

8/8/23

MKM

Eukaryotes → genetic material $\left\{ \begin{array}{l} 50\% \text{ from father} \\ 50\% \text{ from mother} \end{array} \right.$

every organism -
single or multicellular

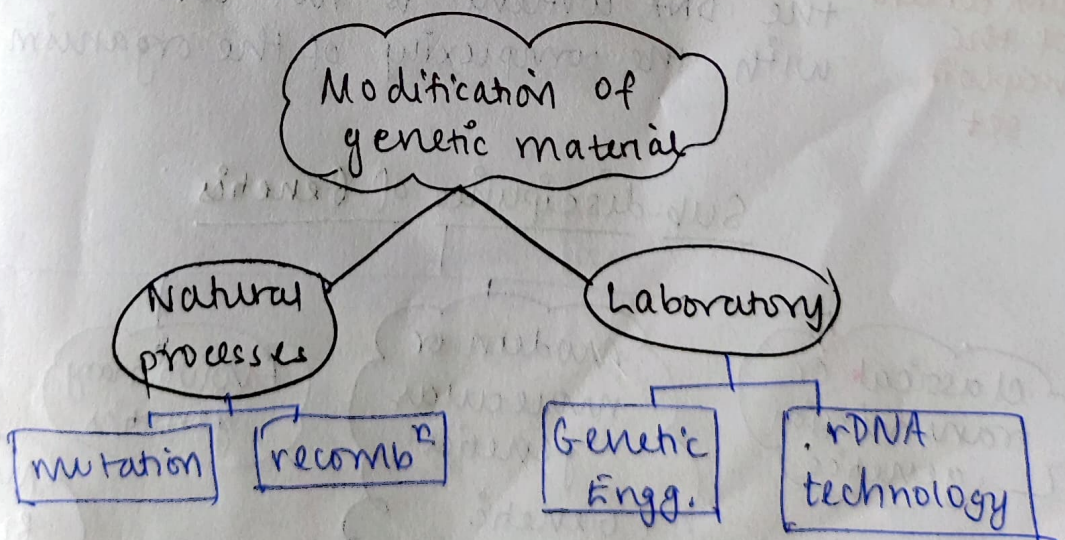
- Propagⁿ / Reprodⁿ (transmission of traits)
- Survivability & continuity of species specificity
- Varⁿ & adaptⁿ
- Evolution / emergence of new species.

crossing over/
recombination
during meiosis
mutations

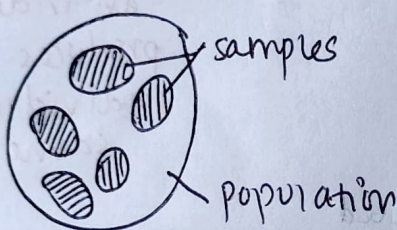
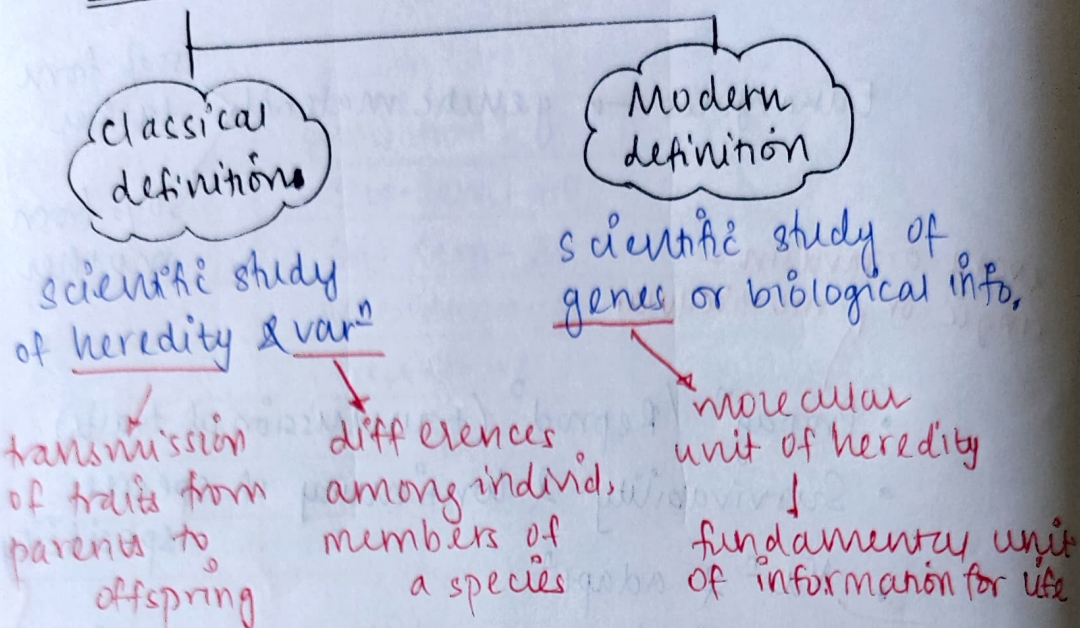
an individual
produces new
individual of the
same species.

