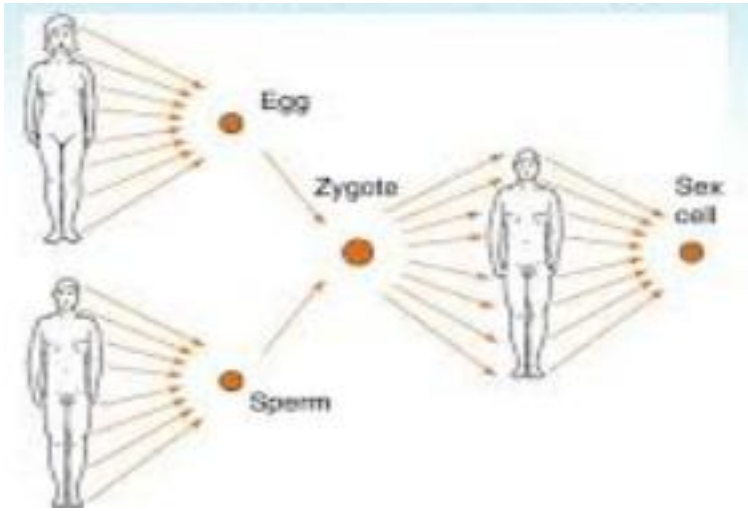
Charles Darwin

Pangenesis

- Every structure which is inherited will pass on its characteristics by contributing a small amount to the gonads.

- Particles (**pangenes or gemmules**) formed in each body part are transported through the blood vessels to sperms/eggs and then inherited by offspring.

- Proposed by Charles Darwin



Pangenesis

- The similarity between parents and offspring was accounted for by postulating that the pangenes or gemmules formed in each part of the body reflected the characteristics of that part.

- This theory was supported by Aristotle and other ancient Greeks. It prevailed for many centuries into the 19th Century.

Lamarckism

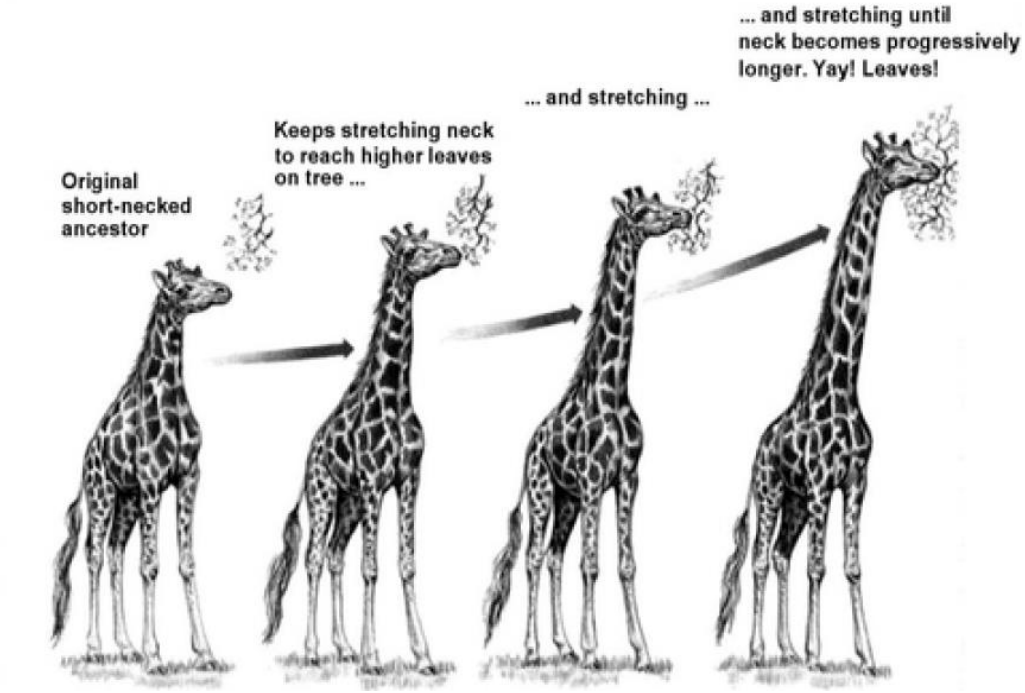
- Evolution was the result of acquired characteristics accumulated over many generations:

  e.g. in body modifications such as muscle development in an athlete, these characteristics could be transmitted to the offspring if the semen formed throughout the body would reflect such modifications.

Lamarckism

- Another explanation was that organisms acquired traits during their life-times and then passed on those traits to their offspring.

e.g. tattoo or scar would be inherited as tattoo or scar pangenes.



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Germplasm Theory

- The first serious challenge to the theory of pangenesis was made by August Weismann.

- He proposed, instead, the germplasm theory. (Read more about this theory)

Preformation

- Explains the differentiation that takes place in the zygote which contains tiny amount of material into a human being.

