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Bacteria – Growth – Visually

Culture media → Broth → Turbidity

→ Plate / Solid Agar / Gel.

Bacterial colonies → Blood plate

Viruses → Bacteriophages.

Determine Growth → "Plaques" ✓ → Yes Growth!

X → No Growth!

Gene mapping in Phages. → Genetic material Transfer → Transduction

Almost Same like that of Eukaryotic System!

Mapping of genes! ← Recomb. / Diversity / variation?

→ Recomb.

Yes Crossing over → Recomb.

No Crossing over → Parental

In 1949, Alfred Hershey and Raquel Rotman

Examined – Strains of T2 bacteriophages.

Rate of Recombination is a Heritable.

Gene Plaque appearance

Gene Host range → At least 2 genes.

Bacteriophage can infect E. coli B type but not B/2

Normal host range (h+) Allele

Mutant host range (h)

Infect both B and B/2 type!

Abnormal Plaque with distinct Borders

Normal Plaque that is small with fuzzy borders.

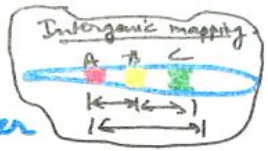
E. Coli: – 2 types.

Type B

Type B/2

Fine-structure analysis of bacteriophage genes

Intragenic mapping

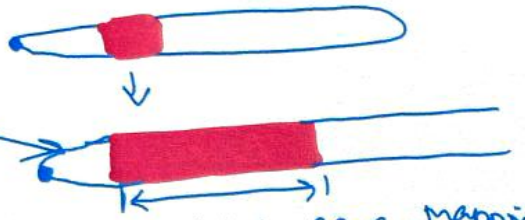


In 1950s and 1960s – Seymour Benzer

→ Fine structure of size of gene → Physically on a chromosome.

→ Whether the gene is monocistronic or polycistronic

"Cistron" → size of cistron.



Within a gene-mapping.

Benzer's mapping Technique

① → Wild type T4 phage → Normally produce small plaques with round edges.

② → Mutants → r or 'r'-mutant → 'rapid lysis' → Produces larger plaques and sharply defined edges

Wild type T4 phage produces typical plaques on E. coli Strains B, K

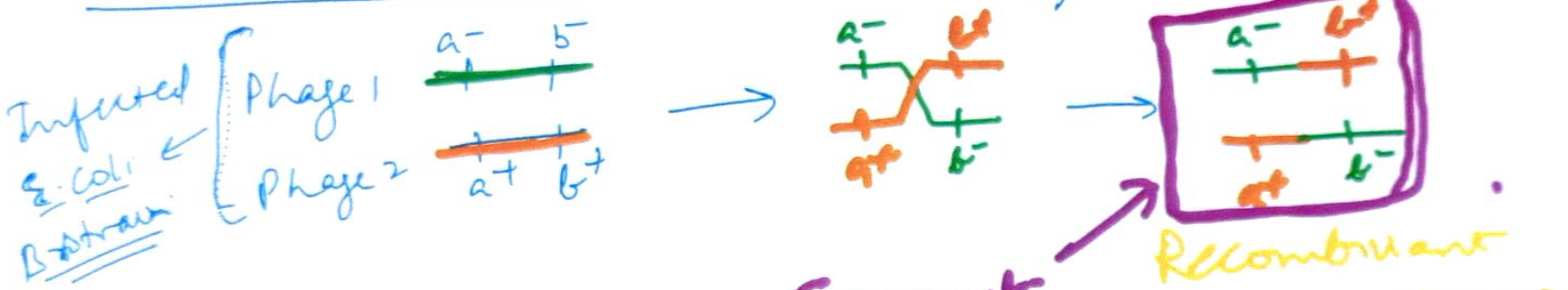
r mutants → (Bacteriophages) → rII mutants → Produce r plaques on B strain of E. coli but no plaque on K strain

Benzer collected thousands of rII mutants

He simultaneously infected bacterial cells with two diff. mutants and looked for recombinant progenies!