Accelerated
evolution

- in single-cell organisms
- in laboratory
- induced mutations
accumulating into evolⁿ



Genetics :



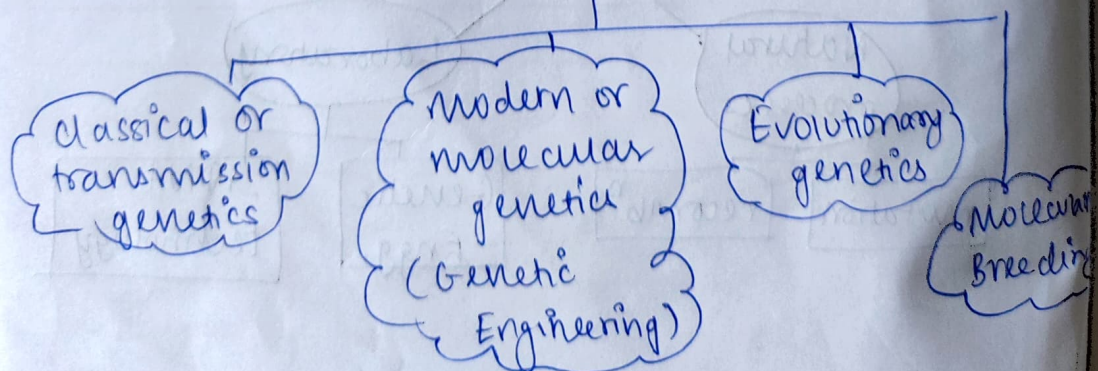
a segment of DNA that encodes a functional product (RNA or protein), and essentially consists of a promoter, coding sequence and transcriptional terminator.

C-value paradox :

DNA content of the haploid set

the DNA content is not correlated with the complexity of the organism.

Sub-disciplines of Genetics



Classical or Transmission Genetics

Mendelian genetics

Cytogenetics

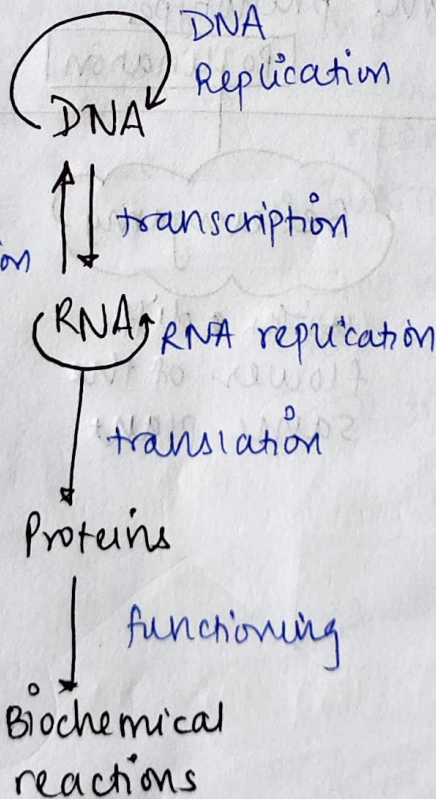
Populⁿ genetics

Quantitative genetics

Differential Gene Exprⁿ (DGE)
(or) Tissue-specific exprⁿ

only certain genes are expressed in any particular tissue to give it its characteristic

