

Principles of Inheritance and Variation

Non-Mendelian Inheritance

Multiple Alleles

In a gene normally two alleles are present but when more than two alleles are present in a gene then they are called Multiple Allele.

→ The concept of Multiple Allele is not applicable for an individual it is applicable for a population

→ E.g of Multiple Allele is AB O blood group in Humans.

→ Inheritance of A, B, AB and O blood types in man was discovered by German mathematician Felix Bernstein.

→ There are three Alleles for ABO blood group these alleles

are located on chromosome
no 9 the gene controlling
blood group is labelled as I
(-Isohaemagglutinin) or L [after Land-
sterner]

Blood gr.	Antigen	Antibody	Genotype
A	A	b	IAIA or IAio
B	B	a	IBIB or IBio
AB	A, B	No a, b antibody	IAIB
O	No antigen	a, b antibody	ioio

Q. If a man marries a woman
(AB blood group)
with blood group B what are
the possible genotypes of their
offspring

Father: IAIA
IAio

Mother: IBIB
IBio

I} I^A I^A I^B I^B
 ↓
 I^A I^B AB

II I^A i^o I^B i^o

 I^A I^B I^A i^o I^B i^o i^o i^o
 AB A B O

I^A i^o I^B i^o
 I^B i^o I^A i^o

I ^A I ^B	I ^B i ^o
I ^A i ^o	i ^o i ^o

II Coat colour of rabbit

Four Allele C^a, cch, ch, c^+

- 1) Wild type - Full coloured - c^+
 - 2) Himalayan [White with black tip on extremities like nose, tail and feet]
 ch
 - 3) Chinchilla - cch [Mixed coloured and white hairs]
 - 4) Albino - C^a (colourless)
- possible genotype.
- coloured - $c^+, c^+, c^+ch, c^+cch,$
 $c^+, C^a,$
 Chinchilla $cchcch, cchch, cchC^a,$
 $cchch, chC^a.$
- Himalayan $C^aC^a.$
- Albino -

Possible Genotype formula.

$$\frac{n(n+1)}{2}$$

n = no of Allele.

$$4 \times \frac{(4+1)}{2} = \frac{20}{2} = 10$$

For Blood group.

$$n = 3$$

$$\frac{n(n+1)}{2} = \frac{3(3+1)}{2} = \frac{12}{2} = 6$$

Pleiotropy

When one gene controls more than one character it is called the Pleiotropic gene and the Phenomenon is called Pleiotropy.

e.g. In Pea plant
Single gene influences.
Seed colour Flower colour
Red Spot on Leaf

In *Drosophila*.
recessive gene of vestigial wings
also influence some other
characters a) structure of
reproductive organs.

- Longevity i.e. length of body
- Bristles on wings.
- Reduction in egg production.

III

Sickle cell Anaemia.

The gene Hb^S causes change in structure of Haemoglobin. Shaped RBC become sickle shaped, RBC movement in capillaries.

In $Hb^A Hb^S$ condition it shows the phenomenon of codominance and provides resistance to malaria caused due to *P. falciparum*.

