

National 5 Biology

Unit 2: Multicellular Organisms

5) Variation and Inheritance

Variation

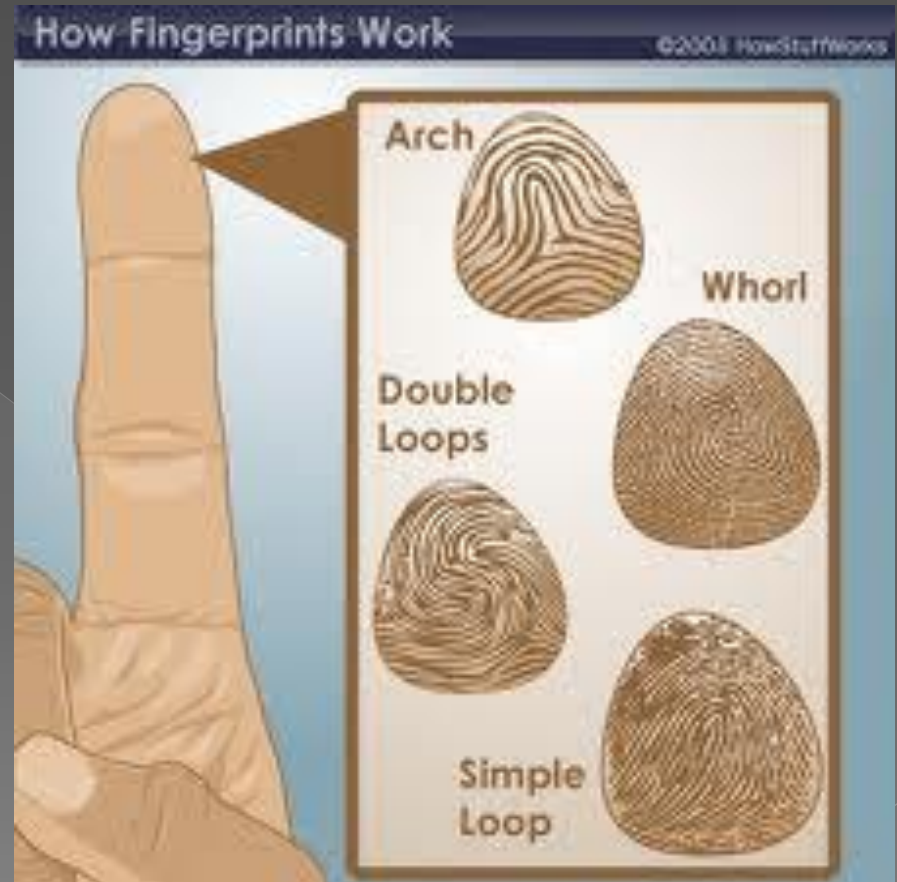
- Differences between individuals within a species are known as variation.
- Sexual reproduction produces new genetic combinations that contribute to variation.
- There are two types of variation:
 - Discrete Variation.
 - Continuous Variation

Discrete Variation

- Discrete variation occurs when a characteristic falls into distinct groups
- Discrete variables are presented in a bar graph or pie chart.
- Examples:
Blood Groups,
Ability to Tongue Roll,
Ear Lobe Attachment.
- Can you think of any others?

Thumb Prints

- Take your thumb print
- Categorise it using the pictures
- Fill your result into the class table
- Draw a BAR graph of the results





An Attached Ear Lobe



A Free Ear Lobe



**This is
Tongue Rolling!**

Can you do this? What proportion of the class can?

