**Class notes ch. 13.1**

**Vocabulary**

1. **Sex chromosomes** – A pair of chromosomes carrying genes that determine whether a person is male or female.
2. **Sex-linked gene**- A gene that is carried on a sex (X or Y) chromosome.
3. **Carrier**- A person who has one recessive allele and one dominant allele for a trait.

**What Are Some Patterns Of Human Inheritance? Pg. 444**

Look at the students in your classroom. Some have curly hair and others have straight hair. Some people are tall, some are short and others are in between.

The different traits you see are determined by a variety of inheritance patterns.

Some human traits are controlled by single genes with 2 alleles, and others by single genes that have multiple alleles. Still other traits are controlled by many genes that act together.

Single Genes With Two Alleles

Human traits that are controlled by a single gene with either a dominant or a recessive allele, such as a dimpled chin, or widow’s peak produce two distinctly different *physical appearances, or phenotypes.*

Single Genes With Multiple Alleles

Some traits are controlled by a single gene that has more than two alleles (multiple alleles- 3 or more forms of a gene that code for a single trait).

Human blood type is controlled by a gene with multiple alleles. There are 4 main blood types- A, B, AB, and O.

Three alleles control the inheritance of blood types.

AB blood type is codominant which means that both alleles for the gene are expressed equally. If you get an A allele from one parent and a B allele from the other you can have type AB blood.

**Traits Controlled by Many Genes**

Some human traits show a large number of phenotypes because the *traits are controlled by many genes*. The alleles of the different genes act together as a group to produce a single trait.

At least 4 genes control height in humans. You can see the extreme range of heights in the picture.

Skin color is another human trait

that is controlled by many genes.

Some Genetic Traits

.**What are the Functions of the Sex Chromosome? Pg. 446**

The body cells of humans contain 23 chromosome pairs, or 46 chromosomes. The sex chromosomes are one of these pairs.

The sex chromosomes carry genes that determine a person’s gender as being either male or female. They also carry genes that determine other traits.

**Girl or Boy?**

The sex chromosomes are the only

chromosome pair that doesn’t always match.

Girls have 2 X chromosomes XX

Boys have an X and a Y XY

*The Y chromosome is much smaller*

*than the X chromosome.*

**Sex Chromosome and Fertilization pg. 447**

While all eggs carry one X chromosome, sperm cells carry either an X or a Y chromosome. When an egg is fertilized by a sperm cell, the sex chromosome carried by the sperm cell determines whether a child will be a girl (X) or a boy (Y).

So…. The father determines the sex of the baby!!!!!!

**Sex- Linked Genes pg. 448**

Genes found on the X and Y chromosomes are often called sex-linked genes because their alleles are passed from parent to child *on a sex chromosome*. Traits controlled by sex-linked genes, such as colorblindness, are called sex-linked traits.

Sex-linked genes, like other genes, can have dominant and recessive alleles. In females, a dominant allele on an X chromosome will mask a recessive allele on the other X chromosome. But in males, *because the Y chromosome is much smaller than the X chromosome, there is usually no matching allele on the Y chromosome to mask the allele on the X chromosome*. So any allele on the X chromosome, even a recessive allele, will produce the trait in the male who inherits it.

**Inheritance of Colorblindness pg. 449**

Colorblindness is a trait controlled by a recessive allele on the X chromosome. Many more males than females have red-green colorblindness.

*A carrier* is a person who has one recessive allele for a trait and one dominant allele. A carrier of a trait controlled by a recessive allele does not express the trait, but can pass the recessive allele on to his or her offspring.

* In the case of sex-linked traits, only females can be carriers because they are the only ones who can carry two alleles for the trait.

**Classnotes ch. 13.2**

**VOCABULARY**

**genetic disorder**- An abnormal condition that a person inherits through genes or chromosomes.

**Pedigree-** A chart that shows the presence or absence of a trait according to the relationships within a family across several generations.

**Karyotype-** A picture of all the human chromosomes in a cell grouped together in pairs and arranged in order of decreasing size.

**How Are Genetic Disorders Inherited In Humans? Pg. 451**

A ***genetic disorder*** is an abnormal condition that a person inherits through genes or chromosomes.

**Caused by:**

* Mutations in the DNA of genes
* By changes in the overall structure or number of chromosomes.

**Cystic Fibrosis**

**Cystic fibrosis** is a genetic disorder in which the body produces ***abnormally thick mucus***. In the lungs, this can cause difficulty breathing. A person with cystic fibrosis inherits one mutated allele from each parent.

Sickle-Cell Disease

* **Sickle-cell disease** is caused by a mutation that affects hemoglobin. Hemoglobin is a protein in red blood cells that carries oxygen.

The red blood cells of people with the disease have a sickle, or crescent shape. Sickle-shaped red blood cells cannot carry as much oxygen as normal cells and clog blood vessels. The allele for the sickle-cell trait (S) is codominant with the normal allele (A). A person with one normal allele and one sickle-cell allele (AS) will produce both normal hemoglobin and abnormal hemoglobin. This person usually does not have symptoms of the disease. He or she has enough normal hemoglobin to carry oxygen to cells. A person with two sickle-cell alleles (SS) will have the disease.

**Hemophilia**

**Hemophilia** slows or prevents blood clotting so that even small bumps can cause bleeding. Because hemophilia is caused by a recessive allele on the X chromosome, it is more common in males than females.

**Down Syndrome   
pg. 452**

In **Down syndrome**, instead of a pair of chromosomes, a person inherits three copies of ***chromosome 21***. People with Down syndrome experience some degree of mental retardation and often have heart defects.

