



Province of the
EASTERN CAPE
EDUCATION

GENETICS AND INHERITANCE

PAPER 2 45 MARKS

GENETICS AND INHERITANCE Paper 2: 45 marks	Term 2	4 weeks
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CONTENT	ELABORATION
Introduction	<input type="checkbox"/> Mention of Mendel as the father of genetics
Concepts in inheritance	<input type="checkbox"/> Chromatin and chromosomes <input type="checkbox"/> Genes and alleles <input type="checkbox"/> Dominant and recessive alleles – The Law of Dominance <input type="checkbox"/> Phenotype and genotype <input type="checkbox"/> Homozygous and heterozygous

INTRODUCTION

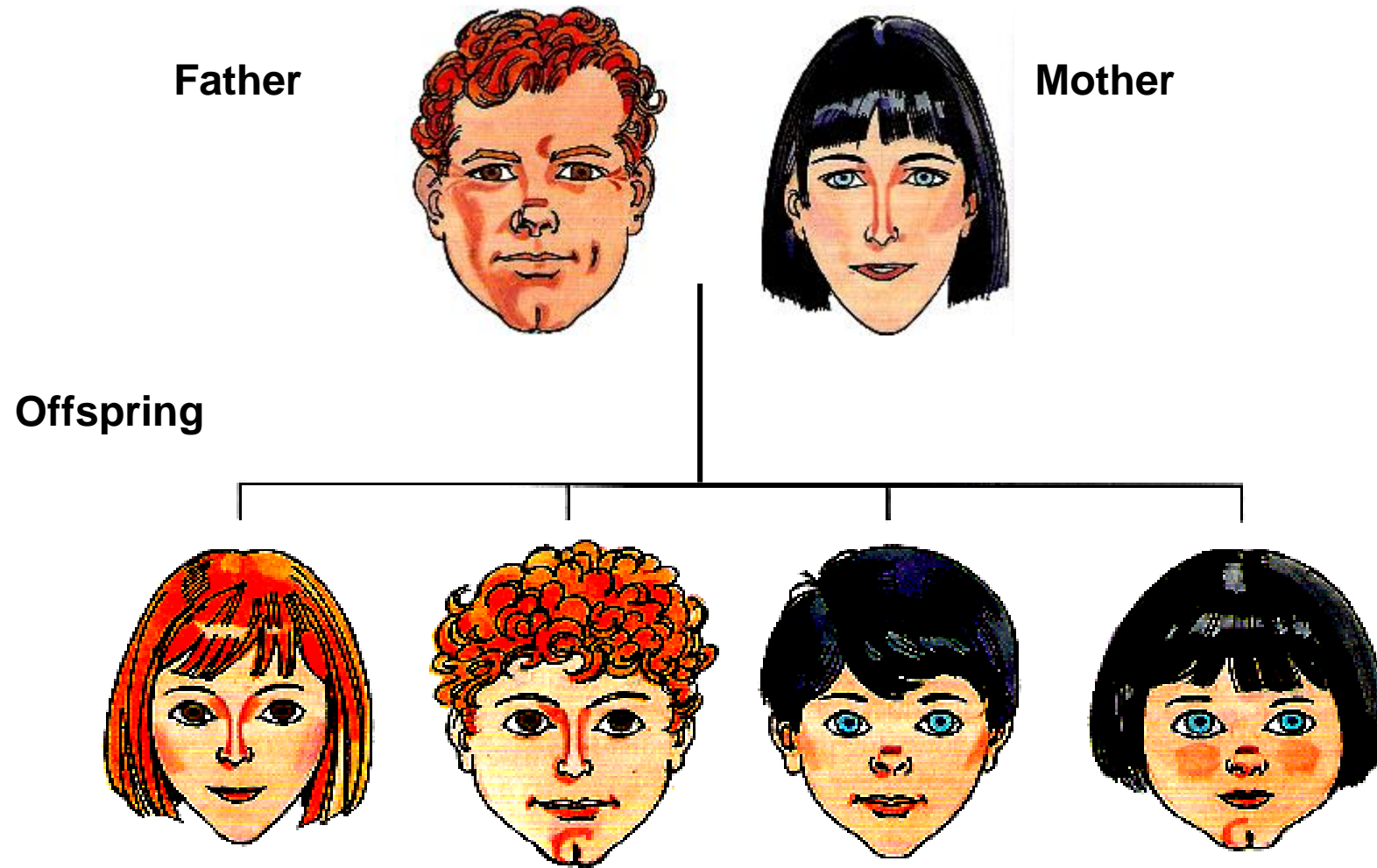
Heredity is the transmission of characteristics from parents to their offspring

