

## **Science 24: Dec 11th**

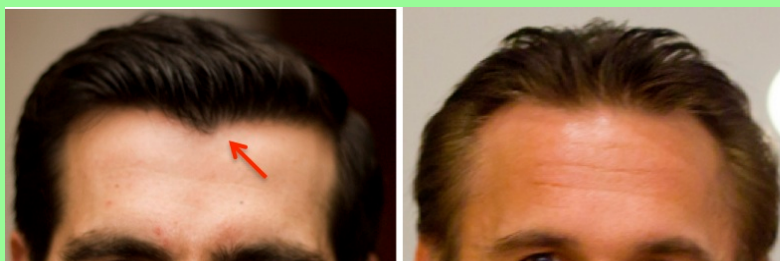
1. Introduction to Inheritance and Genes
2. Structure of DNA and chromosomes
3. Building DNA models

Can you...



Roll	Not Roll
###	

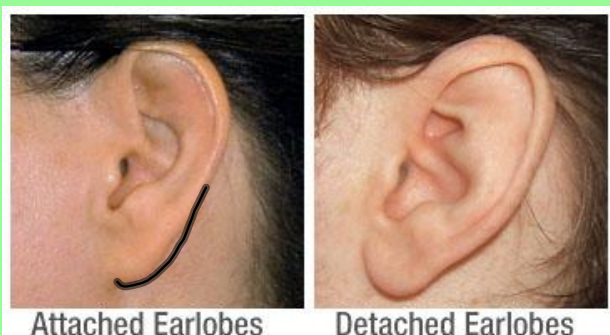
Do you have a widow's peak?



Images courtesy of GregPC



What about your earlobes?



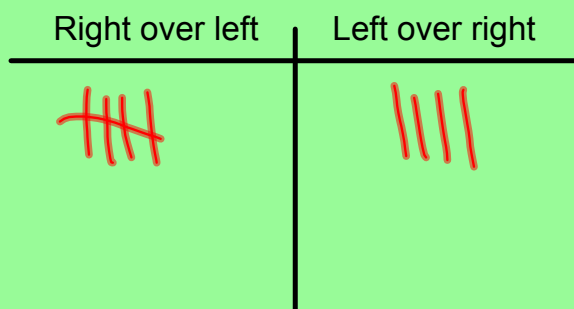
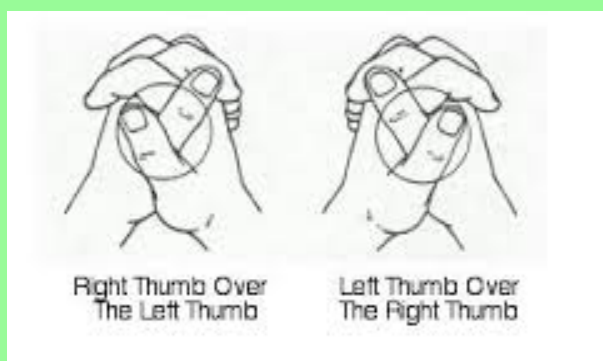
Attached	Detached
 .	

