

Why offspring from the same parents are different in appearance

Different offspring from the same parents inherit the same genetic information however appear differently. A process called meiosis forms our gametes, whereby the chromosome number is halved from the diploid parent cell producing four haploid daughter cells that can be used for sexual reproduction. This links directly to the question as random fertilisation of these gametes meaning any sperm cell can fertilise the egg cell which leads to offspring being produced that means no two offspring hold the exact same alleles leading to genetic variation and differences in how we appear with the same parents.

Within meiosis, there are two ways in which genetic variation can be increased. The first way is crossing over occurring in prophase one. Sections of non-sister chromatids of bivalents wrap around each other whereby sections of chromatids swap over and form recombinants. The other way is independent segregation that occurs during metaphase one and two. In metaphase one the bivalents line up on the spindle equator randomly and in metaphase two chromosomes line up on the spindle equator randomly. This links to the question as both these processes occurring lead to the chromosomes being slightly different resulting in different genetic combinations leading to a different appearance of offspring.

Another way appearances can be different is due to a mutation in one of the genes which is a change in the DNA base sequence that can happen at any time the cell is replicating. There are three types of mutations, a substitution, an addition and a deletion. A substitution is where one or more of the nucleotides in the DNA is replaced by another nucleotide that has a different base. Sometimes a substitution can be silent whereby the same amino acid is coded and no effect however a substitution can also lead to a different amino acid being coded that changes the overall protein with a different shape and different bonds that could mean the protein is non-functioning for example amino acid valine being substituted for glutamic acid meaning the protein synthesised no longer works resulting in sickle shaped red blood cells. Addition and Deletion cause a frame shift whereby the same concept occurs as substitution. This links to the question as if a mutation occurs where a non-functional protein is coded in one offspring then it could change the appearance of the offspring affected whereas other offspring may not be affected and therefore appear differently.

An offspring's appearance is their phenotype which is the physical characteristics they show however this is determined by their genotype which is the alleles that make up each gene. A parent can either be heterozygous, homozygous dominant or homozygous recessive. Since every gene consists of two alleles there are multiple combinations that can occur from random fertilisation. Due to this, differences in appearance can occur as offspring can inherit different combination of alleles for example, the allele for dwarfism in humans is dominant to the normal growth that is recessive. This means that if parents both have dwarfism and are heterozygous then they have a one in four chance of having a child that is homozygous recessive and would have the normal growth gene. This links to the question as the inheritance of different alleles helps to explain how offspring from the same parents can appear differently by inheriting different allele combination to their sibling.

Finally, variation can occur environmentally. For example, in plants the availability of nutrients and energy source like light can differ how they appear. In this instance, two plants like daffodils may differ in appearance if one has been grown in the complete dark $\checkmark$ compared to one grown in direct sunlight. Although the plants are from the same parent plant, the offspring would appear differently due to different surroundings. This links to the question as it explains how offspring may be the same genetically how still differ in appearance due to external factors that affect upbringing. $\checkmark$ R.

Great last sentences to make paragraph relevant to the question.

1- $\checkmark\checkmark$ R
 2- $\checkmark\checkmark$ R
 3- $\checkmark\checkmark$ R
 4- $\checkmark\checkmark$ R
5- $\checkmark\checkmark$ R
 15 max.

B- $\checkmark\checkmark\checkmark$
 R- $\checkmark\checkmark\checkmark$
 QWC- $\checkmark\checkmark\checkmark$

(24).