Inheritance is the set of characteristics that have been transmitted from parents to offspring

Genetics is the scientific study of how characteristics are transmitted from parents to their offspring

Variation is the differences which exist between **phenotypes** (appearance) of individuals belonging to the same species

Inheritance and variation



Gregor Mendel















- Gregor Mendel, was an Austrian Monk known as the 'Father of Genetics'
- Conducted breeding experiments with pea plants
- Wanted to find out the effect of cross fertilisation on seven **contrasting traits** of pea plants and how traits are passed from generation to generation
- He developed a basic understanding of genetics and inheritance



Gregor Mendel 1822-1884

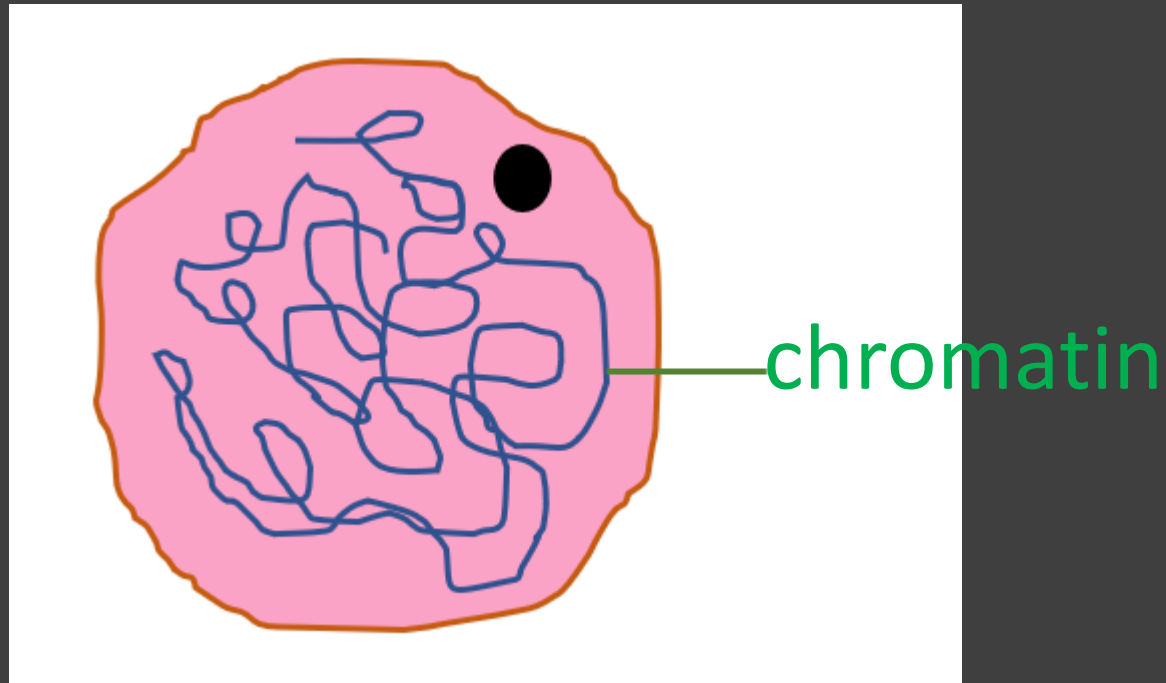
- Mendel studied seven **contrasting** pea characteristics

