

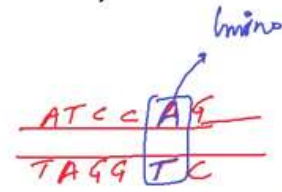
DNA damage / mutations

Spontaneous
vs
Induced

Germline vs somatic
↳ In Diploid Body
at the time of gamete formation

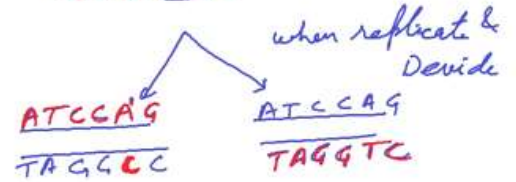
Transversion
 $Pu \rightleftharpoons Py$

Transition
 $Pu \rightarrow Pu$
 $Py \rightarrow Py$



Spontaneous mutations
↳ mainly because of tautomerization (Keto ↔ enol conversions)

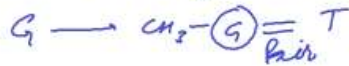
T (enol)	pair	G (keto)
G (enol)		T (keto)
C (imino)		A (amino)
A (imino)		C (amino)



Induced mutation = CHEMICAL MUTAGENS

↳ Alkylating agents = EMS, EES

① Alkylation leads to mispairing and generation of AP condition
↳ Responsible for Transversion as well as transition



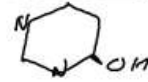
② Deaminating agents — $C-NH_2$ (amino) \rightarrow $C-OH$ (hydroxy or keto) $C=O$

$\xrightarrow[\text{bisulfite}]{HNO_2}$
C \rightarrow U then pair \bar{C} A

- G \rightarrow Xanthin pair \bar{C} T
- A \rightarrow hypoxanthin pair \bar{C} C
- 5mC \rightarrow T pair \bar{C} A

5mC \rightarrow (T)
converted to

③ hydroxylating agents → hydroxylamine
 add hydroxyl grp at 4th position of C → pair with A



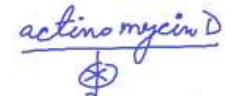
④ Base analogue incorporation →

5 Bromouracil analog = Thymine
 2 aminopurine analog = Adenine
 A = keto
 G = end
 Normally pair with Thymine
 But
 protonated form pair with Cytosine

Imp

① Cross linking agents
 - Mitomycin C
 - Borsons

⑤ Intercalating agents = Cause frameshift mutation
 EtBr, proflavin, acridine orange,



Toⁿ as well as replication

⑥ Bulky group addition = Aflatoxin B₁ from Aspergillus flavus

PHYSICAL MUTAGEN

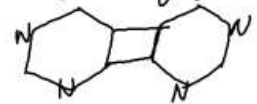
↳ Ionizing radiations = X-rays & γ-rays

↳ Induce free radical formation because of high energy and penetration power

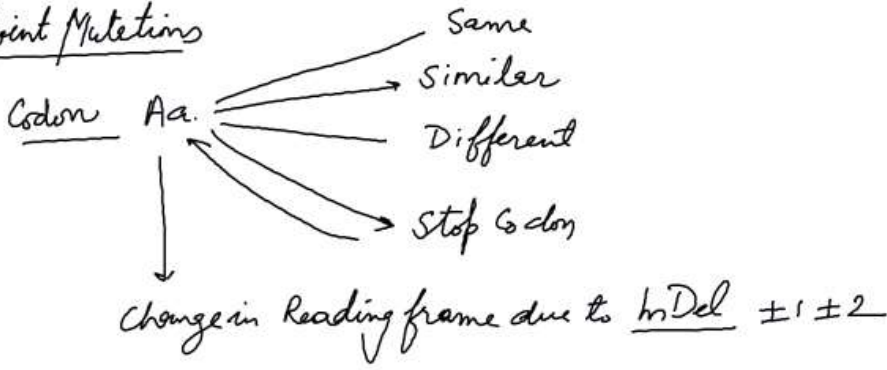
↳ Can cause
 Base Deletions
 SS Nick
 crosslinking
 chromosome breaks

Non Ionizing radiations → U.V. is mutagenic →
 U.V., microwave, IR
 Radiowave

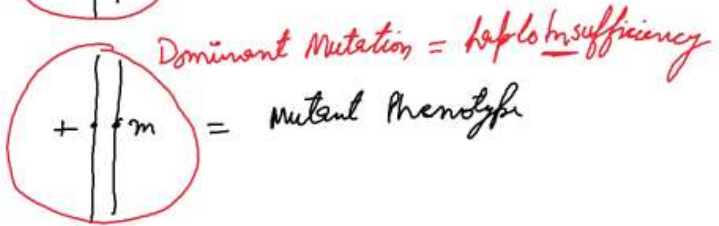
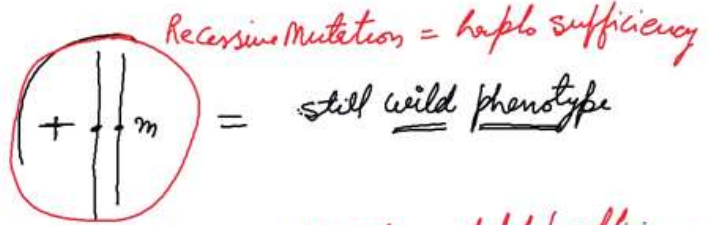
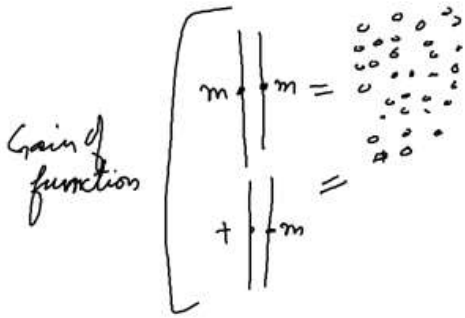
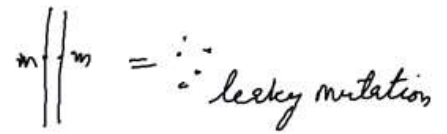
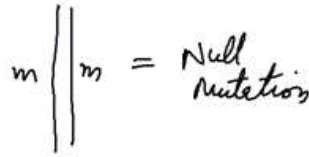
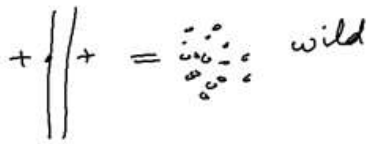
Induce Pyrimidine Dimer formation
 mainly T-T → if adjacent
 cyclobutyl ring formation



Point Mutations



Mutation — loss of function.



$m_1/m_1 = \text{mutant}$
 $m_1/+ = \text{wild}$ } Recessive

Morphological = affecting major phenotype or viability

Biochemical = Prototroph \rightleftharpoons auxotroph

$m_2/m_2 = \text{mutant}$
 $m_2/+ = \text{mutant}$ } Dominant

Conditional

↳ Permissive Condition = wild

Restrictive Condition = mutant

$m_3/m_3 > m_3/+$
severity } Semidominant

Muller's classification of mutants

- ① Nullimorph = Deficiency = No remaining gene function
- ② hypomorph = weak allele = leaky function
- ③ hypermorph = hyperactivity of allele = Gain of function
- ④ antimorph = Protein product is antagonistic to wild form
- ⑤ Neomorph = Abnormal (New) gene product