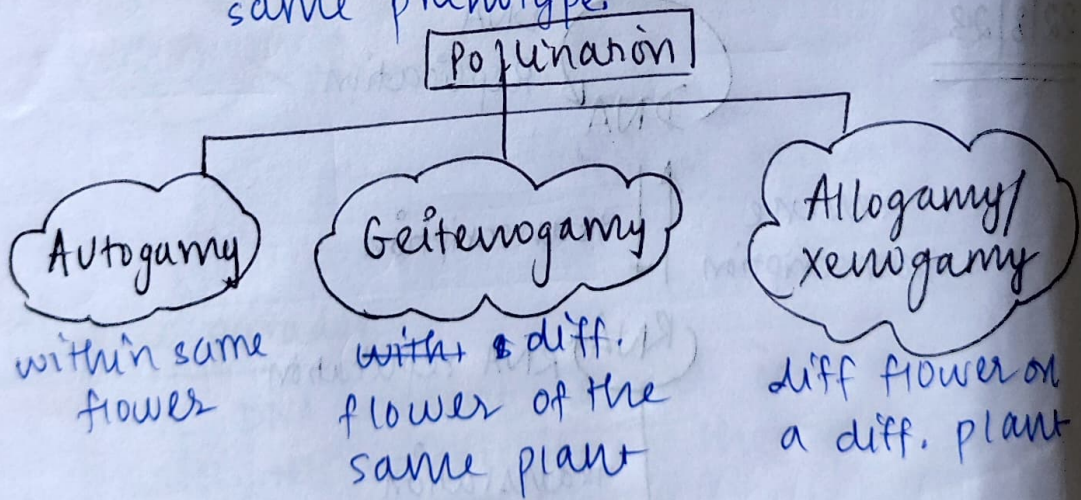
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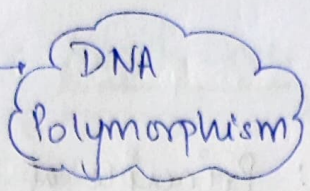
Trails	Genotype	Phenotype
Height ↓ a particular characteristic of an organism	<div> <div>allele 1</div> <div> \textcircled{T} Tt $t\textcircled{t}$ <div>allele 2</div> </div> </div> <div>↓</div> <div>combination of gene alleles</div>	<div> <div>Tall</div> <div>Tall</div> <div>Dwarf</div> </div> <div>↓</div> <div>observable outcome of gene exprⁿ</div>

Gene-environment interⁿ

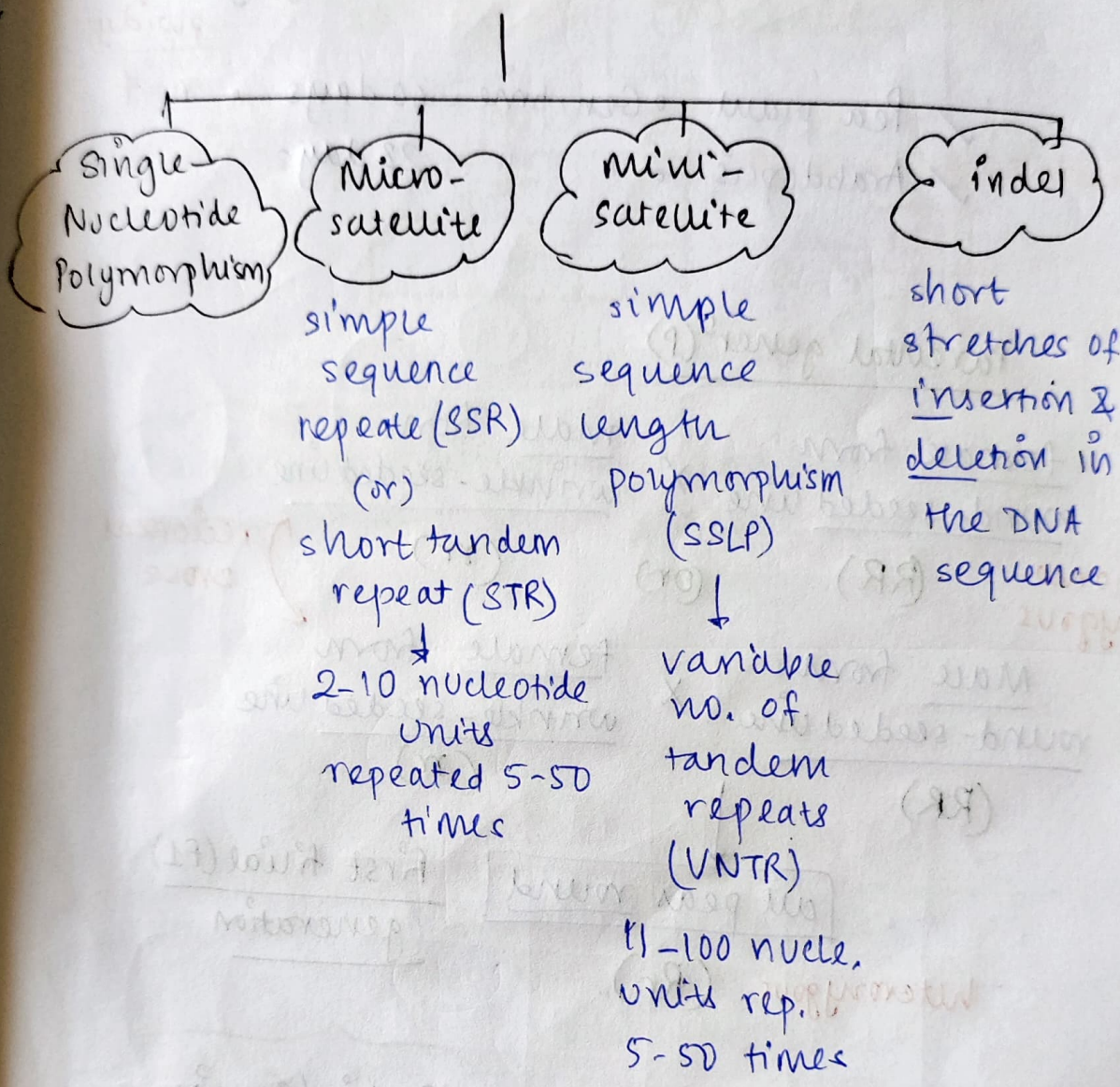
↓
two individuals may have the identical genotype, but not the same phenotype.