# Dimples?



Dimples	No Dimples
1	

## How do you clasp your hands?



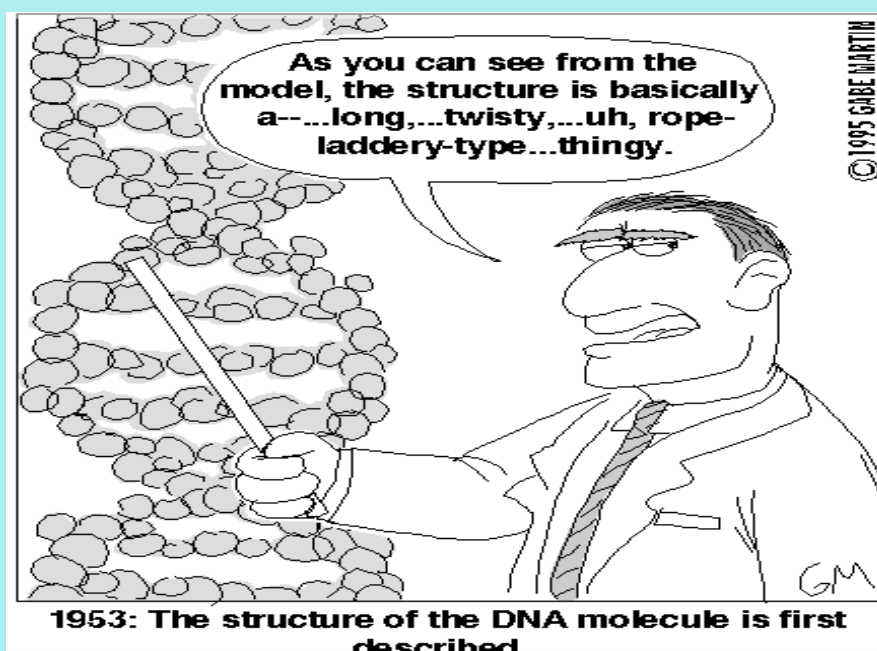
What do all these traits have in common?

Genetic

What other types of traits might fit into this category?

- eye color
- aspects of personality
- hair color
- body type
- eyesight
- cancer
- disease (non-communicable)

# Chapter Twelve



## Genetics and Health



## 12.1 Structure of DNA

Genetics is the study of how characteristics or traits are passed from parents to offspring.

How are genes organized in your body?

A. Your body contains trillions of cells

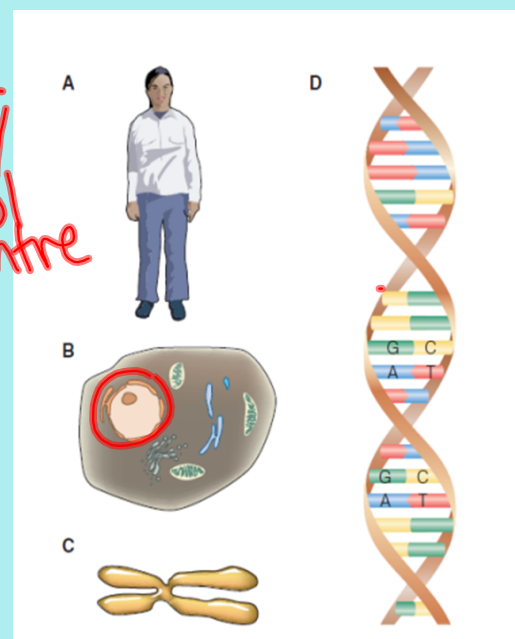
B. Each cell has a nucleus

C. In the nucleus, there are chromosomes

D. Chromosomes are made of double helix shaped molecules called DNA. DNA is divided into segments called genes, which control inherited traits

↳ ex. gene for eye color

twisted ladder



## Structure of DNA

If we take a close-up of DNA what do we notice about the DNA molecule itself?

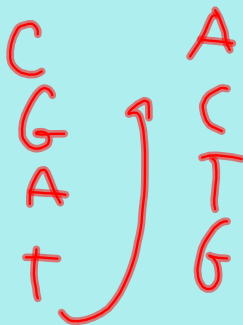


### 1) Base Pairs

- a) **Guanine** >> pair
- b) **Cytosine** >> pair
- c) **Adenine** >> pair
- d) **Thymine** >> pair

### 2) Double-Helix Shape

The order of the base pairs will code for a specific trait that you will inherit from your parents.



