

Protein synthesis puzzle

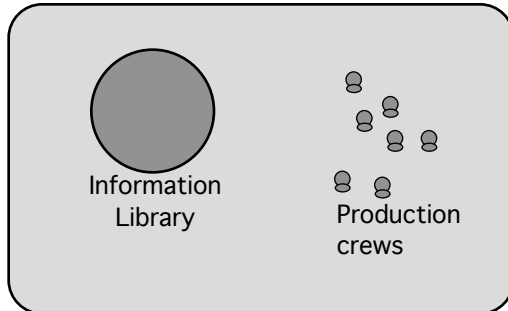
The intent of this exercise is to get students thinking of the logic of protein synthesis before they attempt to figure out the mechanism. This much is evident from the first page. The second page attempts to give them additional conceptual help, by asking them to think about “problems” that must be solved in real cells. For example, students always want to know how RNA polymerase “knows” which strand to transcribe, and which direction to go. This is one of those problems.

In practice, it is hard to get them to think this way. The vast majority attempt to write down what they have memorized about transcription and translation.

Names _____

The Logic of Protein Synthesis

Part I. The General Problem...using an analogy



In a widget factory, the information for each kind of widget is in reference books in the library. The books cannot be removed from the library. The production crews that make the widgets are in the workroom. The crews do nothing unless they have instructions and widget parts.

A call for a particular widget arrives at the library. This triggers a series of events, resulting in the production of the widget. What must these events be? The factory has no telephones, no fax machines, no xerox machines...just librarians, production crews, and miscellaneous necessary parts.

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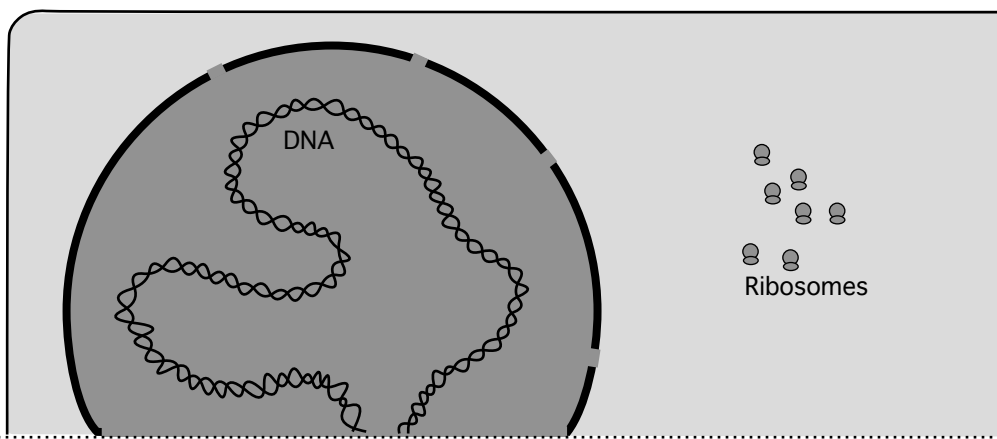
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Part II. The Problem...as faced by actual cells



The information for protein is in DNA, a double-stranded polymer made from only 4 different nucleotides, millions of which are strung together in specific sequences. Each DNA molecule has information for

thousands of proteins. DNA cannot leave the nucleus. The protein-making machines, “ribosomes,” (which cannot enter the nucleus) must assemble protein using 20 different amino acids, stringing them together in a sequence determined by the information in the DNA.

A signal arrives in the nucleus, calling for the production of a particular protein. This triggers a series of events, resulting in the production of that protein. Those events may be conceptually similar to the events you identified for the widget factory. For each such event, what “molecular problems” can you identify that the cell must be able to overcome in order to use DNA as a source of information for making protein?

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