Continuous Variation

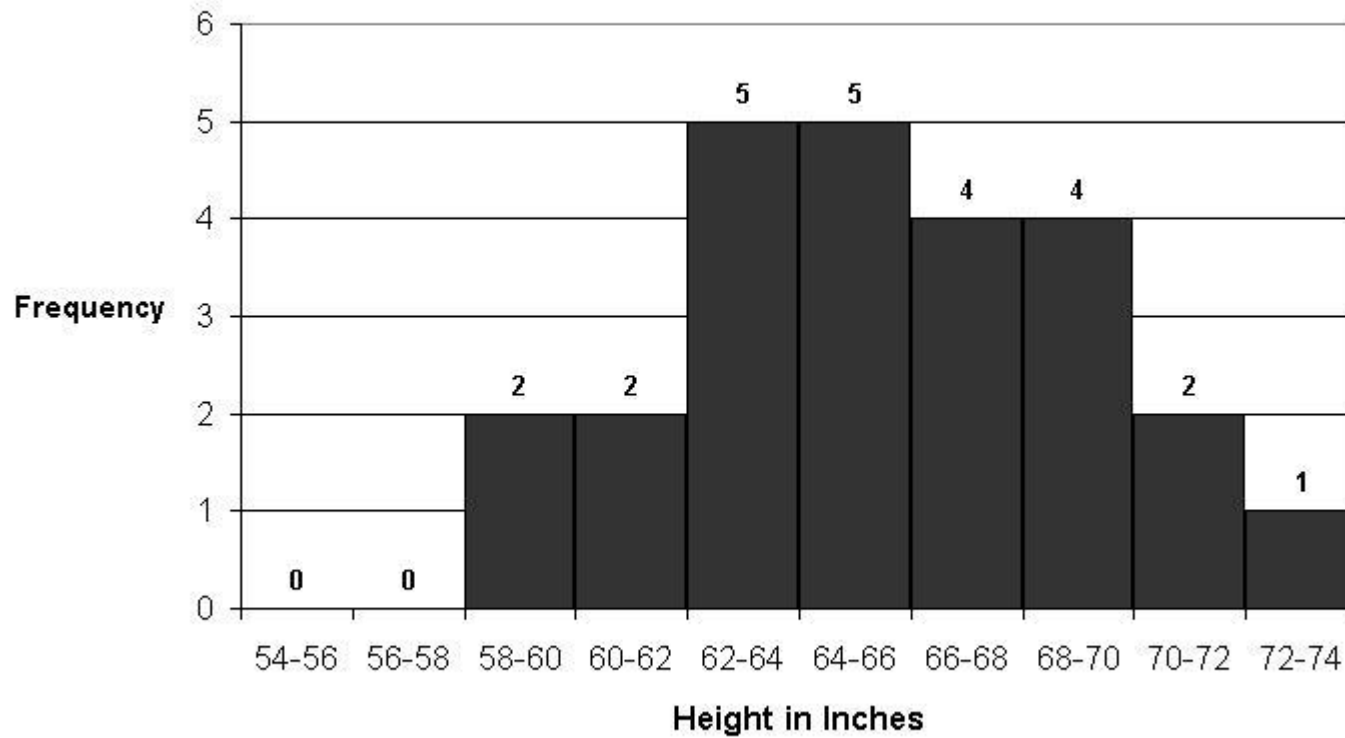
- Continuous variation occurs when a characteristic changes gradually over a range.
- Examples are human height, body mass & resting heart rate.
- Continuous variation is shown using a line graph or a histogram



*People are not always either tall or short.
Height varies across a range; it is a continuous variable.*

Frequency Distribution of Height of 25 Students

Data Source: Center of Rural Studies, UVM, 2004



Continuous variation can be shown in a histogram

Hand Span Histogram

- The table below shows information about the hand span of a group of students
- Draw a histogram of this information

Hand-span category (cm)	Number of students in category
15-16	2
17-18	6
19-20	4
21-22	3
23-24	2
25-26	1

Discrete	Continuous

Put these types of variation into the table:

- eye colour
- shell diameter in limpets
- height in emperor penguins
- free or attached ear lobes in humans
- gender in house sparrows

Phenotype & Genotype

- Organisms possess many characteristics that can vary, such as coat colour, wing type and leaf shape, etc.
- Genetic information controls the appearance of such physical traits.
- An organism's **phenotype is the physical appearance.**
- An organism's **genotype** means its genetic make-up.
- These are not necessarily the same; an organism can be a genetic carrier of characteristics that it does not show itself.

Passing on genetic information

- For every characteristic you receive 2 gene forms – called **alleles**
- 1 from your mother and 1 from your father
- It is the combination of genes that you have that determine your phenotype.
- So...your **genotype** controls your **phenotype**

True-Breeding or not?

- Organisms that have 2 alleles the same are called **homozygous**.
- These organisms are called **true-breeding**
- Organisms who have 2 different alleles are called **heterozygous**.

Dominant & Recessive Traits

- A trait is an inherited form of a characteristic.
- In heterozygous individuals, the trait that shows in the phenotype is called **dominant**.
- The other version of the characteristic is called a **recessive** trait.
- Heterozygous individuals can be genetic carriers of recessive traits that do not show in their phenotypes.

Genetic carriers

- It is possible to carry and gene (for example for a disease) but not actually have the disease
- These people are called carriers
- This is because they can pass the gene onto their offspring

