**On bad genes and how to detect them**

**Abstract:** In this activity students use jigsaw puzzles and a pedigree to learn how to identify a bad gene that is responsible for a genetic disorder.

**Appropriate for:** Middle-High School: grades 7-12 (Life Science)

**Supporting material:**

* link to game at the University of Utah: [http://teach.genetics.utah.edu/content/begin/dna/chromosome\_map.html](https://uwmail.uwyo.edu/owa/redir.aspx?C=57442756cbb043b2b6822f9838a716f6&URL=http%3a%2f%2fteach.genetics.utah.edu%2fcontent%2fbegin%2fdna%2fchromosome_map.html" \t "_blank)
* Power Point (attached)

**Time:**

**Option 1:** power point, back ground information, and activity from above link (U. Utah): 90 min

**Option 2:** U. Utah game only: Class Time: 30 minutes

**Key concepts:**

DNA carries the genetic information for life in forms of genes. The amount of this information is enormous. In order to fit it into cells, genes are compacted on chromosomes. Each human being has the same set of chromosomes. The fact that each person is unique is because the information carried by the genes is slightly different, much like a blueprint for a house allows for variations in size, shape, color, etc. In this way, different forms of genes (alleles) lead to different traits. Unfortunately, some of this information carried by DNA can be faulty. Not every alteration is bad, but some can lead to genetic disorders. The question that scientists are trying to solve is to identify the bad genes. This is like isolating a bad apple from good ones. But it is harder, because we do not know which ‘color’ the bad gene (the specific allele) has. A pedigree that shows the relationship between affected and unaffected individuals can help identify both the faulty gene, as well as its location on the chromosome map.

**Vocabulary:** DNA, gene, chromosome, allele, dominant gene, recessive gene, mutation, genetic disorder

**Learning objectives:**

Students will learn that humans have the same set of genes, arranged in the same order along the 23 pairs of chromosomes.

It is the type of information that is carried by the genes what varies between individuals. This is what gives us individual traits.

Some changes in the different forms of genes are very harmful. This is when the DNA corresponding to the gene is mutated such that the gene product is faulty. Instead of encoding for the correct protein this may lead to medical conditions known as a genetic disorder.

Scientists try to locate the faulty gene. However, since there are so many different versions of genes that encode different traits without causing a disorder, it is challenging to identify which of the genes is defective, and in which way.

This can be illustrated by a small set of genes, carried by only a few chromosomes. The faulty gene will stick in that it will be different from those of healthy individuals. In real life, this is hard, because humans have about 29,000 genes on 46 chromosomes.

Just as our genetic setup is inherited, genetic disorders are too. Students will learns how scientists use pedigrees to help find the exact location of defective genes that is responsible for the medical disorder.

**Lesson:**

Start with the names of some of the new concepts (mutation, gene, allele, etc), and ask students to match them to a set of possible answers. Tell them they don’t need to be right because they will learn this during the class. Revisit at the end of the class period.

Give a power point illustration that explains the background information (attached)

Engaging questions: Do different people have different genes? How is the genetic information carried in our bodies? Genetic material relates to the blueprint of building a house. What would this mean relating to genes? What are traits? What can go wrong? What are examples of mutations? How can bad genes be detected (illustrate on small example using bad apples illustration as well as for small subset of genes/chromosomes). How do you detect the faulty genes for a real disorder that involves many more genes? How can a pedigree help? What are the key points that distinguish affected and unaffected people ? How does this relate to the faulty gene?

**Activity:**

Hand out the student’s pages from the University of Utah Teacher Guide, ‘Finding a Gene…’. Ask students to identify the gene for the disorder. (Answers included).

If time permits, move on to the questions on the Teacher’s guide that involve family relationships and pedigree.

**Materials needed:** color printed handout (Univ. Utah), power point.

**Reference:**

FINDING A GENE ON THE CHROMOSOME MAP, - University of Utah [http://teach.genetics.utah.edu/content/begin/dna/chromosome\_map.html](https://uwmail.uwyo.edu/owa/redir.aspx?C=57442756cbb043b2b6822f9838a716f6&URL=http%3a%2f%2fteach.genetics.utah.edu%2fcontent%2fbegin%2fdna%2fchromosome_map.html" \t "_blank)