

Basic Bioscience Midterm Exam

Tags

1. There are many benefits of understanding the building blocks of life (biomolecules). In your own words, explain how the understanding of biomolecules is important in the field of agriculture and environment conservation. Include at least 2 examples with you answer. (10marks)

Understaning biomocules in organisms have various applications like increasing nutrition or yield of crops, creating disease-resistant crop or decreasing some by-product produce by the livestock. One example is the creation of golden rice which is rich in carotene. The other example is by understanding how cow digest the forage, the scientists found they can feed them seaweed to decrease the methene which is also a important gas that effect the climate produce by cows.

2. What are the differences between natural selection (natural variation) and artificial selection? Explain with examples for each selection. Explain also how artificial selection can benefit us today? What are the concerns regarding artificial selection? Explain with examples. (15 marks)

- Natural selection

A species face various challenge like natural disaster, disease (sometimes causes by gene mutation), competition of resource or companion (between same species or different species). They need to survive from these challenge to have chance to leave its offsprings. Those that cannot adapt to the environment or survive from the challange, their gene won't have chance to remain in the gene pool. Finally, except for some special cases, only the species have characteristics to survive and left their gene will remain. This process is what called natural selection.
- Artificial selection

Human uses methods like genetic editing, breeding or hybrid to intentionally make a species has our desired characteristics. For example, using genetic editing to make red bean have the resistance to herbicide so that we can kill all the other plants that compete with the crop. The other example is that our ancestors bred kale with different characteristics for a long time and finally create a whole vegetable family including cabbage and broccoli.
- Benefit

We can have the species that have our desired characteristics like disease-resistant crop, more delicious fruit, increase the yeild.
- Concern
 - I .decerease diversity: the species may become too strong in the environment, cause some important gene being wash out from the gene pool.
 - II. potential harm to human: one example is GMO soybean, people originally not allergic to it may have allergy to the GMO one
 - III. monopoly by enterprise: some enterprise hold the patent of the genetic editing tech or some breed, people cannot access to those or need to pay a lot, this may result to enlarge the gap between rich and poor and various problem.

3. The central dogma of molecular biology explains the flow of genes in any biological system. Describe in detail the how genetic information is converted in to making proteins. (10 marks)

- Transcription
 - a . RNA polymerase attaches to promoter on DNA and sperates two strands of DNA helix (break the hydrogen-bond). And generate a transcription bubble.
 - b . RNA polymerase add the complementary RNA nucleotides and sugar-phosphate them to form the strand of RNA
 - c . Break the hydrongen-bond between DNA and RNA strand, completing the generation of mRNA
- Editing: may mute or strengthen the effect of some section on RNA
- Translation
 - a . Ribosome binds to the promotor of mRNA strand
 - b . tRNA bring the amino acid to ribosome and then ribosome use the amino acid bring by the tRNA with correspond codon to synthesize the amino acid chain
 - c . Until ribosome reach the stop codon, all adjacent amino acid connected by peptide bond and form the polypeptide. The already formed polypeptide then fold by hydrogen bond or other force to form the secondary structure protein. The protein may further be decorated or combined with other protein or ion to form tertiary structure and quaternary structure.

4. Describe the four levels of organization possible in a protein and explain what forces are involved at each level. What must a protein have in order to have a quaternary structure? Why is the three dimensional shape of a protein so important? Explain with examples. (15 marks)

- Structure
 - Primary structure

The amino acid are connected by peptide bond and form a simple strand of polypeptide.
 - Secondary structure

The polypeptide is folded by the hydrogen bond between residues and form 3D structure in alpha-helix or beta-sheat.
 - Tertiary structure

Many secondary structure proteins are combined by hydrogen bond, ion bond and covalent bond to form more complex struture. Sometimes need molecular chaperone to stable the structure. In this phase, most protein already have fully functions.
 - Quaternary structure

Two or more tertiary structure protein are combined together to form a fully functional protein, for example hemoglobin.
- The 3-D shape of protein determine its function and attribute. Just like hemoglobin needs to be a quaternary structure to have the function to carry oxygen.