

## Understandings:

### 1. Define gene.

- A gene, we have learnt that it is the coding section of the DNA. But also, it is the heritable factor that influences a characteristic! Is it a just a convenience? Well, in truth more sections of DNA are heritable, but the genes are the ones that actually affect our next generation so it is what we consider as important.

### 2. Explain the position of gene.

- A gene is a sequence of DNA (100-1000 bases) that is located in on a specific place on the chromosome. We call the position of the gene locus. In total we have about 23,000 genes spread out on our 46 chromosomes. Quite amazing.

### 3. Explain alleles.

- Alleles are different forms of genes, just like isotopes. For example, let's say we have a gene that codes for hair colour. Then we can have black allele, blond allele, brown allele, etc. Since we have chromosome pairs, we also have two alleles for the same gene. The alleles can either be the same or different since one chromosome is from mother and other from father.

### 4. State how different alleles are different.

- Alleles usually differ by 1 or 2 bases only.

Also, when our cells replicate, it replicates the chromosome, hence DNA sequence. However, no one is perfect, so a base in that DNA might get added or substituted by another. We call that a Single Nucleotide Polymorphism or SNP. We have several SNPs in our body, and this is what also determines the allele.

### 5. Explain how new alleles are formed.

- Alleles can vary through SNPs but also mutation. The result is the same. One or more bases are replaced by another.

Since human beings have already gone through mutations for many years and natural selection has taken place, we are already "good". So it is hard to find a random mutation that suddenly benefits us for natural selection to take place. Therefore, mutations nowadays are usually neutral or harmful. OR IS IT? \*Dramatic music\*

### 6. Define genome.

- This is all the genetic information of the body. So it is the base sequence of all our chromosomes! Just remember that all humans have unique genome but also very similar.

## **7. Give information about the Human Genome Project.**

- This was a project launched 1990 in aim to sequence the whole human genome. This was completed 2003. One of the main goals of this was to cure cancer and other genetic diseases but it has not been proved very effective in that context. However, it has given us an advance in genetics and also a valuable data that will definitely be useful soon or later.

We have discovered some interesting things such as junk DNA (part of the DNA that seems to be completely junk, but is it really?). So genetics is definitely an area still covered in veil.

## **Applications and skills:**

### **1. Explain the cause of sickle cell anaemia.**

- When there is a mutation of the gene that codes for haemoglobin that changes glu (GAG) to val (GTG), we have a very fatal disease called sickle cell anaemia.

This distorts the shape of haemoglobin into a sickle or crescent shape, so these become trapped in capillaries causing clotting.

In addition, when these sickle cells come to oxygen rich lungs, they become normal shaped, but the cell is already damaged causing it to only live for max 4 days. Body cannot replenish fast enough hence you will have deficit of oxygen.

### **2. Compare the number of genes in humans with other species.**

- Be aware that just because humans are smartest animals (which is debatable per se), we do not have most genes. In fact, bacteria called *Trichomonas vaginalis* have almost triple the amount!

### **3. Be able to determine differences between two species by looking at the data bases.**

- Ok. You will probably use Crustal W or something.

## **TOK:**

**1. There is a link between sickle cell anaemia and prevalence of malaria. How can we know whether there is a causal link in such cases or simply a correlation?**