Principles of Biomedical Science

Virtual Learning

9-12 / PLTW® PBS

April 23, 2020

Principles of Biomedical Science

9-12/PLTW® PBS
Lesson: April 23 2020

Objective/Learning Target:

Students will be able to: Students will research, explain, and describe what hypercholesterolemia is and how it is passed through a family using Pedigrees and Punnett Squares. *(Reference: PLTW® 4.3.2 Hypercholesterolemia)*

Let’s Get Started (Bell Ringer):

Watch Videos:

High Cholesterol and Familial Hypercholesterolemia, Animation

Your Health: Familial Hypercholesterolemia with Stanford Cardiologist Joshua Knowles, MD, PhD

Lesson/Activity:

Read the article from National Human Genome Research Institute *About Familial Hypercholesterolemia* in your notebook or a seperate piece of paper make a list of symptoms for this disease.

Answers:

The major symptoms and signs of familial hypercholesterolemia are:

- High levels of total cholesterol and LDL cholesterol.
- A strong family history of high levels of total and LDL cholesterol and/or early heart attack.
- Elevated and therapy-resistant levels of LDL in either or both parents.
- Xanthomas (waxy deposits of cholesterol in the skin or tendons).
- Xanthelasmas (cholesterol deposits in the eyelids).
- Corneal arcus (cholesterol deposit around the cornea of the eye).
- If angina (chest pain) is present, it may be sign that heart disease is present.

Lesson/Activity continued:

Read the article from MAYO CLINIC *Familial hypercholesterolemia* in your notebook or a seperate piece of paper make a list of treatments for this disease.

Answers:

Lifestyle changes: Exercising and eating a healthy low-fat diet, are the first line of defense against high cholesterol. Specific recommendations include:

- Reducing the amount of saturated fat in your diet to less than 30 percent of your daily calories.
- Consuming 10 to 20 grams of soluble fiber a day. Good sources include oats, peas, beans, apples, citrus fruits and carrots.
- Increasing physical activity.
- Maintaining a healthy body weight.

Medications:

Statins, Bile-acid-binding resins, Cholesterol absorption inhibitors

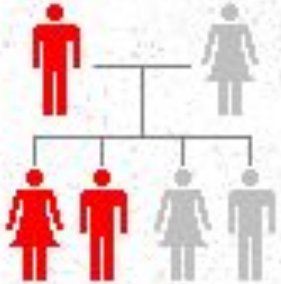
Lesson/Activity continued:

You should already know how to make a Punnett Square but just in case you need to brush up watch the following video on how the process works. Learn Biology: How to Draw a Punnett Square and a short article of multiple examples. Probability of Inheritance. In your notebook or a seperate piece of paper take notes over how to make a punnett square.

Answers:

Notes will depend on background of student, a short example below: this is a dominant disorder so the following rules will apply.

	A	a
a	Aa	aa
a	Aa	aa



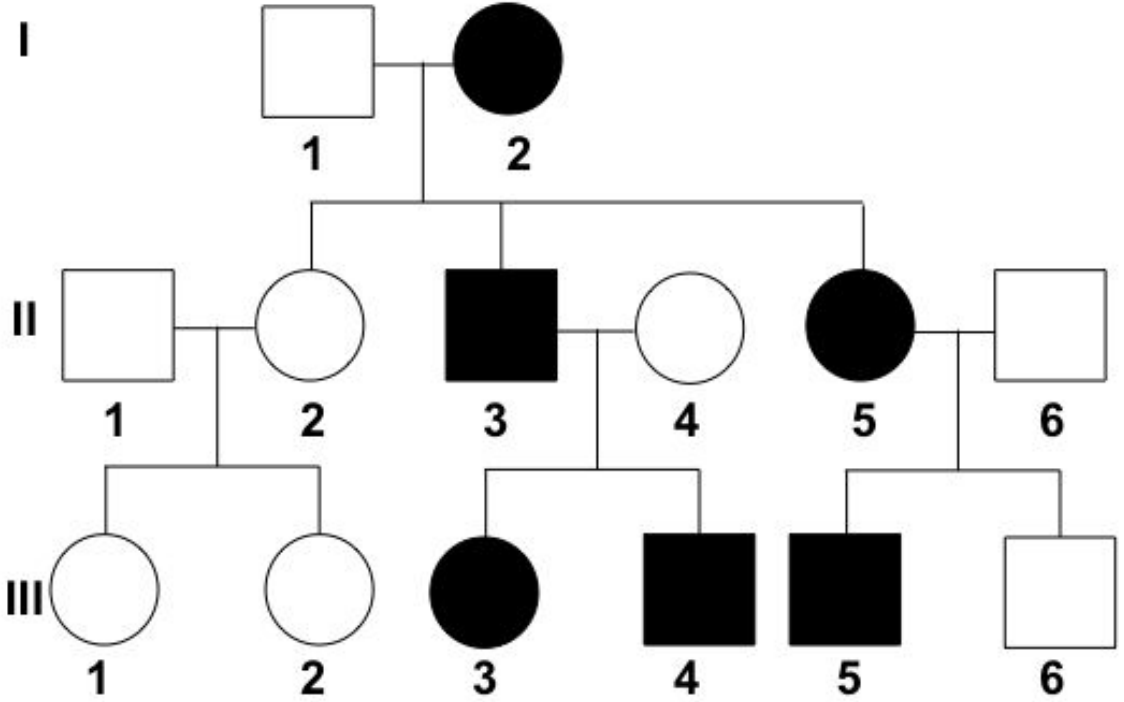
If only one parent has a single copy of a dominant allele for a dominant disorder, their children will have a 50% chance of inheriting the disorder and 50% chance of being entirely normal.