Is it having mutations at various different locations?

Two rII mutation → a^- and b^- // Wild type alleles - a^+ b^+



Recomb Progeny Phages

Grown on

E. coli K strain.

Recomb Progeny Phages

Each recomb. event produces an equal no of double mutants ($a^- b^-$) and wild type Chromosomes — $a^+ b^+$

So the no. of recomb progenies should be twice no. of wild types plaques that appears on K strain of E. coli

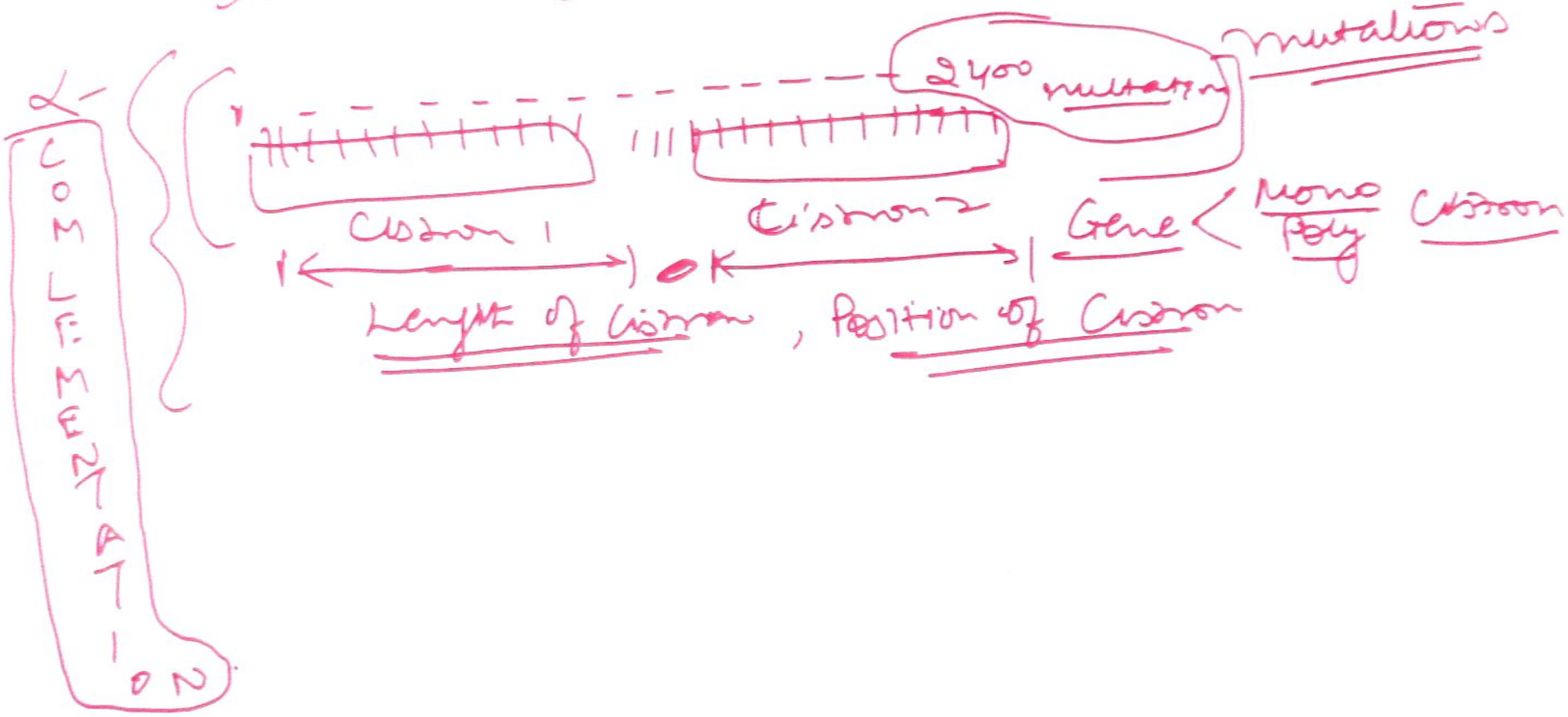
R.F. (Recomb. Frequency) = $\frac{2 \times \text{No. of plaques on E. coli K strain}}{\text{Total no. of plaques on E. coli B strain}}$

↓ R.F.