- He deduced that there are alternative forms of genes (although he did not use that term) which are inherited as distinct units from each parent i.e. the units that determine heredity

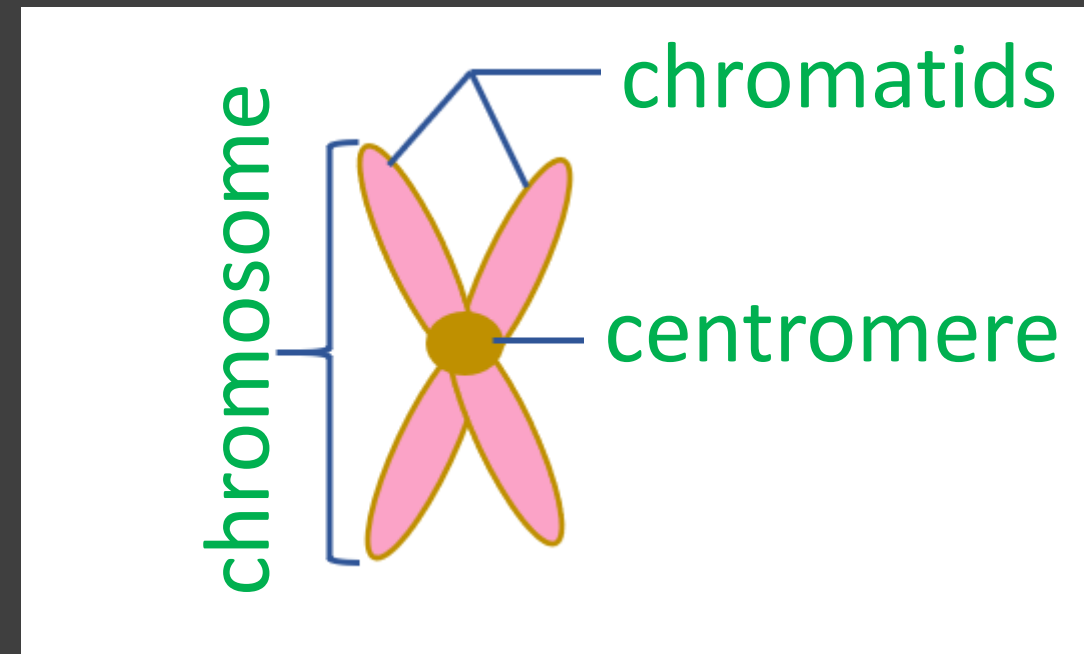
FLOWER COLOUR	 Purple	 White
FLOWER POSITION	 Axial	 Terminal
SEED COLOUR	 Yellow	 Green
SEED SHAPE	 Round	 Wrinkled
POD SHAPE	 Inflated	 Constricted
POD COLOUR	 Green	 Yellow
STEM HEIGHT	 Tall	 Dwarf

