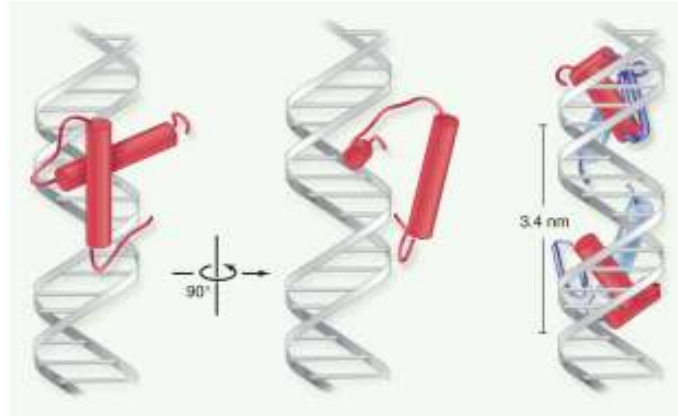


Chapter 16 – Control of Gene Expression



1. What is meant by the phrase “control of gene expression”?

2. What is the value of controlling gene expression for a prokaryote (a single-celled organism)?

3. What is the value of controlling gene expression for a multi-celled eukaryote?

4. Explain the different evolutionary forces that have caused the development of distinctly different systems of regulation for the control of gene expression in prokaryotes and in eukaryotes.

a. **prokaryotes** _____

b. **eukaryotes** _____

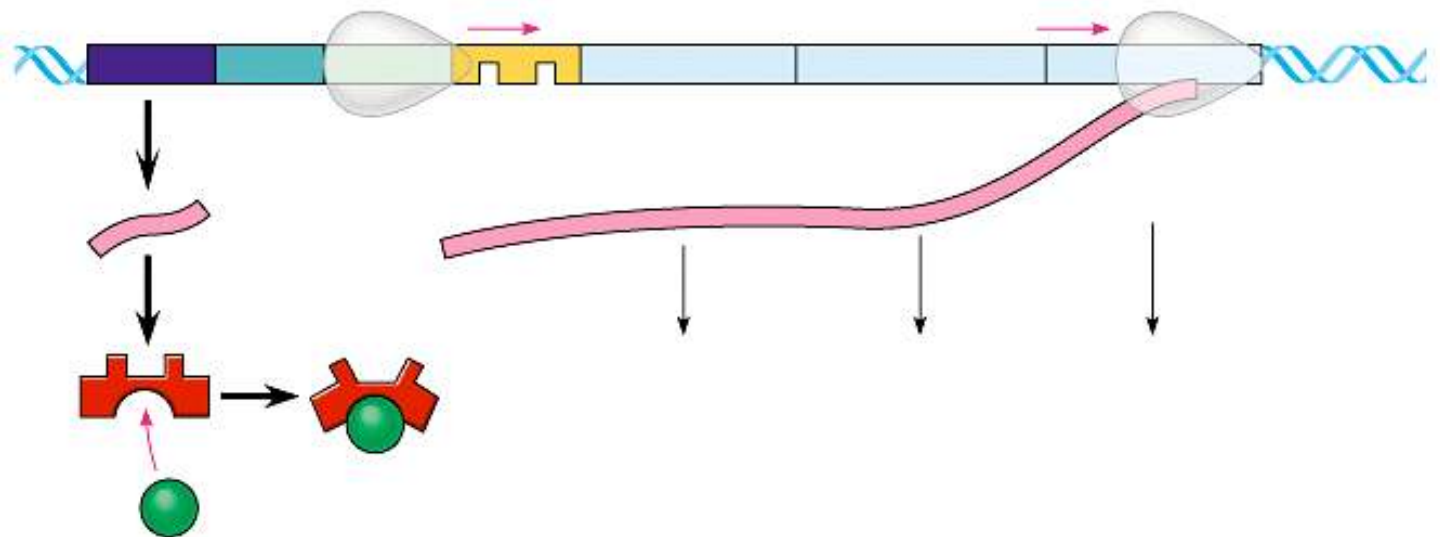
5. Regulatory proteins bind to and interact with what part of DNA ?

6. What is meant by a **DNA-binding motif**? What are the 4 major types?

Control of Transcription in Prokaryotes

7. Prokaryotes use a regulatory system called an **operon**. Explain what an operon is. Identify the function of the following components: **promoter**, **operator**, **repressor**.