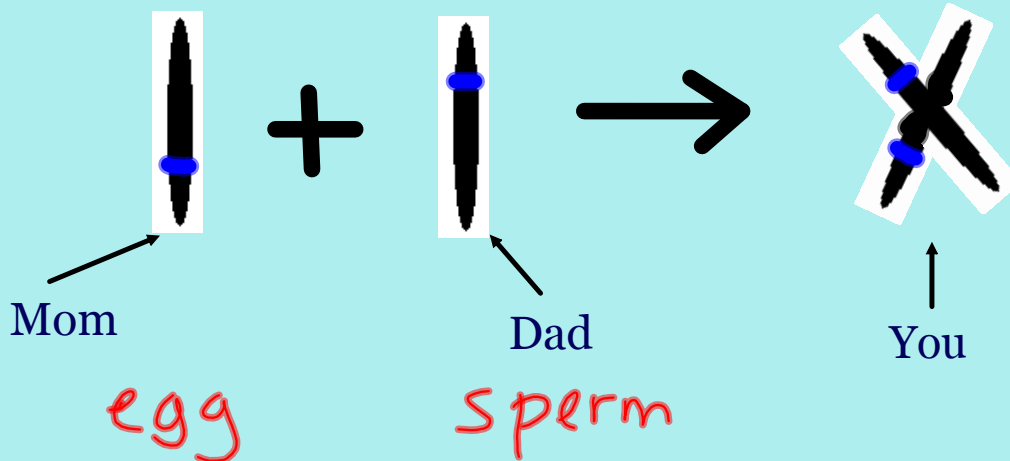
## Chromosomes

Human body contains 46 chromosomes that are arranged in pairs. So, how many pairs of chromosomes will the body have?

23

Why are they arranged in pairs?

One chromosome will come from your mother and one from your father.



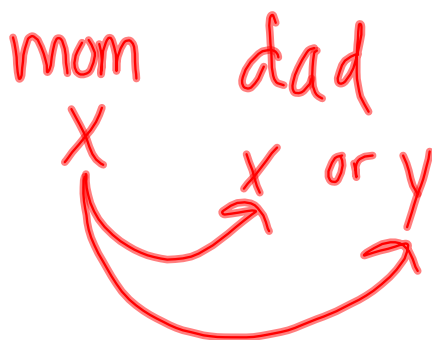
### Karyotype of Human Genome



What do you notice about the chromosomes?

Is there anything that doesn't match?

Why do you think that is?



X + Y = boy  
X + X = girl

Section End

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## **Science 24: May 26th**

1. Review structure of DNA
2. Build DNA out of candy!
3. Ethical questions with genetic research

## Review DNA/chromosomes "5-Minute Quiz"

1. Fill in the blank: Bodies contain cells, cells have a \_\_\_\_\_, where chromosomes are located.

2. What is the purpose of DNA?



3. What is a gene?

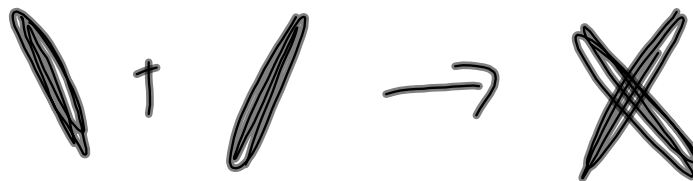


4. Explain the role of DNA in making you who you are.

5. What is the difference in chromosomes between girls and boys?

6. How many chromosome pairs do humans have?

23 total of 46



## Review DNA/chromosomes "5-Minute Quiz"

1. Fill in the blank: Bodies contain cells, cells have a nucleus, where chromosomes are located.

2. What is the purpose of DNA?

Codes for traits- controls the functions of the cell and body

3. What is a gene?

Segment of DNA that codes for a specific trait

4. Explain the role of DNA in making you who you are.

DNA contains genes that determine your various traits.

