Honors 177

Biotechnology and Art

Nature Nano-Origami

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Major: Biochemistry

ABSTRACT

This nature origami project will expose users to visualize the proper folding of nature nano-machine, proteins both under the normal optimal physiological condition and under the influence of diseases and drugs. This project will allow users to manipulate and create their own three dimension of protein origami through the designing program similar to Rosetta. This project will educate users about the importance of enzymes and their roles in maintaining functions.

CONCEPT / TOPIC

Many enzymes in our bodies collaborated to perform many complexes tasks to maintain life. Since enzymes are such small in size and many people do not normally able to see how the particular enzymes look like and their interactions. Therefore, this project will create appreciation of these tiny machines that work in our bodies.

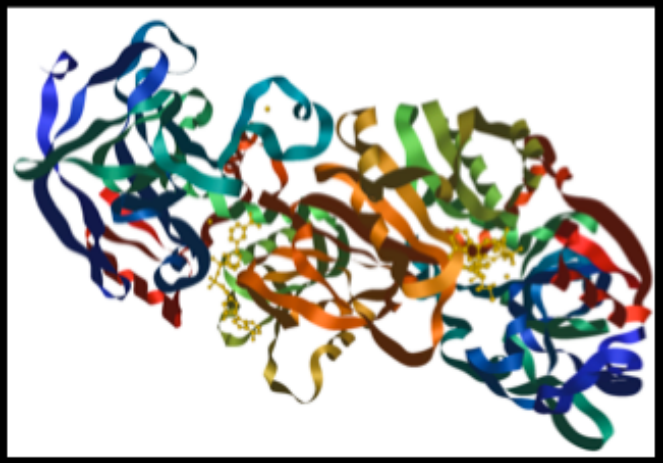
CONTEXT & PRECEDENTS

Proteins and enzymes are nature nano-machines and our bodies are composed of many different kind of enzymes and proteins from your hair all the way through your toe nail.(1) The amino acids encoding from the message of DNA basepairs are responsible for the 3-dimensional shape of proteins and enzymes which are fundamental to keeping things in order. (2)

Many scientist have been studying and solving the 3-dimensional puzzle to understand the mechanisms and create treatment and new drugs for many diseases. (3) Scientist have used designing program such as Rosetta to predict the correct folding of the proteins and enzymes. (4)

