

Enzyme Action

Enzymes are biological catalysts that play an important role in many biochemical reactions. Because of this, enzymes are increasingly being studied as potential targets for treating certain diseases. Cancer is one type of disease that might be a particularly good candidate for the development of drugs that target enzymes, particularly the enzyme telomerase. This enzyme plays an important role in cell division by protecting the ends of chromosomes during the chromosome replication process. Telomerase is usually present in stem cells but is normally absent or found only in low concentrations in somatic cells. In cancer cells, however, telomerase may play an important role in allowing for the uncontrolled division of abnormal cells, which characterizes the various types of cancer. Since cancer is characterized by uncontrolled growth and division of abnormal cells and the formation of new cells, one treatment approach is to target enzymes involved in cell division (for background information about telomerase, see this article in [Scientific American](#)). Recently, a group of researchers¹ identified a key aspect of the structure of telomerase. The researchers hope that by better understanding the structure of this enzyme, their findings might lead the way to the development of a drug that targets the enzyme and thereby helps advance cancer treatment.

As a research assistant at a pharmaceutical company, you are part of a research group that focuses on developing drugs that target enzymes. Your group is thus particularly excited about the findings from this study and in the possibility of developing drugs that might target telomerase. The leader of your research group wants to send a summary of the findings from this article to the Head of Drug Discovery at your company. To do this, he asks you to write a short summary that describes the importance of the enzyme telomerase as well as discusses the key findings from this study. As part of your summary, you will need to define enzymes and then both describe the importance of enzymes in biochemical reactions as well as discuss the way in which enzymes can inhibit or accelerate chemical reactions. You should also discuss the ways in which the structure of enzymes affects their activity and how drugs could be developed to interfere with enzymes to alter their activity. You can then end your summary with a description about the importance of the research findings reported in this article.

Items to keep in mind:

- When we read your memo, we will act as the Head of Drug Discovery at your company and will have adequate scientific knowledge about biology, but will likely not remember all of the specifics about enzymes and enzyme reactions.
- External references are not required, but if they are used, they should be cited using MLA citation style format.
- Since you are trying to impress your boss and establish your credibility as a research assistant, you should take care to carefully edit and proofread your memo.
- The memo should be between 400-500 words in length.

¹ Linnea I Jansson, Ben M Akiyama, Alexandra Ooms, Cheng Lu, Seth M Rubin, Michael D Stone. **Structural basis of template-boundary definition in Tetrahymena telomerase.** *Nature Structural & Molecular Biology*, 2015; DOI: [10.1038/nsmb.3101](https://doi.org/10.1038/nsmb.3101) also see <https://www.sciencedaily.com/releases/2015/10/151005120917.htm>

Notes to the Instructor - assignment details

Purpose: To have students explain the process by which enzymes can alter chemical reactions, especially through inhibition (either reversible or irreversible).

Relevant Questions for Assignment: What are enzymes and how do they work to facilitate chemical reactions? In what ways can other chemicals (or drugs) be developed to interfere with enzyme reactions? How might this approach be useful in targeting cancer cells? If we know the structure of the enzyme used in cancer cells, how might we use this information to develop a drug to target the enzyme?

Note: This assignment prompt could be presented after the chapter in the textbook that discusses cellular regulation (e.g., Ch 11), and the students could be asked to focus equally (or more) on regulation in cancer cells.

Peer Review Guidelines:

- Print and read over your peer's entry to quickly get an overview of the piece.
- Read the essay more slowly keeping the rubric in mind.
- Highlight the pieces of texts that let you directly address the rubric prompts in your online responses.
- In your online responses, focus on larger issues (higher order concerns) of content and argument rather than lower order concerns like grammar and spelling.
- Be very specific in your responses, referring to your peer's actual language, mentioning terms and concepts that are either present or missing, and following the directions in the rubric.
- Use respectful language whether you are suggesting improvements to or praising your peer.

Rubric Prompts:

- In the memo, the writer should clearly communicate about enzymes by providing definitions and descriptions of the following terms: enzymes, catalyze, enzyme inhibition, and irreversible and reversible inhibitors. Based on this, which terms are well defined and which ones are missing or are not well defined? What does the writer need to do to improve the presentation of these terms?
- As the reader, you should be given enough information to understand the basic properties of an enzyme. Given this, what should the writer expand on to improve the description of the properties of enzymes?
- How does the writer describe the way in which the structure of an enzyme affect its activity? In what ways could the writer improve the description of enzyme structure and activity?
- Does the writer summarize the main findings of the article by Jansson et al. (2015)? How could the writer improve the summary to better describe the main results of this study?

Revision Prompt

Revising writing means re-seeing it, and the process of reading and commenting on the writing of others as well as receiving feedback from your peers gives you a way of seeing your own writing differently. Meaningful revision means changes at the sentence and paragraph level, usually involving a minimum of three sentences. *You will not receive full credit for revision unless you make meaningful revisions to your writing.*

Revision Guidelines:

- Re-read the prompt
- Re-read the rubric and consider what a complete and effective response would include, noting what you do not fully address
- Make a list of effective content you noticed in the writing of your peers
- Read and summarize the feedback you received from your peers
- With these things in mind, re-read your draft and mark places where you can improve the content
- Revise and submit your response
- *After* completing this assignment, please follow the link to respond to a survey about the writing assignment:

Checklist from Enzymes Peer Review Rubric:

- The memo should clearly communicate about enzymes by providing definitions and descriptions of the following terms: enzymes, catalyze, enzyme inhibition, and irreversible and reversible inhibitors.
- There should be enough information to understand the basic properties of an enzyme.
- The memo should describe the way in which the structure of an enzyme affect its activity.
- The main findings of the article by Jansson et al. (2015) should be a summarized.