

Your Genes and More


In this article we shall explore the following ideas:

- 1 Some family features that are inherited through our genes;
- 2 What genes actually do;
- 3 What factors influence the genes that determine how we turn out;
- 4 Recent research into how scientists can manipulate genes in the treatment of inherited conditions.

We are often curious to find out about what features we have inherited from our parents, and which ones skipped a generation or two, not appearing in our parents but are passed down from our grandparents to us.

Which Genes Run In Your Family?

Here is your chance to do some research about your family. Perhaps you could call them to check?

Feature	You (put a tick if you have the feature)	How many other family members have the trait?
<div data-bbox="188 1713 406 1751">Widow's peak</div> <div data-bbox="414 1323 767 1738">  </div>		

Unattached Earlobes

(a)

(b)

Unattached Attached**Freckles****Curly hair****Straight hair****Facial Dimples**

Cleft Chin**Curly hair****Straight hair****Hitchhiker's thumb****Hand clasping left thumb over right****ROLLING YOUR TONGUE**

ROLLER
DOMINANT



NONROLLER
RECESSIVE

Hair on second joint of one or more fingers		
Think of one other that runs in your family		

Once you have surveyed your family, please study your results in the above table. Are there any inherited features that are prominent in your family?

Now that you have discovered some of the features inherited through genes that run through your family you may like to find out more about genes. Please click on the following link:

<https://www.youtube.com/watch?v=5MQdXjRPHmQ>

Is It Just The Genes That Influence How We Turn Out?

To answer the above question we shall look at some examples.

These are Himalayan rabbits.



The Himalayan color is pure white with dark “points”; that is, the nose, ears, feet, and tail are colored while the rest of the bunny is white. This is caused by a gene that is commonly called the “Himalayan gene”. To study the genetics of Himalayan rabbits, scientists shaved off the black fur on the ears, and observed the regrowth of the fur over time. If the shaven rabbit is kept in a cold environment, the ears regrow black fur. If THE SAME SHAVEN RABBIT is kept in a warm environment, the ears regrow white fur. Remember we are looking at the same rabbit, with the same genes. Its genes for colour have not changed but the colour of regrown fur changes according to the temperature it is in.

Question: What can we conclude? Do genes alone control the animal’s features?

Something similar is found in Siamese cats.



They have modifier genes which we simply call the modifier.

This modifier starts sending out its “stop the colour!” message around 38-39.2 C, which is a cat’s standard body temperature, and the cat’s body fur looks lighter. Because a cat’s body is cooler around his ears, paws, and tail, that’s where the colour begins to kick in. In essence, these cats are walking heat maps. Kinda cool, huh?

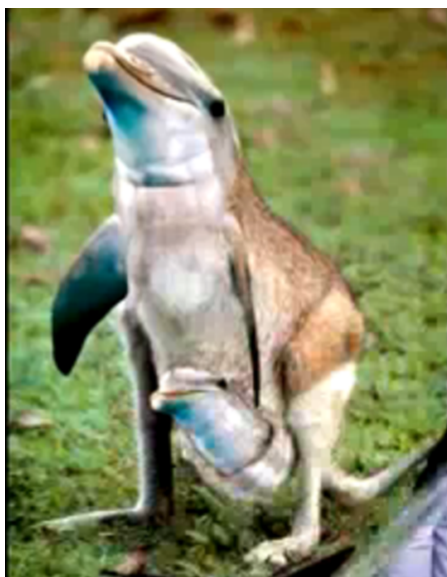
At lower temperatures the modifier becomes inactive and the colour genes are expressed, causing the nose, tips of ears and paws to turn dark in colour.

Why are these cats born lighter and then darken as they age?

It’s pretty warm in the womb, so all kittens with this special modifier are white throughout gestation. They pop out as white kittens too, but once exposed to the cooler air outside, their extremities begin cooling and the black colour genes express themselves on the nose, ear, tips of the paws and tail.

Now lets turn to human features such as body weight and height. Are these features influenced only by genes? Do other factors in addition to genes control our weight and height? What do you think? Please record your views in the space below and then check with your friends as well. Do they share the same ideas? Do they also have ideas that are different from your own?

There are many, many ways we can manipulate genes. For example we can transfer genes between plants and plants, plants and animals or animals and animals to give them the features controlled by the introduced gene. We could end up with these:



Is this the type of genetic manipulation we are aiming for? We know what our answer should be.