5. What is the difference in chromosomes between girls and boys?

Boys have an X and Y, girls have X and X

6. How many chromosome pairs do humans have?

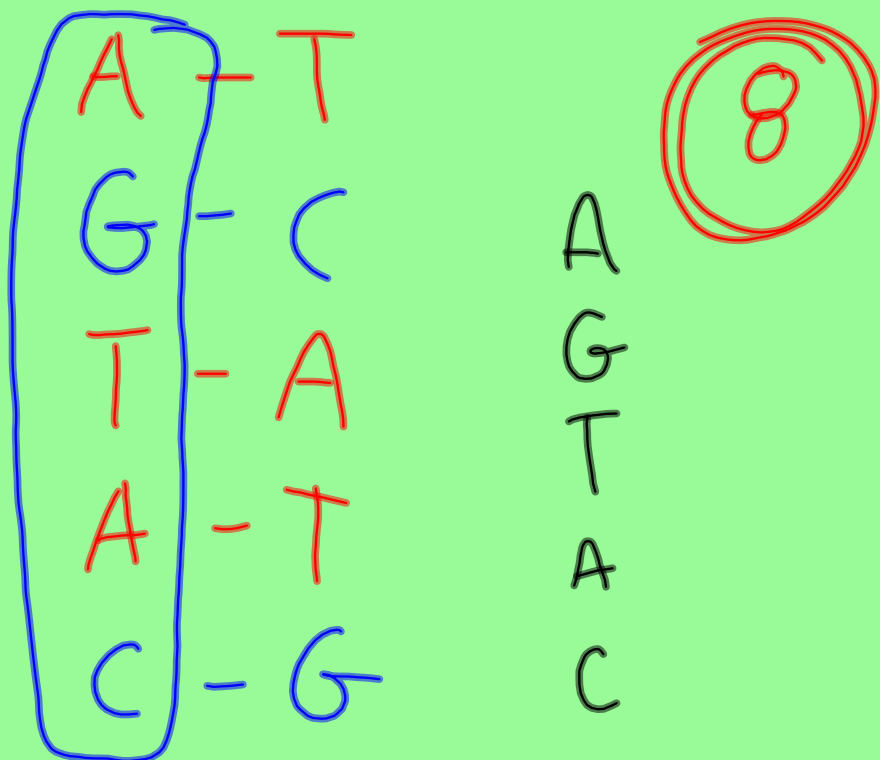
23 pairs (46 chromosomes in total)



**Making a DNA model out of....**

CANDY!

1. Get into groups of 3 or 4
2. Follow the instructions to make and label your DNA model
3. Answer the questions on your worksheet (1 per person please)



## **Science 24: May 27th**

1. Discuss ethical questions
2. Lesson on inheritance: Punnett Squares and Pedigrees

## Ethical Questions that Might Arise from Genetic Research

### + Summary 12.3

- 1) Who has the right to genetic data that provide information about your chances of developing various conditions?
  
- 2) What might happen if health insurance companies had access to everyone's genetic make-up? Could they refuse to provide some people with health insurance?
  
- 3) Should we be allowed to choose the sex of our children?
  
- 4) Should we be allowed to clone animals? Humans?
  
- 5) Do you want to know genetic information that may tell you of a terrible disease you are likely to develop but unable to do anything about? How might knowing this affect the way you live? Might you suffer from depression or adopt behaviors that put you more at risk?

### Where do inherited traits come from?

1 gene from total.

How do the traits that

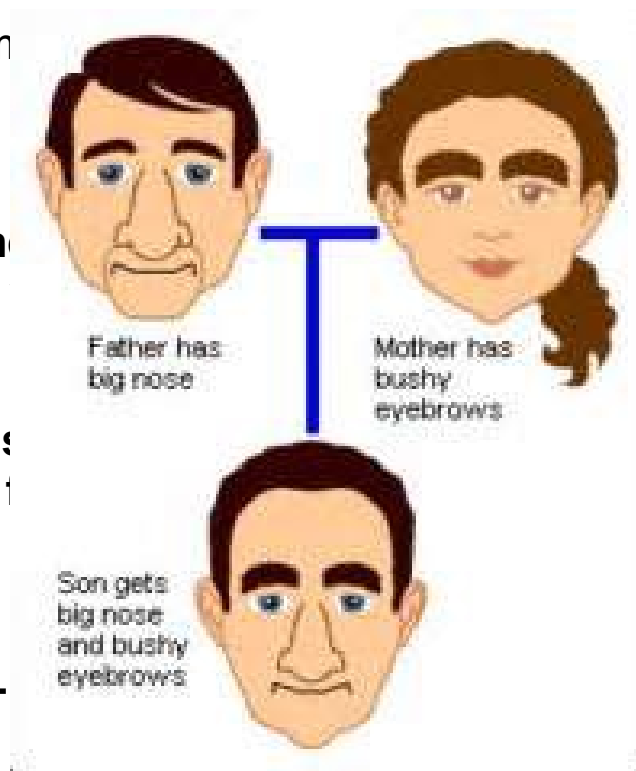
In your as examples in genetics:

Purebred-

Hybrid-

Dominant trait-

Recessive trait-



is in

$$\text{O} + \text{I} = \text{X}$$

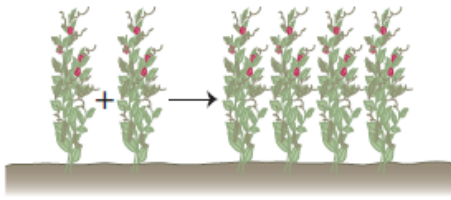
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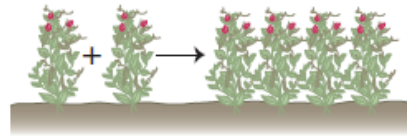
## 12.2 Inheritance and Genetics

Heredity is the passing of characteristics from parents to offspring.

Gregor Mendel was considered the "father of genetics". He was the one to first look at heredity, specifically with pea plants. Here are his results.

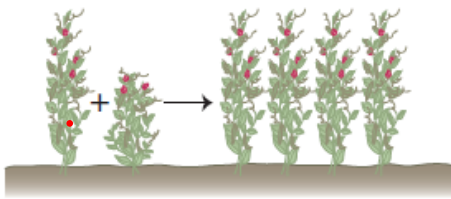


A. tall parent + tall parent = pure tall plants



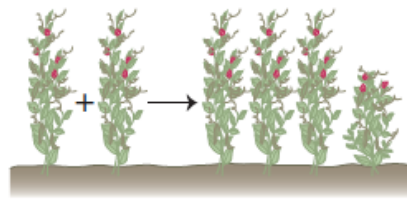
B. short parent + short parent = pure short plants

- Mendel looked at the results of the crosses shown in A and B. He referred to the parent plants as purebreds. **Purebreds** have identical genes for each trait. In this case, the parents in A and B had identical genes for tallness.



C. pure tall parent + pure short parent = hybrid tall plants

- When Mendel crossed the pure tall plants with the pure short plants, the offspring were always tall. The short trait seemed to disappear.
- Mendel called tallness a **dominant** trait because it seemed to dominate the short trait.
- He called shortness a **recessive** trait because it seemed to disappear.
- Offspring of this cross are called hybrids. **Hybrids** carry one gene of each kind for each trait. In this case, they carry one gene of each kind for tallness.



D. hybrid tall plant + hybrid tall plant = mix of tall and short plants (3 tall, 1 short)

- Mendel crossed hybrid tall plants with hybrid tall plants. He was surprised to discover that sometimes shortness appeared in the offspring.
- From these observations, Mendel concluded that tallness must be controlled by factors inherited from both parents.

### Summary of Terms:

1) Purebred:

2 of the same gene



2) Dominant Trait:

overpower or "trump"

3) Recessive Trait:

ex. 1 tall gene = always tall

↳ need 2 to be expressed

4) Hybrid:

↳ mix of 2 different genes  
(1 dominant, 1 recessive).

## Recording Inherited Traits

Traits are controlled mainly by two genes; some can be more.

We are going to focus on two genes (pair of genes). To represent the genes we use something referred to as **genotypes** (letter code for the combination of genes that an organism has for each trait).

*T = tall t = short*

- 1) Capital letters represent dominant traits (T)
- 2) Lower case letters represent recessive traits (t)

Which trait will be expressed: dominant or recessive?