8. Refer to the following diagram of the **lactose (lac) operon system**. Label the diagram and use it to explain how this system regulates the digestion of lactose in a bacterium.



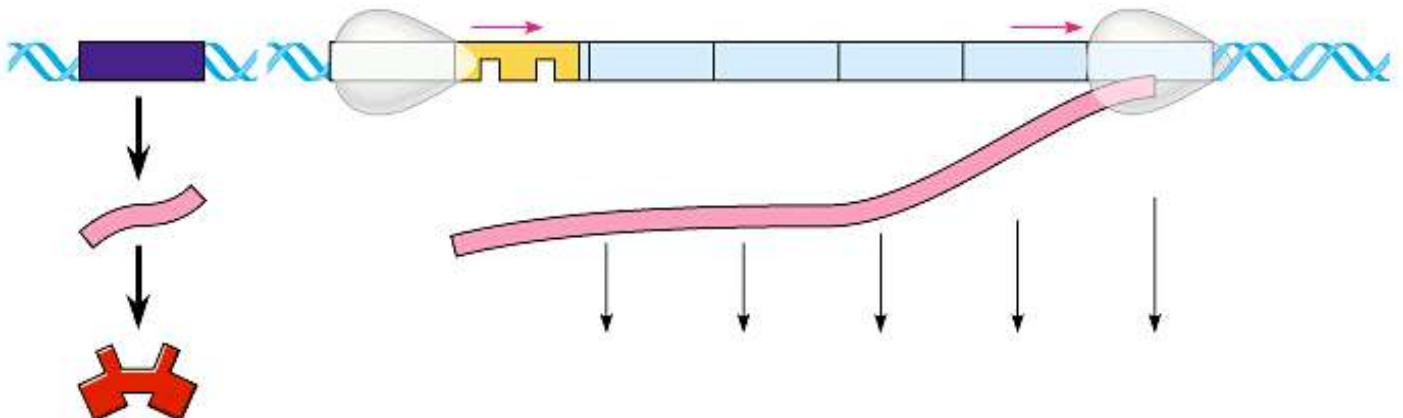
9. Does the diagram above represent the condition for the absence or presence of lactose?

10. Describe what happens when lactose is absent.

11. Describe how the lac operon is an example of an **inducible** operon.

12. Summarize how the presence and absence of glucose influences the lac operon. Be sure to explain the role of the **CAP-cAMP activator** and why it is necessary.

13. Label the following diagram of the **tryptophan (trp) operon** system and use it to explain how this system regulates the synthesis of tryptophan in a bacterium.



14. Does the diagram above represent the condition for the absence or presence of tryptophan?

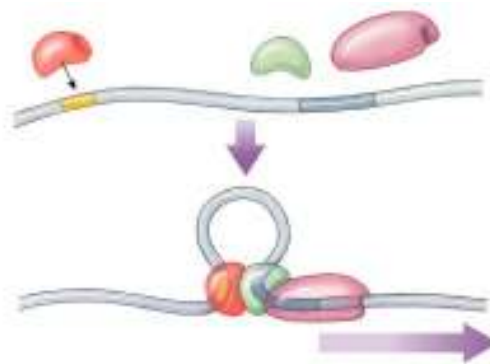
15. Describe how the trp operon is an example of a **repressible** operon.

Control of Transcription in Eukaryotes

16. Why is control of transcription much more complex in eukaryotes than in prokaryotes.

17. Explain the general function of transcription factors. Briefly distinguish between the functions of **general transcription factors** and **specific transcription factors (activators)**.

18. Use the following diagram to explain the coordinated functions of the enhancer and promoter regions of DNA.



19. Briefly describe the organization of DNA in the eukaryotic nucleus. (Chapter 10)



20. Transcription can also be regulated by chemically modifying chromosomes. Briefly describe how **methylation** and **histone acetylation** affect the transcription of DNA.

Post-transcriptional Control

21. RNA interference is an exciting new area of research in molecular biology. Discuss the roles of small RNA molecules (**siRNAs** and **miRNAs**) in gene control. (*Nobel Prize in Physiology or Medicine for 2006 goes to the University of Massachusetts Medical School's Craig C. Mello, PhD!*)

22. How does alternative RNA splicing affect gene expression?

23. Discuss the following additional methods of post-transcriptional control mechanisms.

a. Transport of mRNA out of nucleus _____

b. Initiation of translation _____

c. Stability of mRNA transcripts _____

24. How do eukaryotic cells target proteins for destruction? What is a **proteasome**?