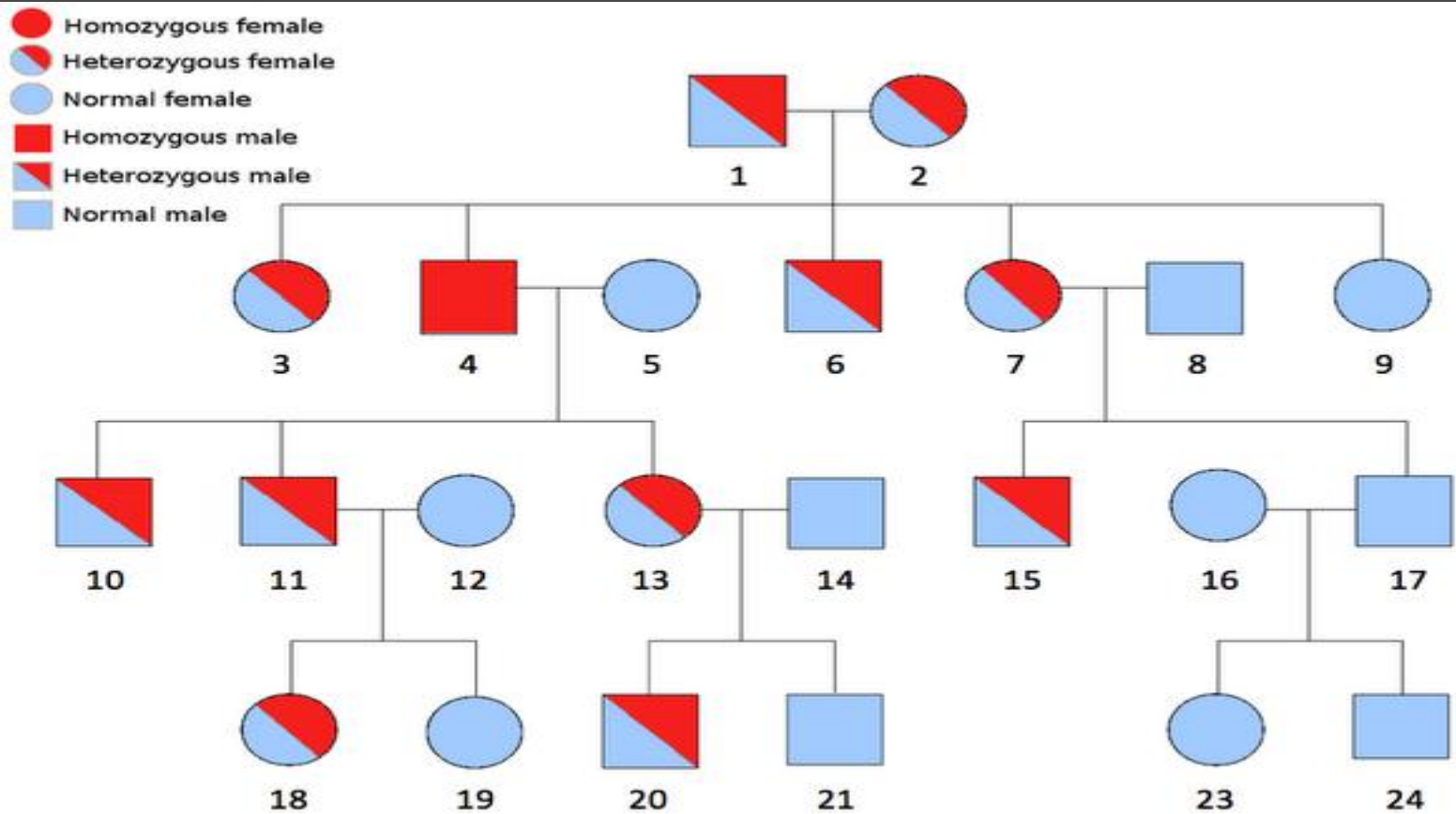
An example of a **Punnet Square**

	Genotypes of female gametes	Genotypes of female gametes
Genotype of male gametes		
R	R	r
r	RR	Rr
	Rr	rr

Punnet squares can be used to predict the genotypes of offspring from the genotypes of their parents.

In this case R is dominant to r and both parents were Rr.

Can you work out the likely proportion of the dominant trait in the phenotypes of the offspring? (With the help of your teacher!)



An example of a **Pedigree Chart**.

These can be used to predict the likelihood of genetic diseases.

Human Inheritance

- Most inherited characteristics are polygenic. All polygenic characteristics show continuous variation.
- This means that more than one gene is responsible for the characteristic.

Human Inheritance

- It is possible to identify **carriers** of many **genetic diseases**.
- They can then be given genetic counselling, to help them avoid passing on the disease to their children.
- It is now possible to avoid the birth of children with genetic diseases (through embryo screening). This raises serious ethical issues for some people.

Summary of Inheritance Terms

Term	Definition
<i>Alleles</i>	Different forms of the same gene
<i>Dominant</i>	An allele that always produces a certain phenotype in an organism. It is represented by a capital letter.
<i>Gene</i>	A sequence of DNA on a chromosome that contains coded instructions for making a specific protein
<i>Genotype</i>	An individual's alleles for a particular characteristic
<i>Heterozygous</i>	Describes an individual who has inherited two different alleles of the same gene from their parents
<i>Homozygous</i>	Describes an individual who has inherited the same allele for a gene from their parents
<i>Phenotype</i>	The outward appearance resulting from an individual's genotype for a particular characteristic
<i>Recessive</i>	An allele whose effect on the phenotype can be masked by a dominant allele of the same gene. It is represented by a lower case letter.

Past Paper Questions

- ◉ Page 48; Qs 10 and 11
- ◉ Pages 106-107; Q8
- ◉ Page 122; Q12
- ◉ Page 145; Q9
- ◉ Pages 180-181; Q7