

Chapter 17: From Gene to Protein

1. What is gene expression?

Gene expression is the process by which DNA directs the synthesis of proteins (or, in some cases, just RNAs). The expression of genes that code for proteins includes two stages: transcription and translation.

2. What situation did Archibald Garrod suggest caused inborn errors of metabolism?

In 1902, Garrod suggested that genes dictate phenotypes through enzymes that catalyze specific chemical reactions in the cell. He postulated that the symptoms of an inherited disease reflect a person's inability to synthesize a particular enzyme.

3. Describe one example Garrod used to illustrate his hypothesis.

Garrod gave as one example the hereditary condition called alkaptonuria. In this disorder, the urine is black because it contains the chemical alkapton, which darkens upon exposure to air. Garrod reasoned that most people have an enzyme that metabolizes alkapton, whereas people with alkaptonuria have inherited an inability to synthesize that enzyme.

4. State the hypothesis formulated by George Beadle while studying eye color mutations in fruit flies.

In the 1930s, Beadle speculated that in *Drosophila*, each of the various mutations affecting eye color blocks pigment synthesis at a specific step by preventing production of the enzyme that catalyzes that step. However, neither the chemical reactions nor the enzymes that catalyze them were known at the time.

5. What strategy did Beadle and Tatum adopt to test this hypothesis?

Beadle and Tatum bombarded *Neurospora* with X-rays, shown in the 1920s to cause genetic changes, and then looked among the survivors for mutants that differed in their nutritional needs from the wild-type bread mold. Beadle and Tatum identified mutants that could not survive on minimal medium, apparently because they were unable to synthesize certain essential molecules from the minimal ingredients. To characterize the metabolic defect in each nutritional mutant, Beadle and Tatum took samples from the mutant growing on complete medium and distributed them to a number of different vials. Each vial contained minimal medium plus a single additional nutrient. The particular supplement that allowed growth indicated the metabolic defect.

6. Which organisms did Beadle and Tatum use in their research? How did its nutritional requirements facilitate this research?

Wild-type *Neurospora* has modest food requirements. It can grow in the laboratory on a simple solution of inorganic salts, glucose, and the vitamin biotin, incorporated into agar, a support medium. From this minimal medium, the mold cells use their metabolic pathways to produce all the other molecules they need. Mutating the wild type allowed Beadle and Tatum to identify metabolic defects.

7. How were *Neurospora* spores treated to increase the mutation rate?

The spores were treated with radioactivity.

8. Outline the technique used to identify and isolate mutant fungi. ✓

Srb and Horowitz grew three classes of mutants, each defective in a different gene, under four different conditions: minimal medium (M-M) as control, M-M with ornithine, M-M with citrulline, and M-M with arginine as another control. They knew that wild-type cells could grow on M-M but mutant cells could not. The results showed that the wild-type strain was capable of growth under all experimental conditions, requiring only M-M. The three classes of mutants each had specific growth requirements from which Srb and Horowitz deduced that each class of mutant was unable to carry out one step in the pathway for synthesizing arginine, presumably because it lacked the necessary enzyme. Because each of their mutants was mutated in a single gene, they concluded that each mutated gene must normally dictate the production of one enzyme.

9. Cite two significant findings that resulted from the research of Beadle and Tatum.

Chapter 17 Ap Bio Reading Guide Answers

Wolfgang Guggemos



Chapter 17 Ap Bio Reading Guide Answers:

Chapter 17 Ap Bio Reading Guide Answers Book Review: Unveiling the Magic of Language

In a digital era where connections and knowledge reign supreme, the enchanting power of language has are more apparent than ever. Its power to stir emotions, provoke thought, and instigate transformation is really remarkable. This extraordinary book, aptly titled "**Chapter 17 Ap Bio Reading Guide Answers**," published by a highly acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we will delve into the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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