Rr

EE

tt

QQ

RR

rr

R

E

t

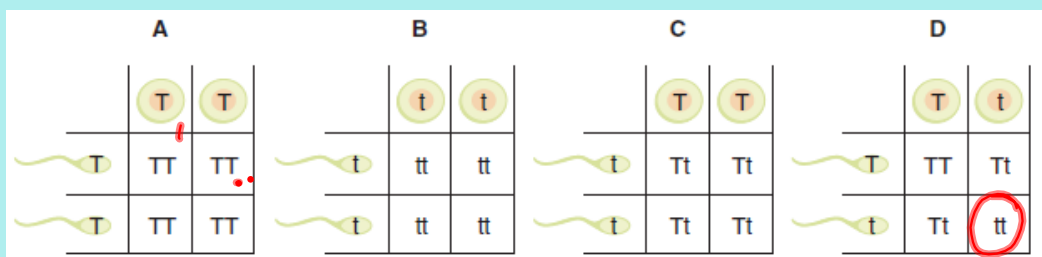
Q

R

r

Punnett Squares are used to predict the probability of offspring inheriting specific traits.

- 1) Eggs with the gene go at the top
- 2) Sperm with the gene go on the left side
- 3) Offspring will go in the boxes left over



T = tall  
t = short

T+

Punnett Square	Percent Probability Tall	Percent Probability Short
A	100%	0%
B	0%	100%
C	100%	0%
D	$3/4 = 75\%$	$1/4 = 25\%$



Examples: Use a punnett square to determine what is the probability of dominant genes and recessive genes.

1) Two pea plants, both have a dominant tall gene and a recessive short gene are crossed.

	T	t	
T	TT	Tt	$\frac{3}{4} = \text{tall}$ $\frac{1}{4} = \text{short}$
t	Tt	tt	

2) Two pea plants: one with two dominant red flower genes and one with a dominant red gene and a recessive white gene are crossed.

R = red      r = white

	R	R	
R	RR	RR	$\frac{1}{2} = RR$ $\frac{1}{2} = Rr$
r	Rr	Rr	

} ALL RED

## Pedigrees

**Pedigrees** are diagrams that shows the history of a trait from generation to generation.

This can trace diseases throughout the generations.

### \*\*Interpreting a Pedigree\*\*

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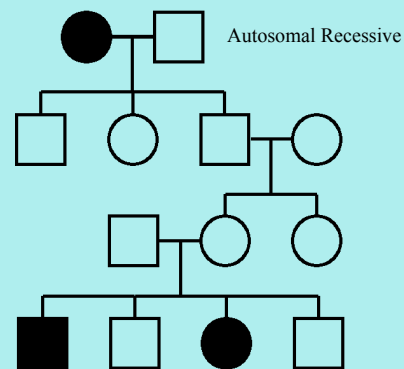
Key:

Male 

Female 

Mating 

Affected  



3 = disease

1 male , 2 females

p.3 Summary Questions

Finish last 3 pages

↳ Ethical questions

↳ Section 3.3 summary

↳ Section 3.4 Summary

In humans, free-ear lobes are dominant to attached. Two parents that are both hybrid for the ear lobe gene are expecting a child. What are the chances that the child will have free ear lobes vs. attached?


Activity:

Go to the following web site and complete the given Punnett squares for the activity.

[http://www.glencoe.com/sites/common\\_assets/science/virtual\\_labs/E09/E09.html](http://www.glencoe.com/sites/common_assets/science/virtual_labs/E09/E09.html)



Section End

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## **Science 24: Dec 15th**

1. Punnett squares review
2. Pedigree problem
3. Lesson on genetic mutation and research
4. Ethical problems in genetics

Think-pair-share:

1. What have you heard about **mutations**?
2. What can cause mutations?
3. Do you think *you* have any mutations?

### 12.3 Genetic Changes

With copying, mistakes are bound to happen. DNA needs to copy itself in order to reproduce and make new cells; along the way there might be a mutation (change in genetic information that can result in an abnormal gene).

