An Introduction to genetics

I look a bit like my Mum

We all inherit characteristics from our parents. You will sometimes hear people remark ‘you’ve got your mother’s nose’ or ‘you have your father’s eyes’ when talking about friends or relatives.

Whilst our faces can show very visible signs of our ‘genetic inheritance’, we also inherit less obvious things from our parents, such as our likelihood of getting certain diseases. Naturally, doctors are interested in this aspect of inheritance. If we can identify those susceptible to particular diseases we may be able to protect those same people from developing the condition.

Inheritance

From the earliest times people knew that humans, plants and animals inherit characteristics from their parents. Farmers, for instance, knew that achieving useful traits in animals (e.g. a faster horse) would be far more likely if they mated parents with those same characteristics. They couldn’t *guarantee* that a horse born to a fast mother or father would *definitely* be fast, but they did know that it was *far more likely*.

But even though people could see inheritance at work, nobody understood *how* characteristics are passed from parents to their children. Various theories were suggested but the real breakthrough came from friar called Gregor Mendel. Perhaps the most diligent grower of peas in history, Mendel’s observations of how pea plants cross-breed led him to develop his theory of Genes.

Gregor Mendel

An important discovery … that nobody noticed.

Mendel spent 7 years growing and cross fertilizing nearly 30,000 pea plants. He grew successive generations of pea plants, making sure they all grew in similar conditions so he could be certain that the changes he observed were down to inheritance and not, for instance, that one pea plant was in a sunnier place than another. By the time he had done this Mendel probably knew more about peas than anyone else on planet earth. But he had also discovered how inheritance works.

Even though Mendel’s discoveries are some of the most important in history they had little impact at the time, other than to attract criticism. Now regarded as one of the most important scientific papers of all time Mendel’s “*Versuche über Pflanzen-Hybriden*” (“Experiments on Plant Hybridization”) remained obscure and largely forgotten until 16 years after his death.

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Genes and you

Genes can be thought of as sets of instructions on how to build a living organism. Different genes relate to different characteristics. For instance, there are genes that determine the colour of our eyes. Genes contain spaces for two instructions - one instruction from our father and the other from our mother.

What happens if we receive conflicting genetic instructions from our parents? Because our genes have space for *two* instructions it's possible to receive one that says 'make the eyes blue!' and another that says 'make the eyes brown!' What colour would our eyes be? The answer is brown. But why?

Some genes are louder than others

The 'make the eyes brown' instruction is said to be 'dominant'. You can imagine that it simply shouts louder than the 'make the eyes blue' instruction. This 'quieter' instruction is called 'recessive'.

Now let's imagine you ended up with brown eyes in the way described above and you meet someone of the opposite sex whose parents passed on the same mix of eye colour instructions to them (one 'brown' and one 'blue'). They will have brown eyes as well. If the two of you have a daughter you'd probably expect her to have brown eyes also. But sometimes this doesn't happen. In fact it's perfectly possible for her to have blue eyes. Why?

The answer comes from remembering that as parents you are both still carrying the recessive 'blue' instruction as well as the dominant 'brown' instruction. These instructions can combine in four ways as shown in the table below. In about one in four cases a child will inherit two copies of the 'make the eyes blue' instruction. Without the dominant 'make the eyes brown' instruction blues eyes are the only option!

Possible instructions from mother

Possible instructions from father	MAKE THE EYES BROWN! (dominant)	make the eyes blue (recessive)
MAKE THE EYES BROWN! (dominant)	MAKE THE EYES BROWN! + MAKE THE EYES BROWN! = BROWN EYES 	make the eyes blue + MAKE THE EYES BROWN! = BROWN EYES 
make the eyes blue (recessive)	MAKE THE EYES BROWN! + make the eyes blue = BROWN EYES 	make the eyes blue + make the eyes blue = BLUE EYES 

You can find out more about genetics at
DNA from the beginning: *www.dnaftb.org/dnaftb*
Genetic Science Learning Centre: *http://gslc.genetics.utah.edu*