**How are Genetic Disorders Traced, Diagnosed, and Treated?  
 Pg. 453**

**Tools used by doctors to trace and diagnose genetic disorders are:**

* Pedigrees
* Karyotypes
* Genetic testing

People with genetic disorders are helped through medical care, education, and job training.

Pedigrees and Karyotypes

A **pedigree** is a chart or “family tree” that tracks which members of a family have a particular trait.

**Circle= Female**

**Square= Male**

A **karyotype**, a picture of all the chromosomes in a cell, can be usedto determine whether a person has

the correct number of chromosomes.

**Genetic Counseling**

Couples that have a family history of a genetic disorder may turn to a genetic counselor for advice. They can find out their chances of having a child with the disorder and learn how to prepare to raise him or her. People with genetic disorders face serious challenges. Yet medical treatments, physical therapy, education, and job training programs can help those affected to live active, productive lives.

**Classnotes ch. 13.3**

**VOCABULARY**

1. **Clone-** Org. that has exactly the same genes as the org. from which it was produced.
2. **Genetic Engineering-** Technique for producing org. with desired traits.
3. **Gene Therapy-** Process that involves inserting copies of a gene directly into a person’s cells.
4. **Selective Breeding-** process of artificially selecting organisms with desired traits to be parents of the next generation.
5. **Hybridization**-breeders cross two genetically different individuals.
6. **Inbreeding**- crossing two individuals that have similar desired characteristics.
7. **Biotechnology**- Application of technological process, invention, or method to living organisms.

**How can Org. be Produced With Desired Traits? Pg. 457**

Due to advances in genetics, DNA evidence can show such things as family relationships or the ability to produce organisms with desirable traits.

**3 Methods of developing organisms with desirable traits:**

* + - * Selective breeding
      * cloning
      * genetic engineering

The process of selecting organisms with desired traits to be parents of the next generation is called **selective breeding.**

**How can Org. be Produced With Desired Traits? Pg. 457**

A [**clone**](http://www.reuters.com/article/2014/05/08/us-ip-dollysheep-idUSKBN0DO1ON20140508) is an organism that has exactly the same genes as the organism from which it was produced. Some plants can be cloned from a stem cutting. The plant that results is genetically identical to its one parent.

**Dolly the Sheep-type clone died 6 yrs. later of progressive lung disease.**

**How Can Organisms be designed with desired traits?457-459**

In the process of **genetic engineering**, genes from one organism are transferred into the DNA of another organism.

**Genetic engineering can produce:**

* + - Medicines
    - Improve food crops.

Many people with diabetes need injections of the human protein insulin. One type of genetically engineered bacterium produces human insulin. DNA for human insulin is inserted into bacterial DNA, which is then inserted into a bacterial cell. The cell and its offspring then produce large amounts of human insulin quickly.

**Genetic Engineering in Other Organisms.   
Pg. 459**

In the future, genetic engineering may correct some human genetic disorders. The process, called gene therapy, will involve inserting copies of a gene directly into a person’s cells. For example, hemophilia might be treated by replacing the defective allele on the X chromosome. Some people are concerned about long-term effects of genetic engineering. For example, some people fear that genetically engineered crops may harm the environment or cause health problems in humans

**How can Org. be Produced With Desired Traits? Pg. 460**

**Two techniques for selective breeding are inbreeding and hybridization.**

In **hybridization**, breeders cross **two *genetically different individuals***.

* A **hybrid organism** has two different alleles for a trait.
* The hybrid organism that results ***is bred to have the best traits of both parents***.

**Artificial Selection pg. 461**

**Two techniques for selective breeding are inbreeding and hybridization.**

**Inbreeding** involves crossing two individuals that have similar desirable characteristics. Inbreeding produces organisms that are genetically very similar.

When ***inbred organisms are mated, the chances of inheriting two recessive alleles are increased. This can lead to genetic disorders.***

**What is the advantage with Biotechnology?**

Biotechnology impacts individuals, society, and the environment. It allows scientists to develop treatments for human diseases and to test for inherited diseases. It can create new jobs, new medicines, and better plants, allowing decreased food prices. It can help or harm the environment depending on its uses.

**Classnotes ch. 13.4**

**VOCABULARY**

**Uses for Genetic Information pg. 464**

* Each person’s genes contain unique information about that particular person’s growth and development.
* Genetic information can be used positively to identify individuals and to learn about health and disease, or negatively to discriminate against people.

**Uses for Genetic Information pg. 465**

***In 2003, scientists working on the Human Genome Project cracked a code that is six billion letters long.***

They identified the DNA sequence of the entire human genome. Scientists continue to research the function of tens of thousands of genes.

An organism’s full set of DNA is called its ***GENOME***

**Uses for Genetic Information pg. 465**DNA Fingerprinting

The DNA technology used in the Human Genome Project can also ***identify people*** and ***show whether people are related***.

Small pieces, or fragments, of a person’s DNA are used to produce a pattern called a DNA fingerprint.

***Except for identical twins***, **no two people have the exact same DNA fingerprint**.

Genetic “fingerprints” can be used to show someone was at a crime scene, to prevent the wrong person from going to jail, and to identify skeletal remains. Saved DNA fingerprints can be used to identify the bodies of unknown soldiers or civilians.

**Genetic Discrimination pg. 466**

As it becomes easier to obtain genetic information, there are concerns about who can access that information and how it might be used. Ethics is the study of principles about what is right and wrong, fair and unfair. Using genetic information in an ethical way means using it in a way that is fair and just. The Genetic Information and Nondiscrimination Act (GINA) of 2008 makes it illegal for health insurance companies and employers to discriminate against individuals based on genetic information. It also makes it illegal for insurance companies and employers to ask or tell an individual that they must have a genetic test done.