Difference Between Monogenic and Polygenic Inheritance

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Key Difference – Monogenic vs Polygenic Inheritance

Inheritance is the process where genetic information is transferred from the parent to offspring. The information that is transferred is stored in genes, which are Deoxyribose Nucleic Acid (DNA)fragments that codes for specific proteins that are functional and could be transferred. Each gene consists of a pair of alleles that determine the character and as Mendelian Genetics suggests, these alleles independently segregate during the formation of gametes to give rise to a particular character. Thus, the key difference monogenic and polygenic inheritance lies in the number of genes involved in the determination of a particular character. **In monogenic inheritance, one trait is determined by a single gene whereas, in polygenic inheritance, one trait is determined by two or more genes.**

What is Monogenic Inheritance?

Monogenic inheritance of organisms is a process where a character is determined by a single gene which is transferred from parent to offspring. The two alleles of this gene are located in the same locus. This inheritance pattern portrays discontinuous variations in characters and is also referred as the **qualitative inheritance.**

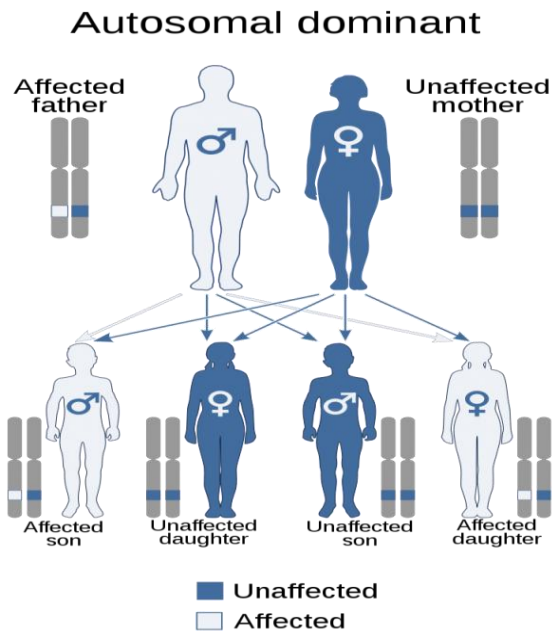


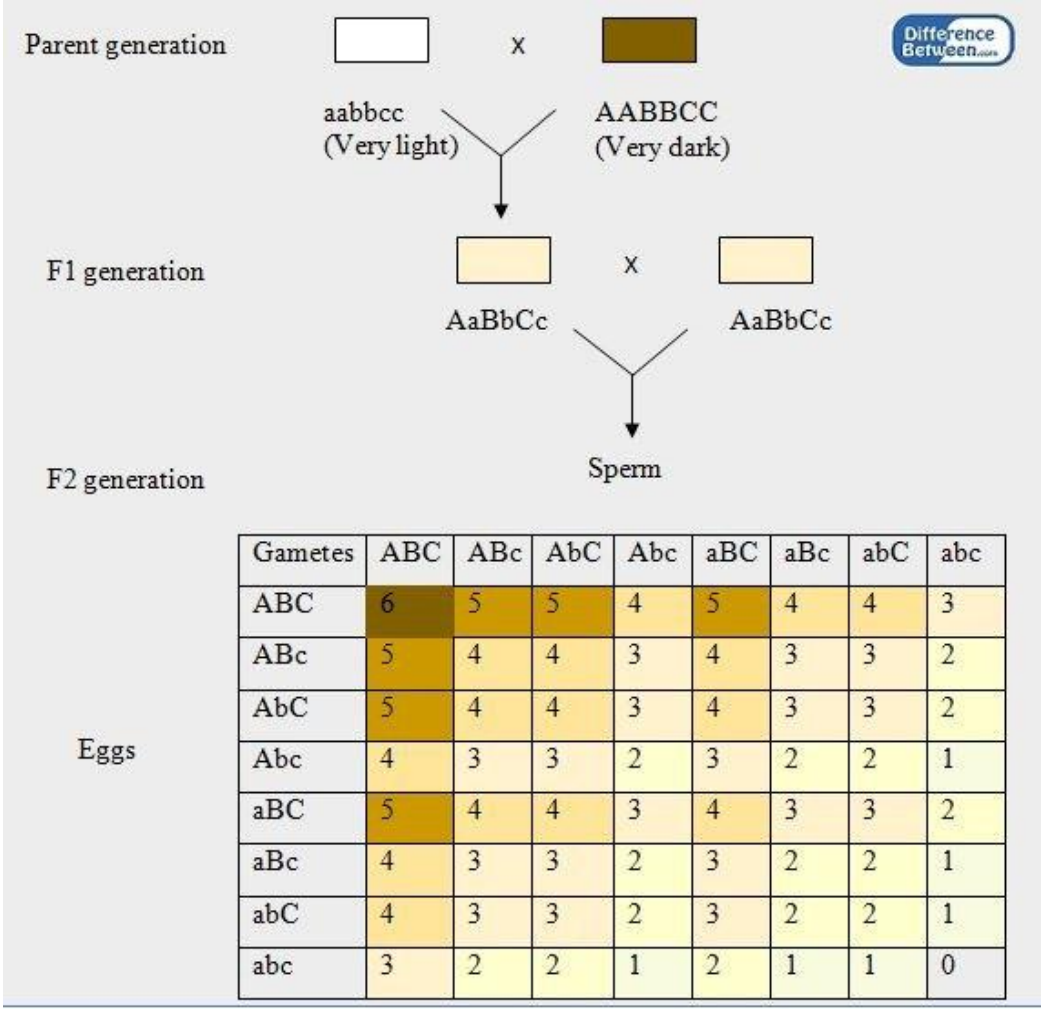
Figure 01: Monogenic Inheritance – A single X gene is mutated which results in Hemophilic individuals (men) after genetic transfer.