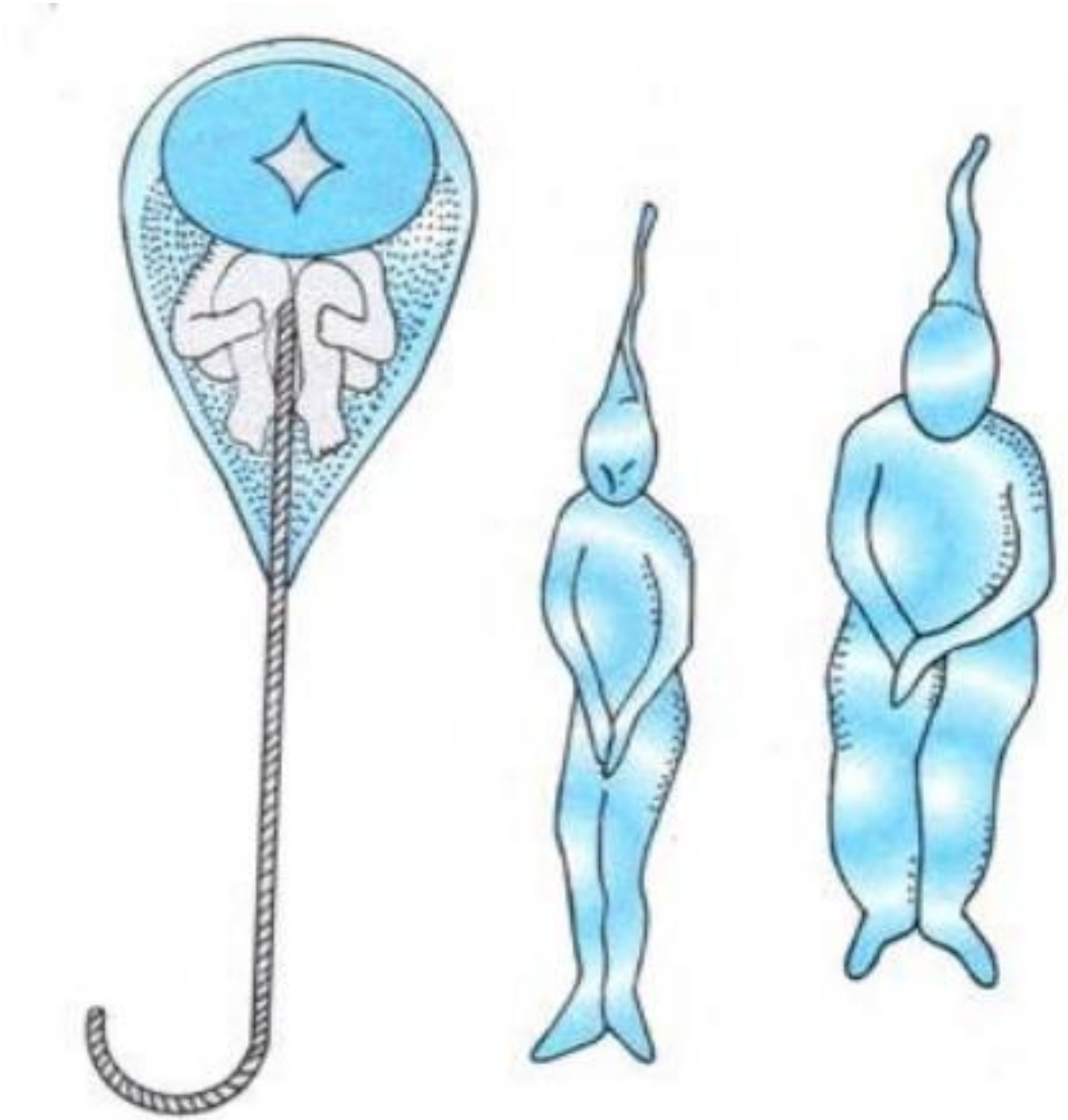
E.g., after cell proliferation, there is differentiation into arms, legs, liver, etc. with diverse shapes and functions.

Preformation

- In the late 17th century, an observer using a primitive microscope and a lively imagination claimed to have seen a miniature figure called ***homunculus*** of a man inside the human spermatozoon.

- Jan Swammerdam and Charles Bonnet discovered this theory and was supported by other scientists at the time.

***Homunculus*: little man in a sperm cell**



Preformation

- The human body, according to some preformationists, was already preformed in the spermatozoon.
- Development was simply a matter of growth of the tiny *homunculus*.
- There were the "spermatists" and the "ovists".

Epigenesis

- Kasper Wolff and Karl Ernst von Baer proposed this theory in the 18th and 19th centuries.
- This theory discredited or disproved Pangenesis, Lamarckism and Preformation.
- According to this theory, the sex cells are largely homogenous bits of organic matter and contain nothing resembling the body that will develop from them.

Epigenesis

- Development is differentiation as well as growth.
- The various tissues and organs gradually form from the zygote through a series of transformations.
- They provided a fairly accurate description of the embryonic development of a chick, where there is a gradual change from the egg to the foetus and finally to the adult body.

Conclusions

- What is transmitted from parents to offspring is a set of “instructions”, i.e., the genetic information in the DNA, which interacting with the environment, direct the development of the organism.

- Theory of epigenesis was more accurate than that of preformation.

- The organism is not preformed in the zygote.

Google classroom

- https://classroom.google.com/c/MTk3MDQ3MTg3MjY4?cjc=fu6jk4q

- **Class code:** *fu6jk4q*