

ICB 5751/The origins of Molecular Biology

ARTHUR B. PARDEE, FRANÇOIS JACOB AND JACQUES MONOD. The Genetic Control and Cytoplasmic Expression of "Inducibility" in the Synthesis of β -galactosidase by *E. coli*

Reading guide

Introduction

1. What is the aim of the paper?
2. Define "induction" and "constitutivity".
3. What *lac* mutations are known? Are they linked? Are these mutations present in the same locus? Explain.
4. What is a merozigote? Explain it with the help of a drawing. How could merozigotes help answering questions about the genetics of particular phenotypes?

Materials and Methods

5. Describe the phenotype of the donor and receptor strains used in the conjugation experiments.
6. What are the two functions of streptomycin in this work?
7. According to the paper IPTG at the final concentration of 1 mM is able to induce the synthesis of β -galactosidase even in the absence of the permease. Explain this phenomenon. HINT: the answer is not in the paper.
8. What is "replica plating" and what was it used for?

Genetic structure of the "Lac" region

9. What can you conclude from the fact that (1) the frequency of recombination **between** *z* and *y* is very low; and (2) the frequency of co-transduction of *i* and *z* is >90% and of *y* and *i* is ~70%?
10. What evidences are there that *z* is a "structural gene"?

β -galactosidase synthesis by heteromerozygotes

11. What strategy has been employed to get merozigotes but not parental strains able to synthesize β -galactosidase?
12. What is the main conclusion of the experiment shown in Figure 2?
13. How did the authors demonstrate that cytoplasmic molecules other than DNA were not transferred to the female strain during conjugation?

14. Which allele is dominant: wild-type or mutant? Are the mutations z^- located in one locus or in different loci? How were these questions tested?
15. What is the expected phenotype of strains (1) $z^+ i^+$ and (2) $z^- i^-$?
16. Describe the conjugation experiment that showed that factors z and i do not belong in the same gene. What is the rationale of this experiment?
17. Which allele is dominant: i^+ or i^- ? How did the authors come to this conclusion?
18. What is the aim of the cross: $\sigma z^+ i^+ \text{Sm}^S \text{T6}^S \times \varphi z^- i^- \text{Sm}^R \text{T6}^R$? Explain why streptomycin and phages T6 were added.
19. Explain why the "control curve" in Fig. 3 and the "no inducer curve" in Fig. 4 stabilized after some time, while the culture supplemented with inducer and streptomycin kept going up.
20. What is the main conclusion of the Pajamo experiments?

Discussion

21. Why the "repressor" rather than the "inducer" model is more adequate to explain the expression of *lac*?
22. What is the relation between Pajamo and the discovery of mRNA?