Lesson/Activity continued:

You should already know how to make a explain a Pedigree Chart but just in case you need to brush up watch the following video on how the process works. Pedigrees / Classical genetics / High school biology / Khan Academy and a short article of multiple examples. Khan Academy Pedigrees Review. In your notebook or a seperate piece of paper take notes over how to make and read a Pedigree Chart.

Answers:

Example:
Autosomal Dominant
Train (this is what FH is)



Practice:

Start by… Drawing a Punnett Square. Remember from the bell ringer video the FH gene is an Autosomal Dominant factor and only requires one gene to end up with the trait. Draw a Punnett Square showing a man who is heterozygous for the trait and a woman who is pure recessive. We will use the letter (H) for Hypercholesterolemia be sure to fill in the Punnett Square.

Answers:

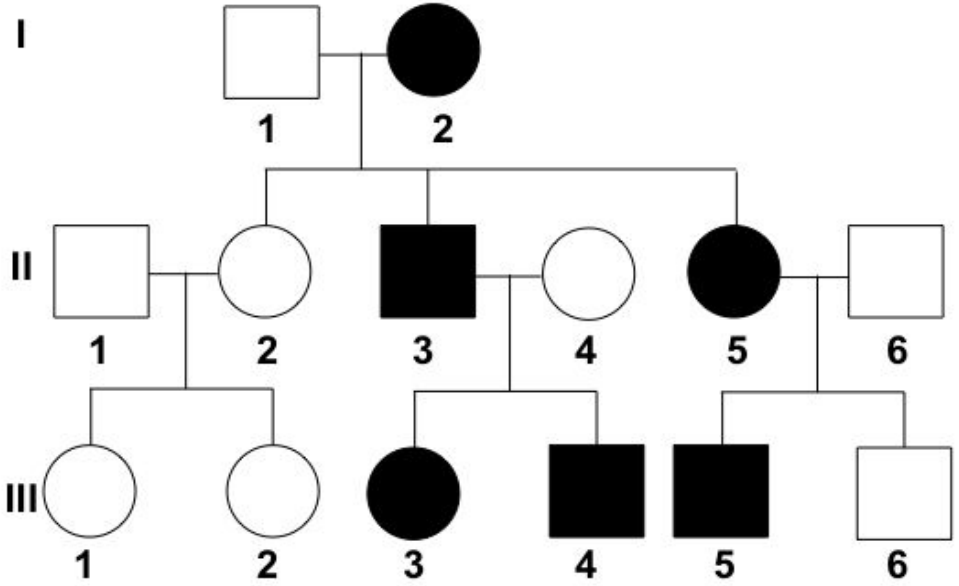
Male

	H	h
h	Hh	hh
h	Hh	hh

Female

Additional Practice:

Answer 10 facts about the Pedigree Chart below



Answers:

Answers May Vary...

1. There are 3 Generations in the chart
2. There are 7 males and 7 females
3. The couple in Generation 1 had 3 children
4. The couple in Generation 1 had 1 boy and 2 girls
5. Each couple in Generation 2 had 2 children
6. None of the Individuals in Generation 3 have a partner
7. The children of couple 3 & 4 in generation 2 have 2 affected children.
8. In Generation 1 female #2 has the trait
9. In Generation 2 male #3 and female 5 has the trait
10. In Generation 3 female #3 and males #4 & 5 have the trait