

## **Modern Genetics: Patterns of Inheritance Beyond Mendel**

### **1-Incomplete Dominance**

not all traits show dominance/recessiveness  
in incomplete dominance, the **heterozygote**  
**shows a phenotype that is intermediate**  
between the homozygous dominant and  
homozygous recessive condition

ex. flower color in snapdragons

P1:     red   X   white

F1:           all pink

even though this seems like old blending  
theory, it still follows basic rules of  
inheritance

when we cross the F1's together, we get a  
1 red: 2 pink: 1 white ratio

## Modern Genetics

### 2-Co-Dominance

in this type of inheritance, **both alleles express themselves completely**

### 3-Multiple Alleles

this occurs when there are **more than 2 forms** of a gene in a population

ex. **Human Blood Groups show dominance, co-dominance & multiple alleles**

Phenotype	Genotype	Antigen	Antibody
A	AA, AO	A	antiB
B	BB, BO	B	antiA
AB	AB	A&B	none
O	OO	none	antiA,antiB

dominance: A is domin to O, B is domin to O

co-dominance: A & B are both expressed

multiple alleles: A, B, O

an **antigen**: is a protein on surface of RBC

an **antibody**: is a protein that recognizes & fights foreign substances in the body

if blood type A is given type B blood: antiB  
antibodies detect this foreign antigen B,  
they attack and RBC's clump together  
this can clog arteries

the **universal donor**: type O, has no antigens

**universal recipient**: type AB, has no antibodies

## **Modern Genetics**

### **4-Polygenic Traits**

these are traits that are **controlled by more than 1 pair of genes**

ex. hair color, skin color, height

eye color: 6 pairs genes giving tone, amount of pigment, and distribution of pigment

### **5-Sex determination**

how sex is determined

in different organisms, there are differences in the way sex is determined

in humans: 23 pairs chromosomes

22 pairs are autosomes, 1 pair is the sex chromosomes

XX: female, 23 pairs true homologous chrom

XY: male, 22 pairs of homologous chromo.

and 1 pair of nonhomologous chromo.

who determines sex of baby?

## **Modern Genetics**

### **6-Linked genes**

chromosomes carry more than one gene

some chromosomes are very gene dense,  
carrying 100s of genes, some chromosomes  
carry very few genes

**genes that are carried on the same  
chromosome are linked together,**  
meaning they are inherited together

Law of Independent Assortment applies to  
genes on different chromosomes  
but linked genes can be separated by  
crossing over in meiosis

### **7-Sex-linked traits**

these are traits carried on the sex chromosomes  
ex. color-blindness & hemophilia  
these 2 traits are carried on the X chromosome  
so females get 2 genes for the trait, males get  
only one

## 8-epistasis

when one gene pair influences the expression of another gene pair

ex. coat color in labrador retrievers

B\_: gives black coat color

bb: gives brown color

but there is 2nd gene pair E/e that allows coat color to be deposited in hair (that allows expression of coat color)

E\_: allows color to be deposited

ee: does not allow color to be deposited

so: BBEE, BB Ee, BbEE, Bb Ee: black

bbEE, bb Ee: brown

BBee, Bbee, bbee: blonde

## **Chromosomal Abnormalities**

a **karyotype** is a display of an organisms' chromosomes sorted by # & homologous chromosomes

to get chromosomes: stop cell division during metaphase when chromosomes line up in center of cell, then cells are treated with chemicals which stops cell division  
the cells are placed on slides, treated w/H<sub>2</sub>O which causes swelling  
the chromosomes then spread out, then we stain them

homologous chromosomes are distinguished from each other by position of centromere, chromosome size, & banding pattern (staining)

we can then determine the sex and any chromosomal abnormalities

**Nondisjunction:** failure of homologous chrom to separate during meiosis

ex. Down Syndrome: nondisjunction of #21  
3 # 21 chromosomes in every cell in body  
this causes mental and physical abnormalities

ex. Klinefelter's Syndrome: XXY  
this results in a sterile male

ex. Turner's Syndrome: XO  
this results in a sterile female

**Deletion:** part of chromosome is missing

Crie du Chat: deletion of chromosome #5