Proportional to physical distances along the Chromosom revealing the positions of the diff. mutations within a region of the phage Chromosome.

more tha

In this way Benzer mapped about more than 2400 rII mutations



Benzer's procedure for Mapping rII mutants

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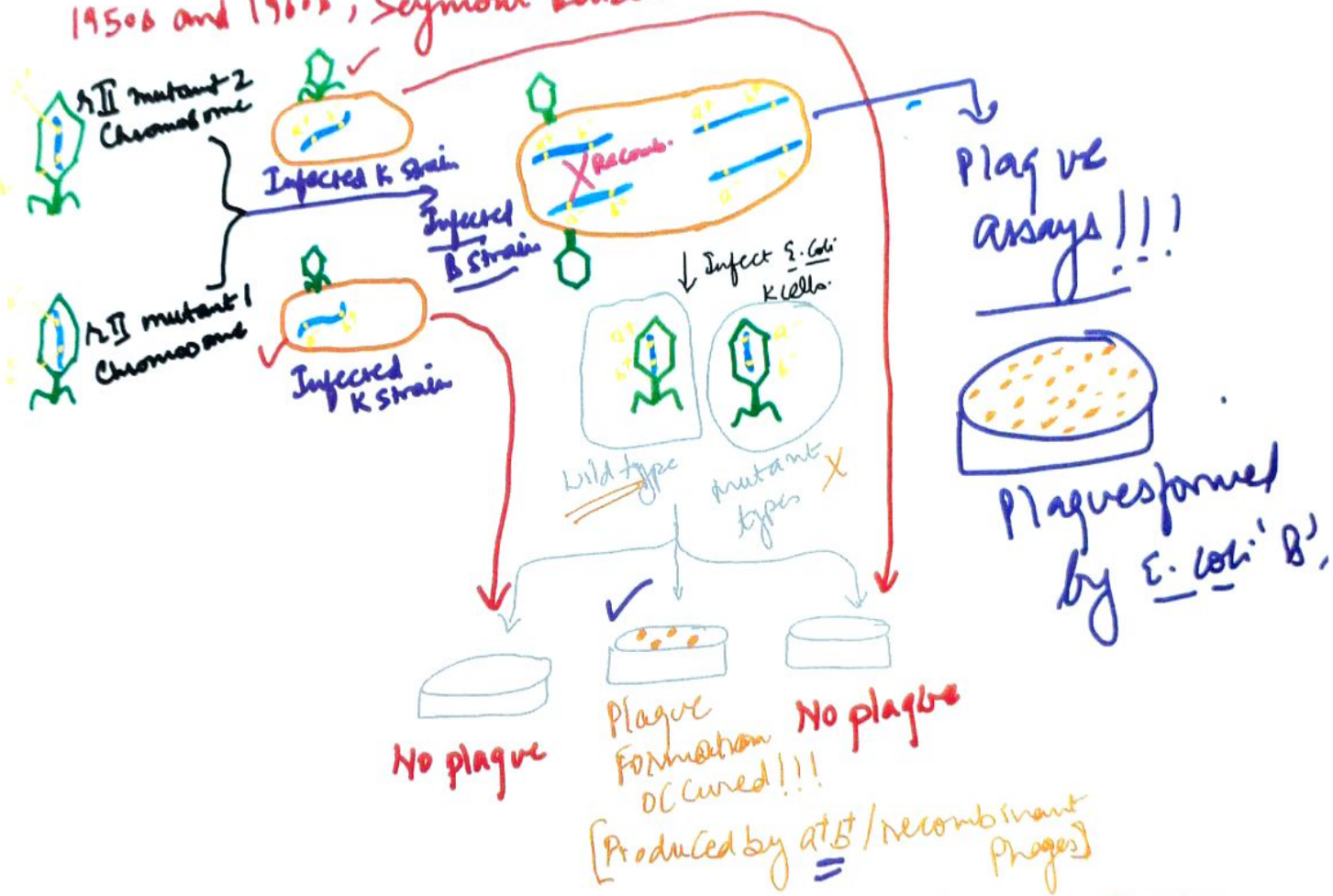
λ → "Rapid lysis"