Now to Gene Therapy

Scientists are focusing on genetic manipulation that will hopefully lead to treatment and cure for some of the human illnesses that are inherited. Take, for example, the condition hypercholesterolemia. This is an inherited condition which causes the retention of abnormally high bad cholesterol in the body. The photo shows extreme cases:

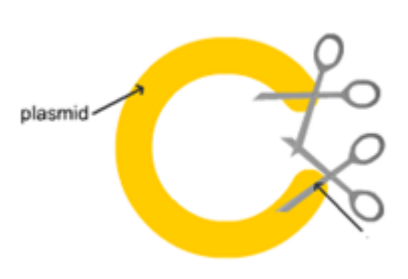


In familial high cholesterol the gene for the protein that normally removes our bad cholesterol has changed. With the change, this protein is no longer produced by the liver. The result is an aggressive buildup of cholesterol deposits in arteries, life-threatening coronary artery disease and an increase in the risk of a heart attack or stroke. If untreated, individuals with inherited high cholesterol can suffer serious cardiac events before the age of 30. Current treatments do not provide a cure and may not lower bad cholesterol to low enough levels. Scientists are working on a way to deliver a healthy copy of the gene to liver cells. They do this by a short, intravenous injection that is expected to travel to the liver. Their intention is for the gene to reach the liver, to enable the liver cells to make the protein they need. The liver is then expected to capture and remove bad cholesterol from the blood to prevent buildup.

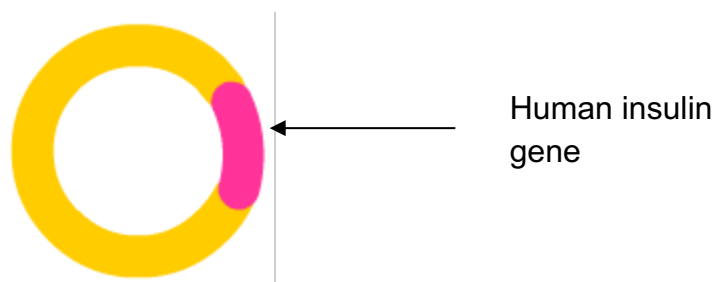
And in the treatment of diabetes...

Diabetes can be caused by a number of factors. In some cases the insulin gene has mutated and can no longer produce insulin. Patients of this group require insulin

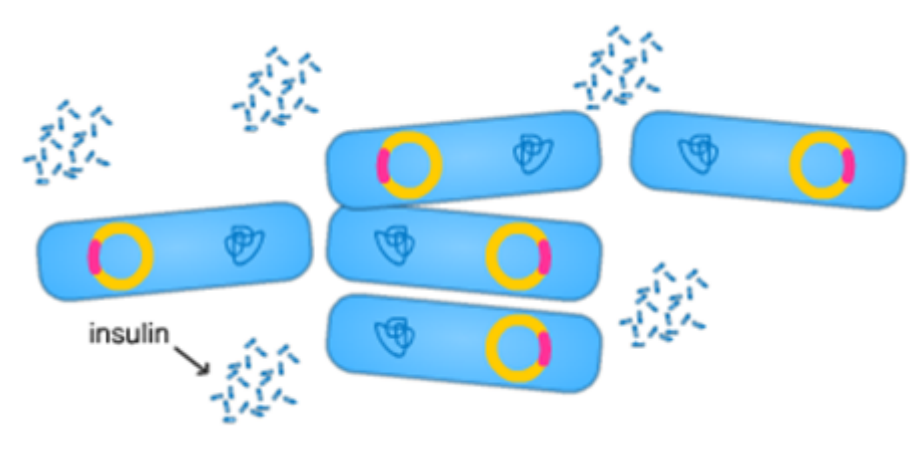
injections to control the level of glucose in their blood. Patients can react to animal insulin and may develop allergic reactions to them. The best alternative would be for them to be injected with human insulin. In 1978 biotechnology firm Genentech used recombinant DNA techniques to produce synthetic “human” insulin. Insulin is the first human protein to be manufactured through biotechnology. This is how it works:



A ring of DNA is taken from a bacterium and cut open with an enzyme which is used as genetic scissors.



The human insulin gene (shown in pink) is inserted into the bacterial DNA.



The bacterial DNA carrying the human insulin gene is reinserted into the bacterial cells(shown in blue). When inside the bacteria, the human insulin gene programs the bacterial cells to produce human insulin. Because bacteria divide and multiply every 15-20 minutes, we can, in a short space of time, get millions of bacterial cells all with the ability to produce human insulin.

The more we study the genes of animals the more we understand our own genes. Here is one example. It is about why blue whales don't get cancer. Please click on the following link:

<https://www.youtube.com/watch?v=1AEIONvi9WQ>

And finally, what is lately foremost on our minds - COVID-19. It has also to do with genes. You will find that this coronavirus has genetic material in a form we call RNA. When it invades our respiratory track, it injects its genes into our cells. The virus genes take over our body machinery and make our cells produce more viruses. Please read on by clicking on the following link:

<https://www.youtube.com/watch?v=BtN-goy9VOY>

The field of Genetics is an ever expanding one. It has interesting and useful ramifications into Ecology, Science and Medicine. The topics discussed in this article are only a few of the concepts covered in the course *Introduction to Genetics* offered at our U3A on Wednesdays.

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