

## Polygenic Inheritance in Wheat (Kernel colour)

Polygenic inheritance - Several genes combine to affect a single trait.

A group of genes that together determine (contribute) a characteristic of an organism is called polygenic inheritance. It gives explanations to the inheritance of continuous traits which are compatible with Mendel's Law.

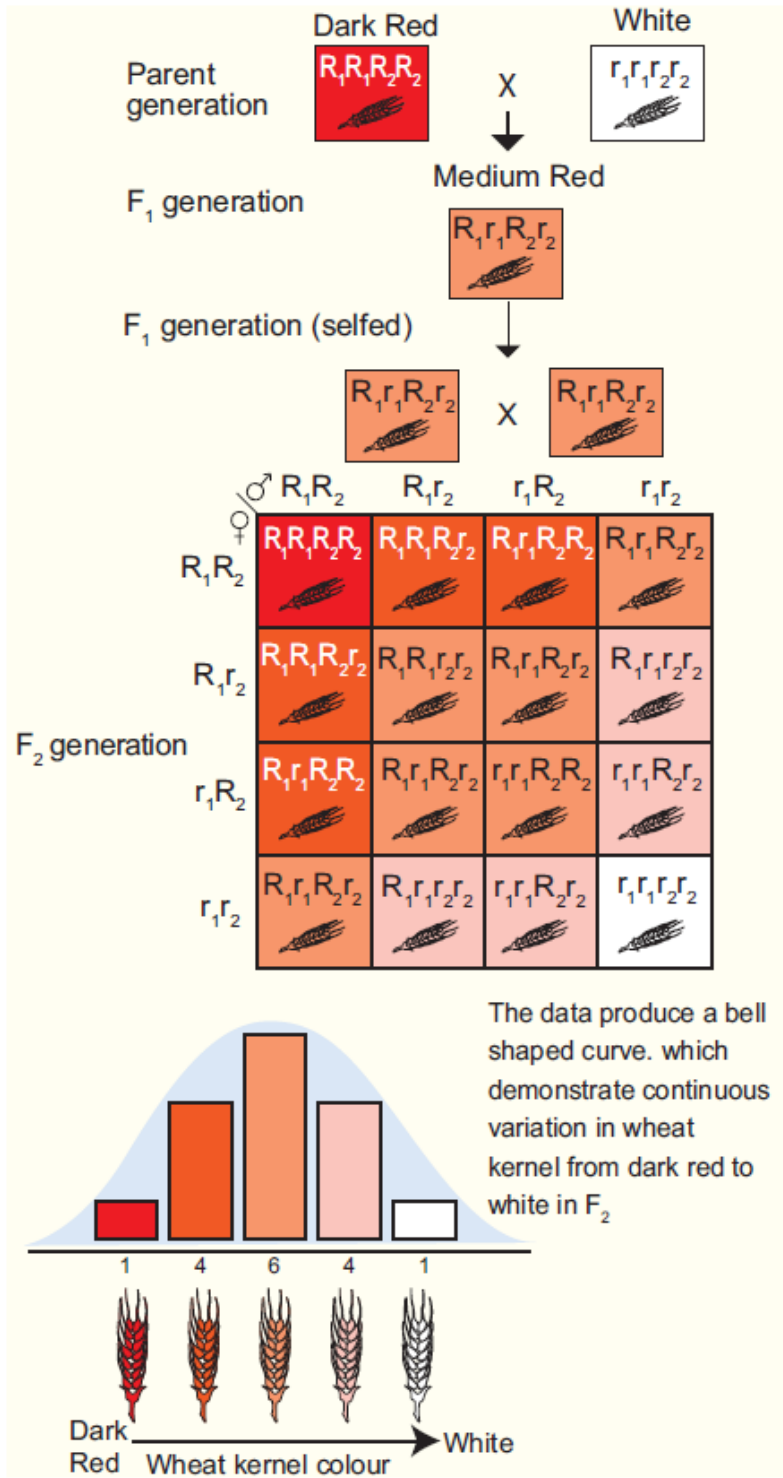
The first experiment on polygenic inheritance was demonstrated by Swedish Geneticist H. Nilsson - Ehle (1909) in wheat kernels. Kernel colour is controlled by two genes each with two alleles, one with red kernel colour was dominant to white. He crossed the two pure breeding wheat varieties dark red and a white. Dark red genotypes  $R_1R_1R_2R_2$  and white genotypes are  $r_1r_1r_2r_2$ . In the  $F_1$  generation medium red were obtained with the genotype  $R_1r_1R_2r_2$ .  $F_1$  wheat plant produces four types of gametes  $R_1R_2$ ,  $R_1r_2$ ,  $r_1R_2$ ,  $r_1r_2$ . The intensity of the red colour is determined by the number of R genes in the  $F_2$  generation.

**Four R genes:** A dark red kernel colour is obtained.**Three R genes:** Medium - dark red kernel colour is obtained.**Two R genes:** Medium-red kernel colour is obtained.**One R gene:** Light red kernel colour is obtained.**Absence of R gene:** Results in White kernel colour.






The R gene in an additive manner produces the red kernel colour. The number of each phenotype is plotted against the intensity of red kernel colour which produces a bell shaped curve. This represents the

distribution of phenotype. Other example: Height and skin colour in humans are controlled by three pairs of genes.

***Polygenic inheritance in wheat kernel colour***



***The genetic control of colour in wheat kernels***

<b>Parents</b>	$R_1 R_1 R_2 R_2$	X	$r_1 r_1 r_2 r_2$	
	Dark red		White	
<b>F<sub>1</sub></b>	$R_1 r_1 R_2 r_2$		Medium red	
<b>F<sub>2</sub></b>	<b>Genotype</b>		<b>Phenotype</b>	
1	$R_1 R_1 R_2 R_2$		Dark red	} 15 red to 1 white
2	$R_1 R_1 R_2 r_2$		Medium-dark red	
2			Medium-dark red	
4	$R_1 r_1 R_2 r_2$		Medium red	
1			Medium red	
1			Medium red	
2	$R_1 r_1 r_2 r_2$		Light red	
2			Light red	
1	$r_1 r_1 r_2 r_2$		White	

**Conclusion:**

Finally the loci that was studied by Nilsson – Ehle were not linked and the genes assorted independently.

Later, researchers discovered the third gene that also affect the kernel colour of wheat. The three independent pairs of alleles were involved in wheat kernel colour. Nilsson – Ehle found the ratio of 63 red : 1 white in F<sub>2</sub> generation – 1 : 6 : 15 : 20 : 15 : 6 : 1 in F<sub>2</sub> generation.

*Polygenic inheritance in Wheat kernel*

