Teacher's Guide: Genetic Basis of Inheritance and Variation

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Thank you for considering the genetic basis of variation module for your class. I hope you and your students enjoy the experience. This short teacher's guide is written as a supplement to the video Teacher's Guide included at the end of the video segments. So, if you have not yet viewed that, it would be best to view it now, and then return here! Thanks!
This module is different from other modules as it's not an applied module. The main objective of this module is to understand the genetic basis of variation among individuals of a certain species like human.

This module doesn't require many prerequisites; it just requires general knowledge of DNA as the genetic material as well as knowledge of meiosis; that's how gametes are produced in the male and female sex organs by gametogenesis.

In the first segment of the module, a group of 4 photos will be shown to the students and the students will try to identify each photo and tell some of the similarities and differences between members in each photo. The idea is to attract student attention to the topic. Then, students will be challenged with the question why sons and daughters are different from their parents and from their brothers and sisters and what are the mechanisms responsible for this variation?

In the second segment, after introducing genes at the beginning, the two genetic hypotheses; the blending hypothesis and the particulate hypothesis, that account for passing of traits from parents to offspring are discussed. Here you should emphasize that the link between parents and children is genes and genes are responsible for all of children's traits. Mendel work will be summarized in this segment.

In the third segment, I started with giving them the answers for the second activity then I start focusing on how genes can pass from parents to offspring through sexual reproduction and at the end of this segment we get to our main topic; the mechanisms leading to genetic variation. I will draw the student attention to that fact that the original source of genetic variations are mutations which results in creation of alleles and it's the reshuffling of alleles during sexual reproduction that causes variation.

The first mechanism that leads to genetic variation will be discussed and that's crossing over. First, I will explain the idea of homologous chromosomes, sister chromatids, non-sister chromatids, then I will introduce crossing over, when it takes place, chiasma formation, and results of crossing over.

In the fourth segment, independent assortment of chromosomes, the second mechanism that leads to variation, will be introduced using a simple activity using two pairs of colored pencils.

The idea of homologous chromosome (sister vs. non-sister chromatids) will be clarified further and the possible arrangement of homologous chromosomes during metaphase I of meiosis will be explained with a diagram that shows two pairs of homologous chromosomes.

The formula to calculate possible combinations will be introduced; 2^n where n is the haploid number of chromosomes (or the number of pairs). The possible number of combinations in case of 4 chromosomes (n=2) is $2^2=4$

The last mechanism that results in variation is random fertilization in which the possible number of combination resulting form independent assortment of chromosomes and crossing over in each gamete is multiplied upon fertilization

At the end of this segment, I want the students to calculate the possible combinations which result from random assortment, crossing over and random fertilization, and to calculate the probability that two individuals will have the same genetic makeup knowing that the diploid number of chromosomes in human is 46.

At the end of the module, the students should know why they are different from each other and why children are different from their parents and why brother and sisters are also different.

You as teacher in charge of the class can stop the video at any time. There is no need to wait until the pre-planned end of any given video segment.
We welcome your feedback. Please feel free to contact me at amjada@just.edu.jo if you and your students have any comments or suggestions.