CONCEPTS IN INHERITANCE: Chromatin and Chromosomes

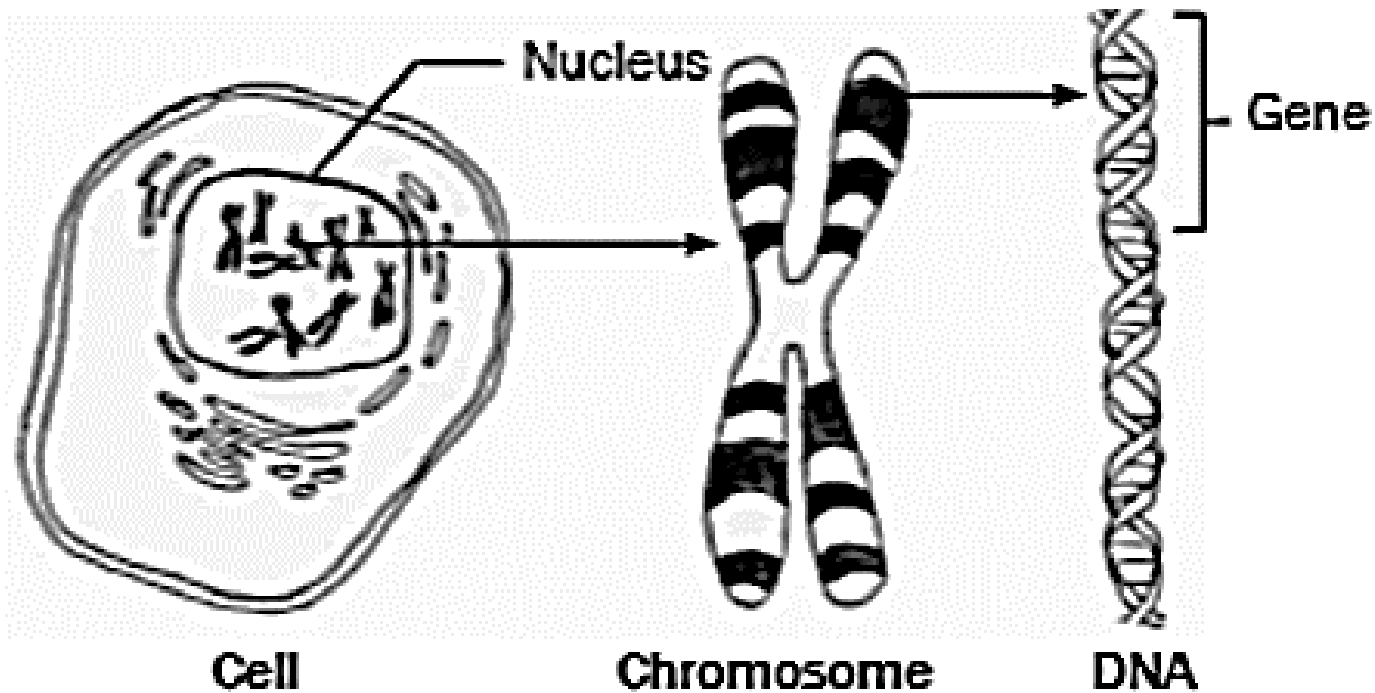
- Chromatin- an entangled mass of threads found in the nucleus of cells which are in the “resting stage” i.e. cells which are not dividing; they give rise to chromosomes



- Chromosomes - string-like structures found in the nucleus of dividing cells; formed from chromatin network; contains the hereditary material DNA



