Essay 1-Why offspring from the same parents are different in appearance

Firstly, the phenotype of an organism is caused by the alleles that are expressed in the genotype. Alleles can be dominant or recessive, dominant alleles are expressed whenever they are present whereas recessive alleles are only expressed when they are the only allele present. The parents will either be homozygous dominant, homozygous recessive or heterozygous for a certain gene. If the parents have a different genotype or are both heterozygous there will be more than one possible outcome for the offspring's genotype. For example 2 heterozygous parents can produce 3 different genotypes, with 2 having the dominant allele expressed and 1 with the recessive allele expressed. So the offspring will be 1 of 2 different phenotypes so can have a different appearance.

Another way genes can affect appearance is through mutations. Mutations change the base sequence of a gene, there are multiple different types of mutation such as deletion and addition where bases are removed and added. The addition or deletion of bases causes the whole base sequence to shift, causing a different mRNA sequence to be coded for and therefore a different protein to be made. This different protein will perform a different function causing a change in the appearance of the organism. A mutation that causes a change in amino acids encoded for is called a missense mutation, nonsense mutations can also occur and are when the mutation changes a codon into a stop codon causing the termination of the polypeptide chain. These changes in base sequence effect the proteins produced which can change the phenotype of the organism and as mutations are random they can occur in any of the offspring.

The expression of genes can be effected by the environment. Factors such as stress, diet and toxins can cause the transcription of genes to be increased or inhibited which could change the physical appearance of an organism. Methylation of the DNA adds methyl groups to the DNA causing the DNA to become more tightly coiled making it harder for transcription factors to bind, so the gene is not expressed. Acetylation adds acetyl groups to the histones causing the DNA to be more loosely packed. So transcription factors can bind more easily and the gene is expressed. So the different environments the organisms experience can change their appearance by causing different genes to be expressed.

The variation in gametes caused by meiosis will create offspring with a different phenotype, meiosis causes variation in different ways with the aim of genetic variation in the population. Crossing over is the exchange of DNA between the chromatids of adjacent chromosomes, so the sister chromatids of the chromosomes are no longer genetically identical. The homologous pairs aline along the equator of the cell above and below each other. The arrangement between the homologous pairs is random so either chromosome can be above or below the other. Crossing over and independent segregation produce genetically different gametes so offspring will have a different genotype and therefore a different phenotype. Chromosome non-disjunction can occur in meiosis and results in cells with a different number of chromosomes due to the unexpected assignment of chromosomes or chromatids to a cell. This would produce dysfunctional gametes or offspring with a genetic disease. So variation caused by meiosis causes a difference in offspring's appearance.

1 - VV R
2 - VV R
3 - VV R
4 - VV R
5 - V R

B - VVV
R - VVV
QWC - VVV

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Each gamete formed by both parent is genetically unique and the process of sexual reproduction is a random event in that any sperm may fertilise the egg released. So no two offspring from the same parents can carry exactly the same alleles. Since it is the combined effects of alleles and the environment which determine the appearance of the offspring, no two offspring will appear identical. Each offspring has a different combination of maternal and paternal alleles which are combined in a random process resulting in a different phenotype for each offspring.