**Resource 2c (KS4) Read & Reduce Activity** *(ref: www.bbc.co.uk/schools/gcsebitesize)*

Every human cell has 23 pairs of chromosomes (except red blood cells and male and female gametes). Red blood cells have no nucleus so have no chromosomes and the games contain 23 single chromosomes.

**DNA, genes and chromosomes**

The DNA molecule looks like a twisted ladder. This shape is a spiral and is called a double helix. Each chromosome is a very long molecule that is very tightly coiled together.

DNA stands for deoxyribose nucleic acid and it is a very large and complex molecule. Everyone’s DNA is unique, including identical twins. Although they may look identical recent research has found that there are hundreds of differences in the DNA of identical twins, so they can now be identified through ‘genetic fingerprinting’, which is especially useful if one twin commits a crime.

A gene is a short section of DNA. Each gene encodes for a specific protein by specifying the order in which amino acids must be joined together. DNA is made up of two backbones and four chemical bases. The backbone is formed from a chain of sugar molecules and phosphates. Each sugar molecule is an attachment site for one of the chemical bases. There are for bases called adenine, thymine, cytosine and guanine. They are represented by their first letter: A, T, C and G. These bases form pairs in a very specific way, A always goes with T, C always goes with G, however the order that they go in dictates which gene they encode for. In very simple organisms, genes can be as small as 3 base pairs but in humans, a gene is an average of 27,000 base pairs long

**Alleles**

In humans, a single gene controls some of our characteristics, such as eye colour, ability to roll your tongue and the shape of our ear lobes. These genes can present in different forms. A different form of the same gene is called an allele. For example, the gene for eye colour has an allele for blue eye colour (recessive) and an allele for brown eye colour (dominant). If the allele is dominant, it means that the characteristic controlled by that allele develops if the allele is present on one or both chromosomes in a pair. However if the allele is recessive then the characteristic controlled by that allele will develop only if the allele is present on both chromosomes in a pair. The dominant allele is represented as a capital letter and the recessive as a lower case letter (for example Brown: B / blue: b).

**Genotype / Phenotype**

Someone’s genotype is how their DNA presents, which alleles they have on each chromosome. Their phenotype is what is visible. For example, staying with eye colour, someone may have the phenotype of brown eyes, but they may have the genotype of one dominant allele (B) and one recessive allele (b).

**Impact on the foetus**

Cystic fibrosis is a life-limiting disorder inherited through our genes. Parents can have the recessive gene and will not show any signs of the illness, but if the foetus receives both recessive alleles (one from each birth parent), they will inherit the disorder. Where people are aware that they may carry the gene (eg a relative with the disorder), they can have genetic testing to identify the possibilities of having a baby with cystic fibrosis. If both parents have the allele, every pregnancy carries a 25% chance of the baby having cystic fibrosis. Parents may need to consider whether to continue with the pregnancy if this was the case. 1 in 25 people in the UK carry the allele for cystic fibrosis.