

4. For each of the following partial diploids, indicate whether the levels of beta-galactosidase and lactose permease are negligible (N), inducible (I), or constitutive (C).

merodiploid	LacZ	LacY
$\Gamma^+O^+Z^+Y^+/\Gamma^+O^cZ^+Y^+$		
$\Gamma^+Z^+Y^-/\Gamma^+Z^+Y^-$		
$\Gamma O^+Z^+Y^+/\Gamma O^cZ^+Y^+$		
$\Gamma^+P^+O^cZ^+Y^-/\Gamma^+P^+O^+Z^+Y^+$		
$\Gamma P^+O^+Z^+Y^-/\Gamma^+P^+O^+Z^+Y^+$		
$\Gamma Z^+Y^+/\Gamma^+O^cZ^+Y^+$		
$\Gamma^+O^+Z^+Y^-/\Gamma^+O^+Z^+Y^+$		
$\Gamma O^+Z^+Y^+/\Gamma O^+Z^+Y^+$		
$\Gamma^+P^+Z^+Y^+/\Gamma^+P^+Z^+Y^+$		
$\Gamma^+P^+O^+Z^+Y^+/\Gamma^+P^+O^cZ^+Y^+$		

5. Provide a molecular explanation for the fact that the four codons for alanine - GCA, GCC, GCG, and GCU - can be translated correctly with only two tRNA molecules.

6. Why is the lac promoter ordinarily a weak promoter?

7. What are gratuitous inducers?

8. Briefly, what question was addressed by the fluctuation test, and what did that test prove?

8. Describe DNaseI footprinting and indicate how it helps identify the bacterial promoter sequence.

. What is an "open reading frame"? Why is this term preferable to "gene"?

10. a) In the Meselson and Stahl experiment, what was the result of growing the bacteria for many generations in the presence of ^{15}N ?

b) Beginning with that bacterial culture, and using the diagrams below, draw lines in the tubes that correspond to the bands of DNA that would have been obtained in the circumstances indicated below the diagrams.

One generation after switch to ^{14}N

two generations after switch to ^{14}N

three generations after switch to ^{14}N

c) If replication was CONSERVATIVE, rather than semi-conservative, what would have been obtained...

One generation after switch to ^{14}N

two generations after switch to ^{14}N

three generations after switch to ^{14}N

11. Which of the following are transversions? AT->TA GC -> AT CG -> TA TA -> GC

12. What is the significance of the sequence 5' UGG UGG in the trp operon attenuator region? What would be the effect (on regulation of trpEDCBA) of a mutation that converted the sequence to 5' UGA UGG?

13. Describe positive regulation of gene expression, using the positive regulation of the lac operon as an example to illustrate your answer. Do not include negative regulation of the lac operon in your answer.

14. Define the roles of the following in replication:

a) DNA polymerase I

b) epsilon subunit of polIII

c) ligase

d) helicase

e) loops in the lagging strand