Inheritance

parents —characters→ offspring

Inheritance

Heridity
similar

Dissimilar Variation
Dissimilar

Genes:→ Inheritance unit
↳ Particular nucleotide sequence of a.a.

↳ Allele: gener partner
↳ homologus chromosome.
↓
position: locus: → ABO → 9
Sickle cell anemia → 11
Gene H → 19
X Linked → X
Y Linked → Y

↳ Homologus:
↳ similar gene pair

↳ Heterozygote
↳ Disimilar
- ↳ Dominance
- → Recessive
- → Incomplete
- → Over Dominance
- ↳ Co-dominance.

→ Trait.

Any character → Height, color, shape

Genotype
↳ genetic composition

phenotype
↳ particular

→ TT/Tt & tt — → short & long
→ YY / Yy / yy — → Yellow & Green
→ RR/Rr/rr. — → Round & Wrinkled.

Genotype:
↳ Total genotype of an individual.

Gene pool: breeding
↳ population

→ Total genes:
↳ Gene frequency i.e. Eye color: G-1, B-6, Bla-10
↳ in specific population

Mendle's Work:

1866 ⇝ plant hybridization:
⇝ Pea plant ⇝ Pisum sativum
→ Easily available
→ Easy to grow
→ Hermaphrodite → self & cross pollination
→ Short life cycle
→ Large progeny
→ Distinct character

• 7 - Traits:

Seed shape	Round	Wrinkle.
Pod shape	Smooth	Constricted.
Seed colour	Yellow	green.
Pod Colour	Green	Yellow
Flower Position	Axial	Terminal
Flower Colour	Purple	White
Height	Long	Short

• Hidden Advantage:
→ 7 Pair ⇝ Chromosome
→ 7 Character ⇝ 4 chromolome
→ No linkage.

• Rediscovery:
⇝ 1900 ⇝ Correns, De varies, Tschermark

Mendle First law.

Segregation, Dominance & Gametes purity:

Criteria:

→ monohybrid → single trait

seed shape.

Round Wrinkle.

1st Cross:

P_1 Round × Wrinkled.

F_1 Round.

2nd Cross:

F_2 × F_1 (self cross)

Round × Round.

F_2 Round → 3 (75%)

Wrinkled → 1 (25%)

Test cross: → to find unknown genotype.

1st Round: unknown genotype × P_1 recessive.

1st Round: × P_1 recessive.

Round → 100%

	r	r
R	Rr	Rr
R	Rr	Rr

2nd Round: × P_1 recessive.

Round → 50%

	r	r
R	Rr	Rr
r	rr	rr

Genotype:

1 : 2 : 1

Phenotype:

3 : 1

3rd Round: × P_1 recessive.

Round → 50%.

	r	r
R	Rr	Rr
r	rr	rr

Heterozygous = 2
Homozygous = 1

→ No. of gametes combination

$R_2r_2Y_2y = 4!$

$RRYY = 2$

$RRYy = 2$

$RrYy = 4$

$RRYyPp = 4$

$RRYYPp = 2$

$RrYyPp = 8$

Mendle 2nd Law:
Law of Independant Assortment:

Criteria:

→ Dihybrid

- Shape
  - Round
  - Wrinkle
- Colour
  - Yellow
  - Green

Initial combinations:

- Round → Yellow
- Wrinkled → green.

→ Pure breed

1st Cross:

P1 Round Yellow Wrinklid green

F1 Round yellow — 100%.

2nd Cross:

Round Yellow × Round Yellow

RrYy × RrYy

(RY) (Ry) (rY) (ry)

	RY	Ry	rY	ry
RY	RRYY*	RRYy	RrYY	(RrYy)
Ry	RRXy	*RRyy	(RrYy)	*Rryy
rY	RrYY	(RrYy)	*rrYY	rrYy
ry	(RrYy)	*Rryy	rrYy	*rryy*

12 → yellow
4 → green

Homozygous dominant: 1

Homozygous recessive: 1

*Homozygous: 4

Genotypic ratio:

1 : 2 : 1 : 2 : 4 : 2 : 1 : 2 : 1

Total genotypes: → 9

Total phenotype No: 16

Total phenotype types: 4

- Round yellow = 9 — 9/16
- Round green = 3 — 3/16
- Wrinkled yellow = 3 — 3/16
- Wrinkled green 1 — 1/16

→ Parental Combination:

Round yellow : 9
Wrinkled green : 1
} 10/16

→ Recomb:

Wrinkled yellow : 3
Round green : 3
} 6/16

Mendellian Traits:

Dihybrid: F_2 → 9:3:3:1

Non mendelian:

- Deviate → 9:3:3:1 in dihybrid.
  - ↳ Incomplete Dominance
  - ↳ Co-dominance.
  - ↳ Over dominance.
  - ↳ Linkage
  - ↳ multiple alleles
  - ↳ Pleotropy.

Linkage:

↳ T.H. Morgan.

B.W = broad wing S.W = Short
R.A = Round abdome P.A = Pointed.

Dihybrid Drosophilla

B.W & R.A ⟷ S.W & P.A → 9:3:3:1 ✗

B.W & R.A → 100% → 3:1 ✓ ↳ deviated.

F_1 × F_1 → self Cross

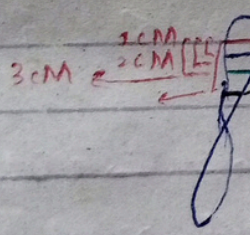
B.W & R.A × B.W & R.A

→ Linkage:

⇝ Physical relationship b/w different genes

⇝ genes ⇝ unlimited

⇝ Chromosome ⇝ limited



→ Transfer pattern → (en block)

Linkage ∝ $\frac{1}{\text{Distance b/w genes}}$

↳ Ratio in F_2:

- ⇝ All parental types
  - ↳ Complete linkage 3:1
- ⇝ More Parental & less recomb:
  - ↳ Incomplete
- Parental & Recomb same.
  - ↳ No linkage. 1:1:1:1

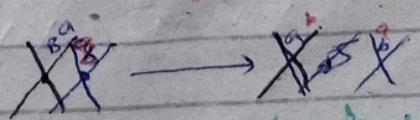
Crossing Over:

↳ reciprocal linkage.