PROJECT PROPOSAL

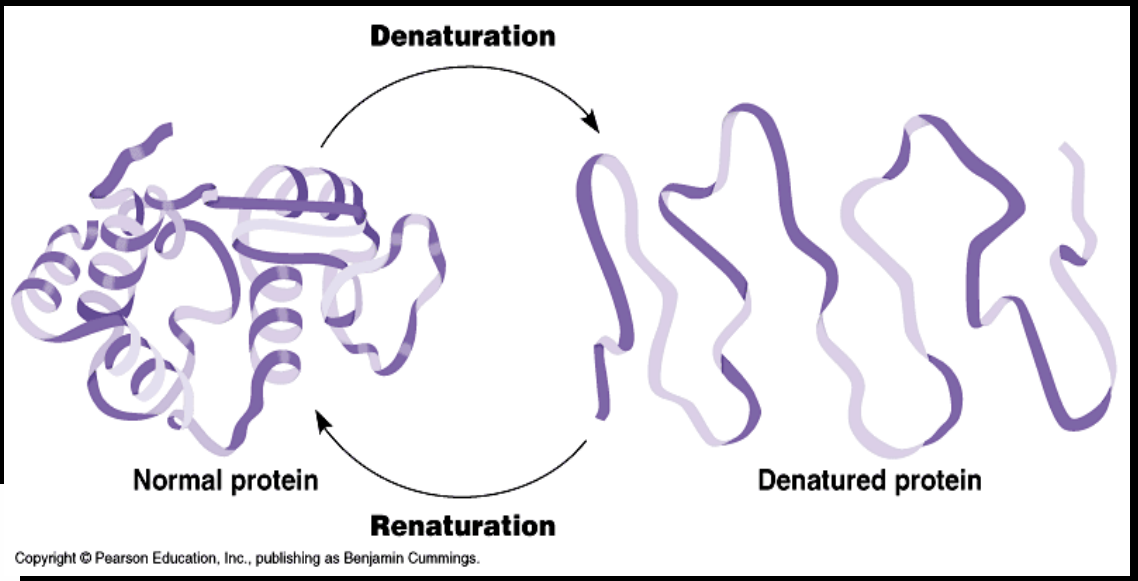
Alcohol Flush Reaction

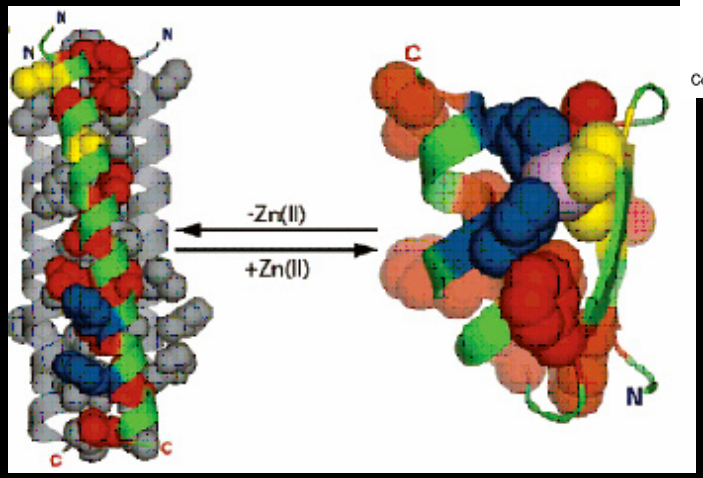


Ethanol —ALDH 2→ Acetaldehyde

Section 1: In this section, the web program will focus on the effect on mis-folding in the case of diseases and drugs. The program will have a list of diseases and drugs which the users can be choose to explore. After choosing the drug or disease, the program will illustrate both optimal and defected enzymes that are related to the chosen drug. The program will also give information on which amino acids and bonding are defected and which biological pathways are affected by these enzymes.

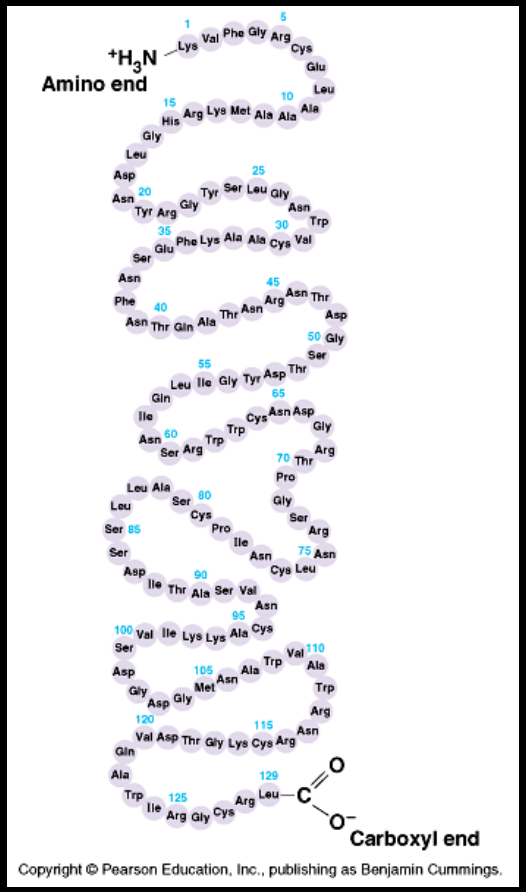
Project Proposal (cont.)