II subgroup of mutant population

Mutant Type bacteriophages has Characteristic
↳ Can infect only 'B' strain of E. coli.

whereas wild type bacteriophages Could infect both 'K' as well as 'B' strains of E. coli

1950s and 1960s, Seymour Benzer



$$\text{Recombination frequency } (\gamma) = \frac{2 \times \text{No. of plaques on E. Coli K Strain}}{\text{Total no. of plaques on E. Coli B Strain}}$$

Complementation experiment - 2

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Mutations - ? rII belong to same gene or 2 different genes

Hal Conducted this expt when the relationship b/w DNA and gene was not known. only it known that gene is "functional unit of heredity"

Complementation - 2 states

Cis - $\frac{a^-\ a^-}{b^+\ b^+}$

Trans - $\frac{a^+\ b^-}{a^-\ b^+}$

Francis Hetz.

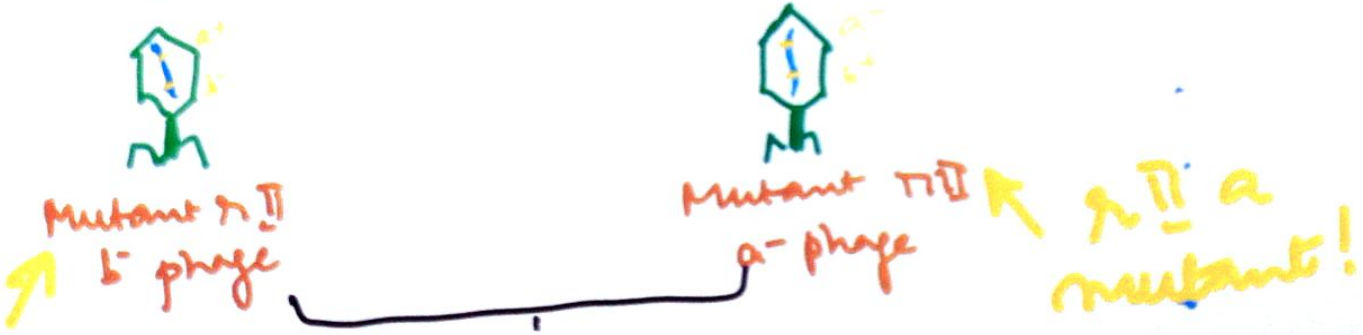
$\frac{a^+ \text{ Functional allele}\quad b^- \rightarrow \text{Non-functional allele}}{a^-\ b^+}$

↓ Non-functional allele

↘ Functional allele.

Functional Protein can be formed.