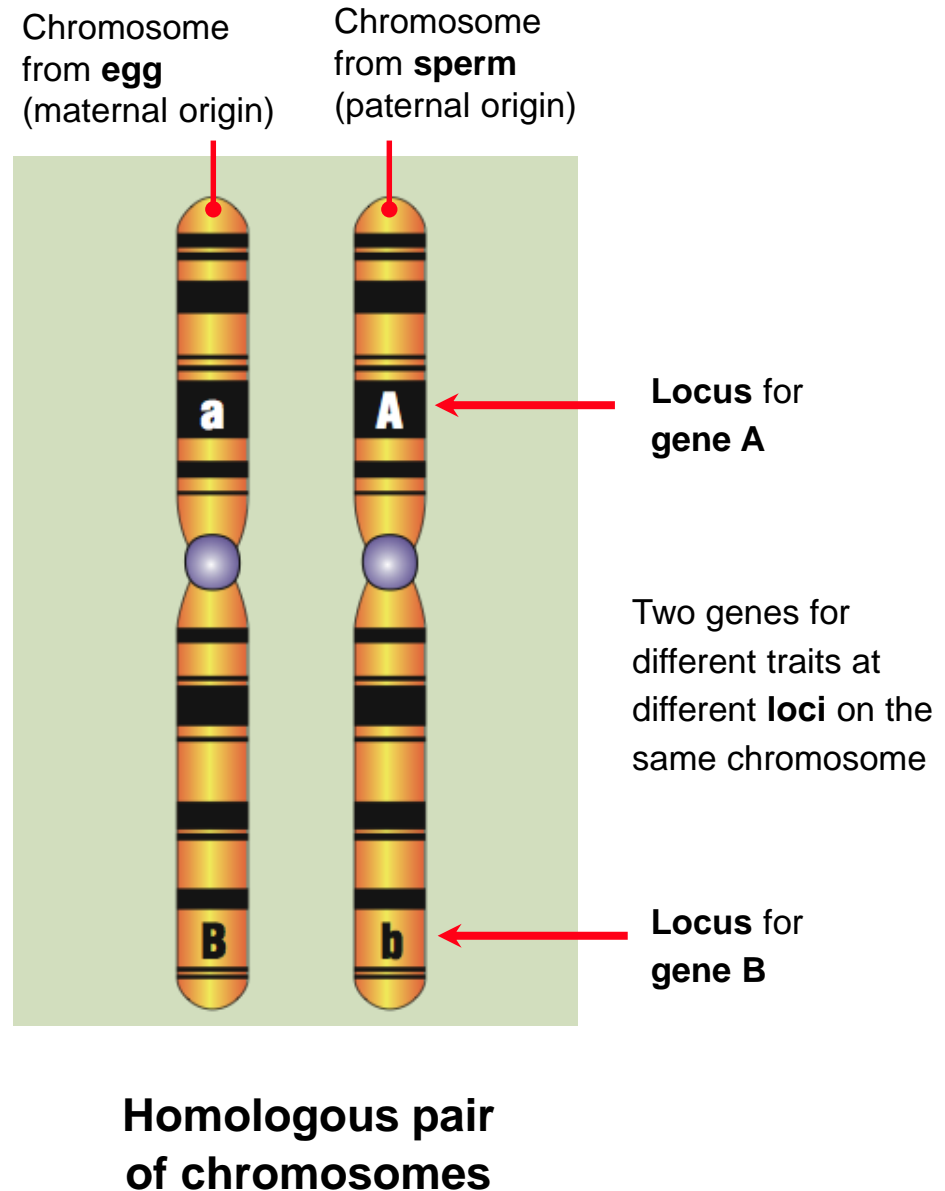
Genes



- **Gene**- small section of DNA containing a particular nucleotide sequence coding for a specific trait e.g. tallness

Location of Genes

- The position of a gene on a chromosome is the **locus**. (plural = loci)
- Most cells of sexually reproducing organisms most cells have a **homologous pair** of chromosomes (one from each parent).
- Chromosomes from a homologous pair have genes that control the same **trait** at the same locus.