How can mutations happen?

- 1) Mutagens- environmental factors that increase the chance of a mutation happening. Examples: radiation, ultraviolet light, and chemicals (PCBs, cigarettes, alcohol, drugs).
- 2) Genetic Disorders- disease or illness caused by alterations to genes that affect their normal functioning. Examples: sickle-cell anemia (abnormal form of hemoglobin...low levels of iron in blood and decreased ability to fight off disease)





## Genetic Disorders Caused by Mutagens

Overdose of radiation/UV radiation can cause: cancer, skin burns and other serious conditions.

Radiation can also be good. By focusing the radiation it can kill cancerous cells.

What are the effects of mutagens on human embryos?

Mutagen	Effect
<p><del>Exposure to alcohol</del></p> <ul style="list-style-type: none"> <li>Children born to mothers who consume any alcohol during their pregnancy may suffer from a condition called fetal alcohol spectrum disorder (FASD).</li> </ul>	<ul style="list-style-type: none"> <li>low birth weight</li> <li>facial and joint abnormalities, small heads</li> <li>heart defects</li> <li>difficulties with learning, behaviour, and mental health</li> </ul>
<p>Exposure to prescription and illegal drugs</p> <ul style="list-style-type: none"> <li>Pregnant women should take prescription drugs only under a doctor's care. Doctors who know the woman is pregnant look for medications that do not harm the fetus.</li> </ul>	<ul style="list-style-type: none"> <li>premature births</li> <li>low birth weight</li> <li>drug addiction at birth</li> <li>possible mental limitations</li> <li>possible birth defects</li> </ul>
<p>PCBs (polychlorinated biphenyls)</p> <ul style="list-style-type: none"> <li>PCBs are a mixture of toxic chemicals present in the environment because of improper disposal of wastes and consumer products. Some are linked to various forms of cancer, including liver and kidney cancer.</li> </ul>	<ul style="list-style-type: none"> <li>low birth weight</li> <li>mild symptoms that often disappear with age: anemia, liver conditions, skin rashes</li> <li>difficulties co-ordinating movement and problems with short-term memory that last several years</li> <li>delays in normal development</li> <li>problems with immune system</li> </ul>

## 12.4 Issues in Genetic Research

The Human Genome Project was the most important scientific effort that humans attempted. It was what allowed scientists to discover that the body contained 46 chromosomes.

Benefits:

Huntington's Disease CBC Video 

1) **Genetic Engineering** is transfer genes from one organism to another.

2) Can check if prone to genetic disorders

*Ex. Huntington's*

Benefit	Examples
<ul style="list-style-type: none"> <li>identifying the source of thousands of genetic disorders (such as colourblindness, hemophilia, or cystic fibrosis)</li> </ul>	<ul style="list-style-type: none"> <li>If scientists can identify the gene that causes a disease such as epilepsy, they may be able to alter that gene and thus cure the condition.</li> </ul>
<ul style="list-style-type: none"> <li>developing new drugs and treatments</li> </ul>	<ul style="list-style-type: none"> <li>Researchers identified the human DNA responsible for insulin production. They inserted that DNA into bacteria. Each time the bacteria cells divide, the human insulin gene is duplicated. The technology produces an inexpensive supply of insulin for people who have diabetes.</li> </ul>
<ul style="list-style-type: none"> <li>helping people make lifestyle choices</li> </ul>	<ul style="list-style-type: none"> <li>By studying a family's genes, researchers can determine which diseases people with that genetic make-up are most likely to develop. Someone with a family history of heart disease, for example, might take special care to eat a low fat diet and exercise regularly.</li> </ul>

## Dolly

Dolly was the world's first cloned sheep. She developed arthritis before she was six years old. They do not know if it was an environmental factor or a genetic factor that caused it.



1. What is a mutagen?

2. Pick one issue with genetics

- 2 points for

- 2 points against