→ prophase I

→ pachytitene

→ homologous chromosomes



Chiasma
↳ overlapping
↳ non sister chromosome.

synapse
↳ crossing over

(Linkage types)

Autosomal:
Autosomes
1 - 22 pair
♂ & ♀ equally.
Chromosome 11
- Sickle cell anemia
- Leukemia
- Albinism

Sex
Y-Linked.
→ Chromosome Y
→ Direct transfer father to son
→ Holandric traits
↳ male specific
specific region on Y: SRY gene.
↳ maleness
- Hypertrichosis
↳ hair on ear.

X-Linked.
→ On X chromosome
→ Affects male & female
→ Zigzag pattern

Dominant
→ Affects more ♀
→ hypophosphatemic rickets of "R" (vitamin D resistant rickets).
- X^RX^R → affect
- X^RX^r → affect
- X^rX^r → normal

66%

- X^RY → affect
- X^rY → normal, 50%

50%

Recessive.
affects more ♂
→ haemophilia "h"
→ color blindness
→ Gout.
- X^HX^H → normal
- X^HX^h → normal

66%

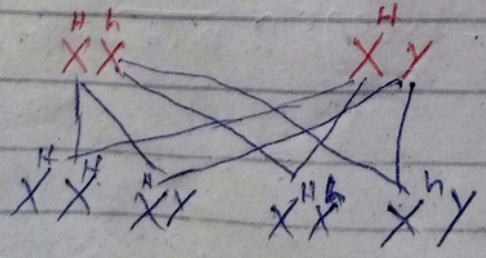
- X^hX^h → affect
- X^HY → normal
- X^hX → affect

33%, 50%, 50%

Haemophilia:
→ clotting factors → absent.
→ blood fails to clot —excessive bleeding→ death
→ Royal disease → Queen victoria.

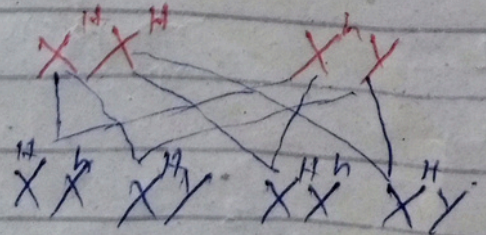
Types: (Absent → clotting factor)

H·A	VIII	X-linked	80%	♂ more
H·B	IX	X-linked	20%	♂ more
H·C	XI	4th chromosome → autosomal.	<1%	♂ & ♀



haemophilic → 25%
Affected → 25%
Carrier → 25%
Healthy → 25%

50% sons are affected



Haemophilic → 0%
Healthy 100%
Carrier 50%

Multiple Alleles:

Single trait controlled by → many alleles
→ maximum alleles discovered → 300.

Population → All alleles
Individual → 2 alleles
↳ gamete → 1 allele.

Example:

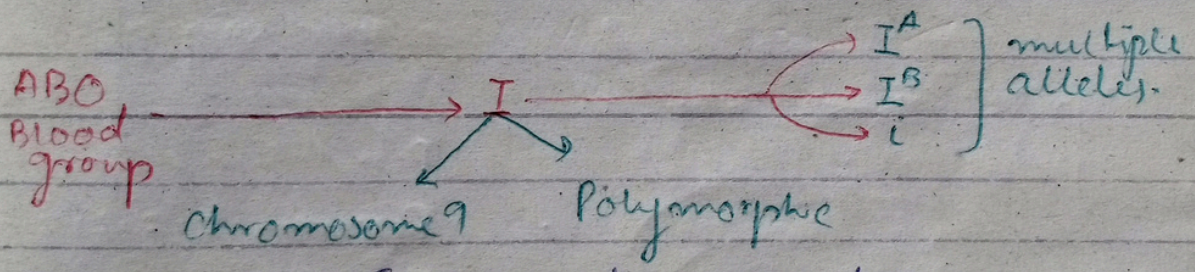
A.B.O Blood Group.

Discovered by:

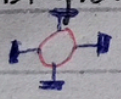
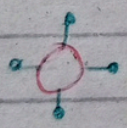
Karl Landsteiner

Genetic bases:

Bernstein.



→ I- expresses → Early embryonic stage.

Genotype	Antigen	Diagram	Blood group	Anti body	Donate to	Donate from.
I^AI^A/I^Ai	A		A	B	A, AB	A, O
I^BI^B/I^Bi	B		B	A	B, AB	B, O
I^AI^B codo minance	Both		AB	X	AB	A, AB, B, O.
i	X	O	O	Both	O, A, B, AB	O only

→ Total phenotypes → 4
→ Total genotype → 6
→ Total antigen → 2
→ Total antibodies → 2

→ Universal Donor → O
→ Universal Receptor → AB

antigen 'A' + Antibody 'A' = agglutination

Children
Parents

Parents
Children

AB

$I^A I^B$ no child will be O

O no child will be AB.

$AB \rightleftharpoons O$

$I^A I^B \times ii$

	i	i
I^A	$I^A i$	$I^A i$
I^B	$I^B i$	$I^B i$

50% A

50% B

$I^A i \times I^B i$

	I^B	i
I^A	$I^A I^B$	$I^A i$
i	$I^B i$	ii

→ all 4 blood groups.

25% → each