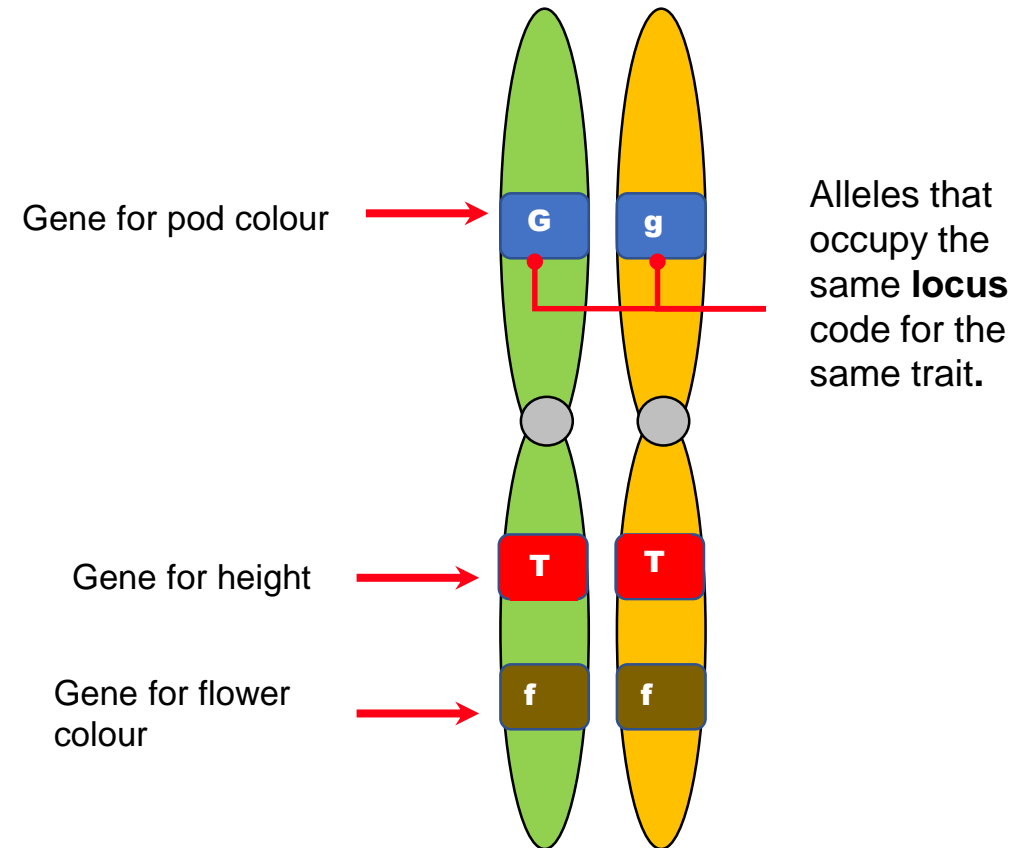


Alleles

- ❖ Alleles are different /alternative versions of the same gene coding for the same characteristic
- ❖ They occupy the same locus on homologous chromosomes
- ❖ Any one individual can only have a maximum of two alleles for a given gene.



Pod colour in peas is a trait controlled by a single gene. The allele for green pods is dominant over the allele for yellow.



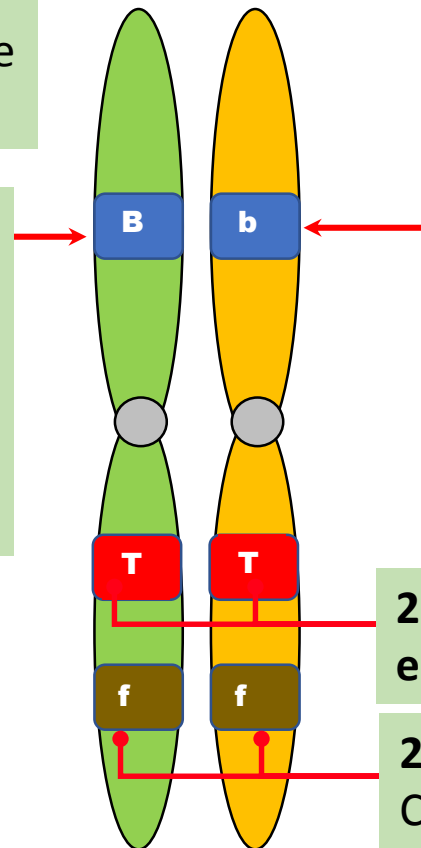
Dominant vs Recessive alleles

An allele may be **dominant**- written as a capital letter OR **recessive** written as small letter.
NB!!!WE USE THE SAME LETTER FOR THE SAME CHARACTERISTIC.
E.g. In humans brown (**B**)eye colour is dominant to blue (**b**)eye colour

Dominant allele

e.g. allele for brown eyes (**B**)

The characteristic controlled by the dominant allele always appears in external appearance (phenotype) of an organism



Recessive allele

e.g. allele for blue eyes (**b**)

The characteristic controlled by the recessive allele is always masked if there is presence of dominant allele (Bb) for the same characteristic.