Monogenic inheritance patterns are associated with sex linked genetic disorders such as Hemophilia and in certain visible traits such as the size of ear lobes (large or small), the texture of ear wax (dry or sticky) and the ability or inability to roll the tongue.

What is Polygenic Inheritance?

Polygenic Inheritance is a deviation of Mendelian Inheritance where a single character is determined by two or more genes. These two genes can be located in two or more loci. This pattern of inheritance is referred to as **quantitative inheritance** and show a continuous variation of a particular character. This pattern of inheritance is contradictory to the patterns discovered and proved by Gregor Mendel, father of Genetics and thus is known as a non-mendelian inheritance.

Examples of such quantitative traits or characteristics in humans or animals of high order are height, weight, intelligence and that of plants include size, shape, and color of plants. In polygenic inheritance patterns, the characters do not show clear cut differences unlike in monogenic inheritance patterns. They portray a combination of the character inherited from both parents.



Gametes	ABC	ABc	AbC	Abc	aBC	aBc	abC	abc
ABC	6	5	5	4	5	4	4	3
ABc	5	4	4	3	4	3	3	2
AbC	5	4	4	3	4	3	3	2
Abc	4	3	3	2	3	2	2	1
aBC	5	4	4	3	4	3	3	2
aBc	4	3	3	2	3	2	2	1
abC	4	3	3	2	3	2	2	1
abc	3	2	2	1	2	1	1	0

Figure 02: Polygenic inheritance in grain colour of wheat

What are the similarities between Monogenic and Polygenic Inheritance?

- Both patterns give rise to a phenotypic character or a trait which consists of its own variations.
- Mutations in the genes can give rise to genetic disorders.

What is the difference between Monogenic and Polygenic Inheritance?

Monogenic vs Polygenic Inheritance	
Monogenic inheritance is an inheritance pattern which	Polygenic inheritance is an inheritance pattern which determines a particular

determines a particular trait by one set of alleles or a specific gene.	trait by more than one set of alleles or more than one gene.
Number of Genes Involved	
Only one gene is involved in determining the character in monogenic inheritance.	Two or more genes are involved in determining a single character in polygenic inheritance.
Location of Alleles	
The alleles are located in the same locus.	The alleles of different genes are located in different loci.
Resultant Phenotype	
The resultant phenotype is similar to the dominant parent in monogenic inheritance.	The resultant phenotype is a combination of the dominant phenotypes of both parents in polygenic inheritance. Intermediate forms are common.
Medium	
Monogenic inheritance shows Mendelian inheritance pattern.	Polygenic inheritance shows deviation from Mendelian inheritance (non-mendelian inheritance pattern).
Measuring the Traits	
Traits cannot be measured in monogenic inheritance. Most of them are qualitative traits.	Traits can be quantitatively measured in polygenic inheritance.
Character Variation	
Monogenic inheritance portrays a discontinuous variation of the character.	Polygenic inheritance portrays a continuous variation of the character.

Summary – Monogenic vs Polygenic Inheritance

In summary, it is of great importance to understand these inheritance patterns in order to understand the manner in which different traits are expressed in organisms. The two main forms monogenic inheritance and polygenic inheritance represents the traditional Mendelian inheritance pattern and the later discovered Non – Mendelian inheritance patterns, respectively. In these two patterns, the inheritance is governed

by the number of genes involved in determining the particular trait or phenotype or character of an organism. Thus, monogenic, as the name suggests, uses one gene to determine a character; in contrast, polygenic patterns involve more than one gene to give rise to a single character. This is the difference between monogenic and polygenic inheritance. The study of the genes involved in these inheritance patterns is important as it helps to study mutations of genes which give rise to genetic disorders and to build up genetic relationships among organisms for a common character and thereby evaluate evolutionary traits.

References:

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