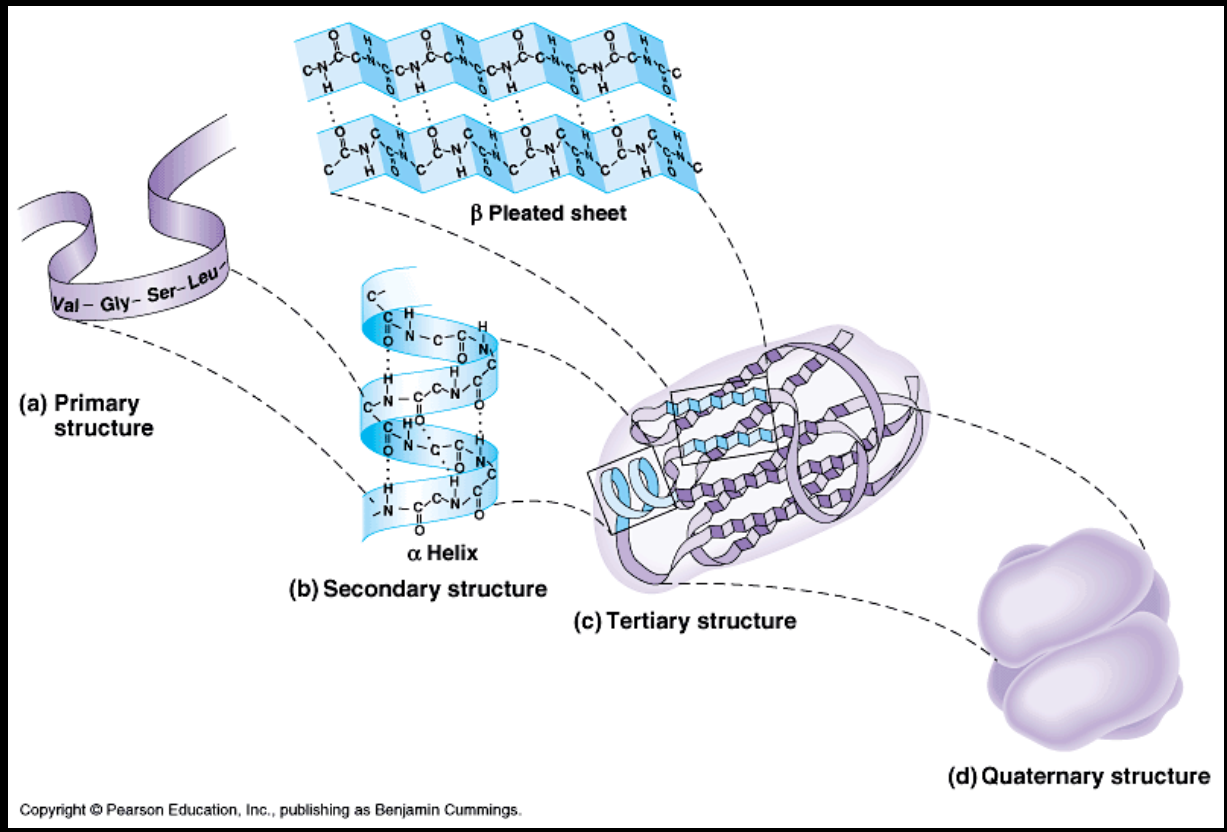




Section 2: Users will be able to manipulate their chosen proteins and enzymes and be able to expose this 3-dimensional structure to be various different conditions and environments such as pH, temperature, denaturants, polar, and non-polar solutions. They will be able to visualize how the proteins will unfold and re-fold to adapt to this newly introduced environments such as exposing either hydrophobic or hydrophillic part of the protein.

Project Proposal: Protein Folding





Section 3: Users will be able to design their own enzymes bases on the building blocks of amino acids to created the 2 dimensional structures such as alpha helix and beta pleated sheets. From there, the users will be able to visual the tertiary folding based on the contact of amino acids. The primary structure can give rise to more than one tertiary structure due to the bonding created by amino acids. This will allow the users to study different kind of bonding between amino acid due to their various properties of the side chain residues.

Conclusion

This project will let the users to be better appreciation of these essential proteins and enzymes. Users will have deeper understanding of mechanisms and pathways that enzymes are involved and how drugs and alcohol can influence these enzymes since this project will help visualizing what students have learned from the textbook. They will also understand the specific enzymes control many functions through out the body and therefore, certain medications can be attached with many side effects. This project will also users to visualize the aesthetic beauties of these molecules and beauties of our everyday functions in order to survive.

Aesthetic and Invisible beauties of Inner Life of a Cell

References

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