2 Dominant alleles

e.g. allele for tongue rolling

2 Recessive alleles e.g. allele for attached ear lobes

Characteristic can be seen externally in the absence of a dominant allele, i.e. when both parents have contributed a recessive allele for a characteristic (ff)

Examples of Dominant and Recessive Traits in Humans:

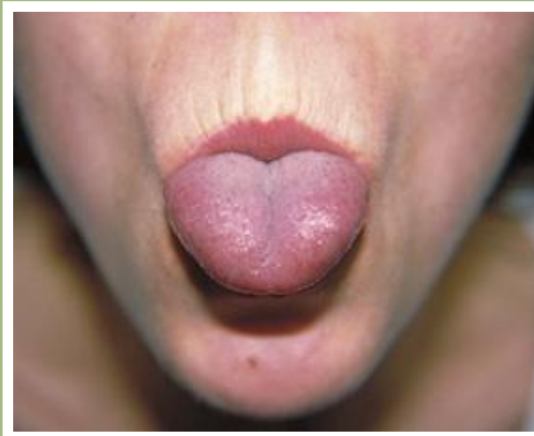
Ability to roll the tongue

Dominant



Phenotype:	Can roll tongue
Allele:	T

Recessive



Phenotype:	Cannot roll tongue
Allele:	t

Human Ear Lobe Attachment

Dominant



Phenotype:	Lobes free
Allele:	F

Recessive



Phenotype:	Lobes attached
Allele:	f

For your information: Other Hereditary Traits



Brown eyes are dominant over blue



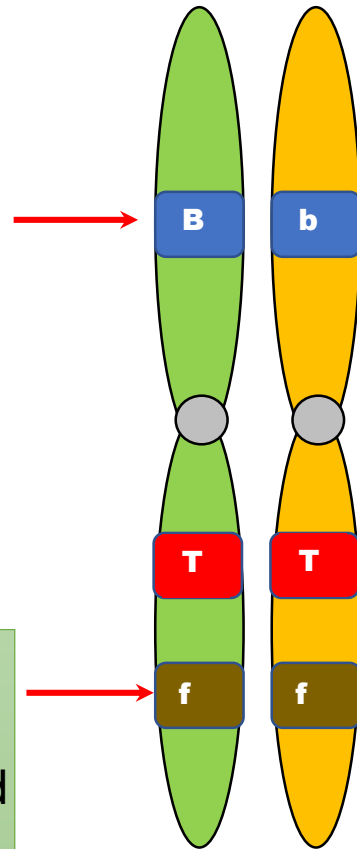
Dark brown hair is dominant over other hair colors

Dominant	Recessive
Curly hair	Straight hair
Dark brown hair	All other colors
Coarse body hair	Fine body hair
Syndactylism (webbed digits)	Normal digits
Normal skin pigmentation	Albinism
Brown eyes	Blue or grey eyes
Near or far-sightedness	Normal vision
Normal hearing	Deafness
Normal colour vision	Colour blindness
Broad lips	Thin lips
Large eyes	Small eyes
Roll tongue into U-shape	No tongue roll
A or B blood factor	O blood factor

Alleles: Homozygous vs Heterozygous

When each of the chromosomes of a homologous pair have different alleles of gene, the organism is said to be **heterozygous**. Only the dominant allele (A) will be expressed.

When both chromosomes have identical copies of the recessive allele for a gene, the organism is said to be **homozygous recessive** for that gene. The characteristic coded for by the recessive allele will be expressed externally



When both chromosomes have identical copies of the dominant allele for a **gene**, the organism is said to be **homozygous dominant** for that gene.


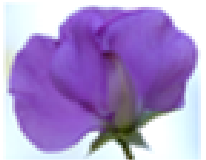

PHENOTYPE AND GENOTYPE

- PHENOTYPE - refers to the **external appearance** of an organism, e.g. *shape, colour, height*, etc.

- GENOTYPE- refers to the actual **genetic make-up** or **genetic constitution** of an organism, e.g. **RR, Rr, or rr**

GENOTYPES AND PHENOTYPES

In pea plants flowers have two alleles for colour:

Genotypes	Phenotypes
Homozygous FF dominant	Purple flowers 
Heterozygous Ff dominant	Purple flowers 
Homozygous ff recessive	White flowers 

Phenotype = **Blue**



Recessive allele = **b**

Genotype = **bb**

Phenotype = **Brown**



Dominant allele = **B**

Genotype = **BB/ Bb**

ACTIVITY: WORKSHEET GENETICS TERMINOLOGY



Genetics
terminology Worksh