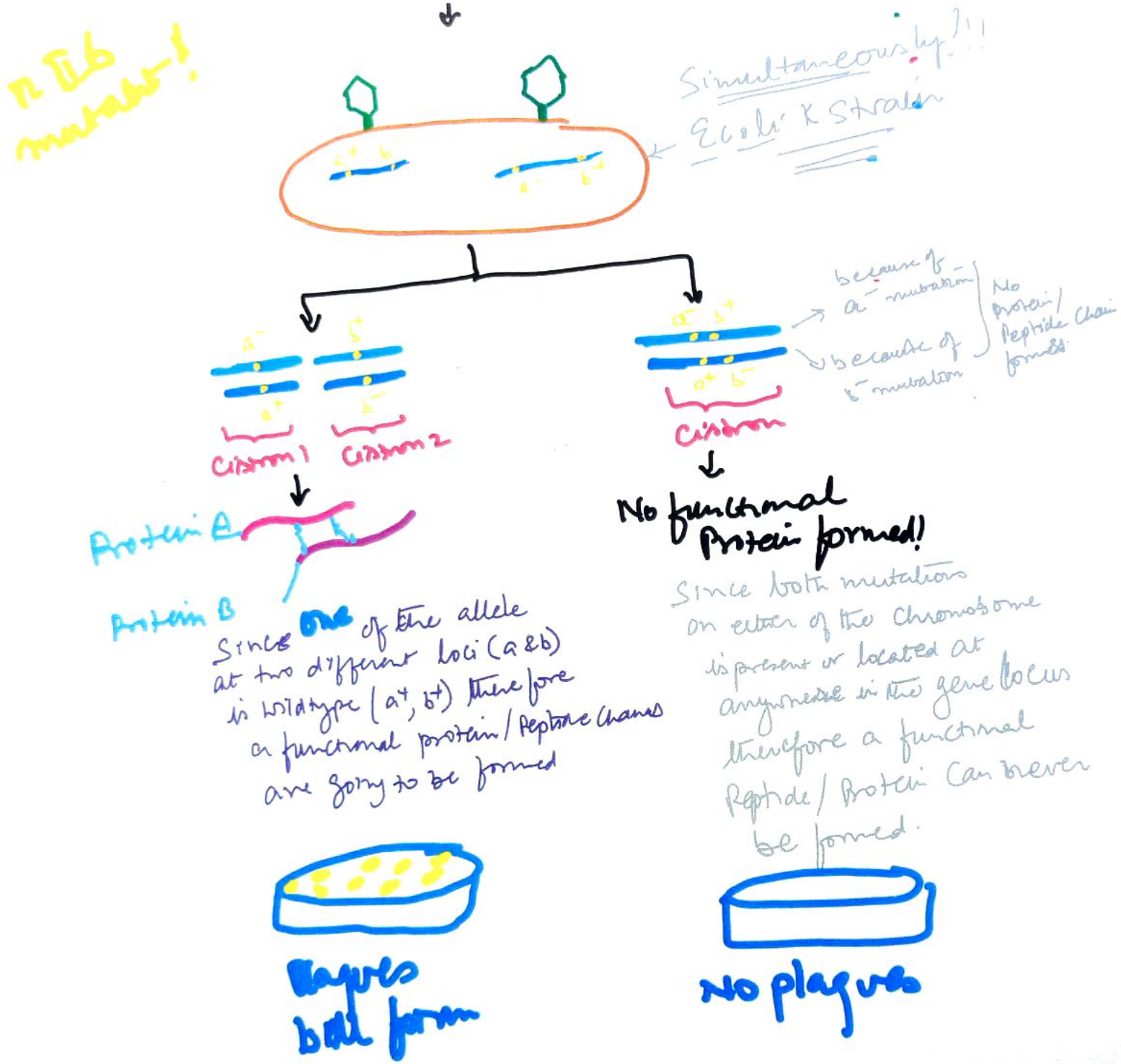
No functional Protein will form!



Mutant rII b⁻ phage

Mutant rII a⁻ phage

rII a mutant!


rII B mutation!
Simultaneously!!!
E.coli K strain
Cistron 1
Cistron 2
Protein A
Protein B
Since one of the allele at two different loci (a & b) is wildtype (a^+, b^+) therefore a functional protein / peptide chains are going to be formed
Plaques will form
because of a^- mutation
because of b^- mutation
No protein / peptide chain formed
Cistron
No functional protein formed!
Since both mutations on either of the chromosome is present or located at any where in the gene locus therefore a functional Peptide / Protein can never be formed.
No plaques