Alleles



alteration in nucleotide of the DNA sequence.



+w
R/r
RA//ra

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Mendel's 1st Law: Principle of Segregation

ploidy

- ✓ Pea plant \rightarrow Gen. time = 60 days $\rightarrow n=7$
- ✓ Arabidopsis \rightarrow " " = 28 days

Parental generⁿ (P)

female from
round-seeded line

(RR)

(or)

male from
wrinkle-seeded line

(rr)

reciprocal cross

Male from
round-seeded line

(RR)

female from
wrinkle-seeded line

(rr)

all peas round

First filial (F₁)
generation

heterozygous, (Rr).

(Rr)

x

(Rr)

Selfing/Crossing

Second filial
generⁿ (F₂)

(RR)

(Rr)

(Rr)

(rr)

3/4th are
round seeds

1/4th are
wrinkled seeds

~ 3:1

Selfing

RR

only round

Selfing

RR Rr Rr rr

3:1 round:
wrinkled

Selfing

rr

only wrinkled

Test Cross / Back Cross : recessive parent (wrinkled in this case)

F₁ round X P wrinkled
(R/r) (r/r)

	R	r
r	Rr	rr
r	Rr	rr

1/2 round : 1/2 wrinkled

1:1

Particulate factors

→ Mendel's version of alleles of the gene.

Y/Y x R/R

↓
R/r x Y/y

	Y	y
Y	Y/Y yellow	Y/y yellow
y	Y/y yellow	y/y green

	Y	y
Y	Y/Y yellow	Y/y yellow
y	Y/y yellow	y/y green

Phenotypic = 3:1

Genotypic = 1:2:1

P = 1:1

G = 1:1

Dihybrid Cross: Law of Independent Assortment

~~RR/RR~~

~~rr/rr~~

R/R; Y/Y

RRYY

x

rryy

r/r; y/y

round, yellow

wrinkled, green

RY

ry

RrYy

round, yellow

RrYy x RrYy

	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

P = 9:3:3:1

round
green
yellow

round
green

wrinkled
yellow

wrinkled
green

dominant pure line in round & recessive pure line in green.

all are pure lines

~~R/R, Y/Y~~
P: $RRYY \times rryy$

$RRyy \times rrYY$

$RrYy$

$RrYy$

$(3:1)^3 (3:1) (3:1)$

$(9:3:3:1) (3:1)$

Trihybrid: $27:9:9:9:3:3:3:1$

$RRYYPP \times rryypp$

$RrYyPp$

③ $2^3 = 8$

	RYP	RyP	RyP	rYP	Ryp	rYp	ryp
RYP	$RRYYPP$	$RRYyP$					
RyP							
RyP							
rYP							
Ryp							
rYp							
ryp							

	RYP	RYp	RyP	rYP	Ryp	rYp	ryP	ryp
RYP	RRXXPP	RRXXpP	RRXyPP	RrXXPP	RRXyPp	RrXXpP	RrXyPP	RrXyPp
RYP	RRXXpP	RRXXPP	RRXyPP	RrXXPP	RRXyPP	RrXXpP	RrXyPP	RrXyPP
RyP	RRXyPP	RRXyPP	RRXyPP	RrXyPP	RRXyPp	RrXyPp	RrXyPP	RrXyPp
rYP	RrXXPP	RrXXPP	RrXXPP	rrXXPP	RrXyPp	rrXXpP	rrXyPP	rrXyPp
Ryp	RRXyPp	RRXyPp	RRXyPp	RrXyPp	RRXypp	RrXypp	RrXyPp	RrXypp
rYp	RrXyPp	RrXyPp	RrXyPp	rrXyPP	RrXypp	rrXyPP	rrXyPp	rrXypp
ryp	RrXyPp	RrXyPp	RrXyPp	rrXyPp	RrXypp	rrXypp	rrXyPp	rrXypp