



AP[®] Biology 2001 Sample Student Responses

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BIOLOGY

SECTION II

Time—1 hour and 30 minutes

Directions: Answer all questions.

Answers must be in essay form. Outline form is not acceptable. Labeled diagrams may be used to supplement discussion, but in no case will a diagram alone suffice. It is important that you read each question completely before you begin to write. Write all your answers on the pages following the questions in this booklet.

1. In biological systems, structure and function are related. Choose three of the following components of organ systems.

alveolus	villus
sarcomere	capillary
nephron	neuron

- (a) For each component, describe the structure of the component and explain how that structure is responsible for the function of that component.
- (b) For the three components that you chose in part a, explain how the structure of the component contributes to the functioning of the organ system to which it belongs.

(a) villus - The villus ~~is~~ ^{is a} tiny fingerlike structure in the small intestines of animals. The villi are responsible for most of the absorption of water, and nutrients in the blood. Because of their structure, a large surface area is available for the absorption of nutrients ~~and~~ such as glucose and vitamins.

• capillary - the smallest blood vessels. Capillaries form the connecting link between arteries and veins. The walls of capillaries are very thin and porous. This structure allows for ~~the~~ gas exchange and absorption. Epithelial tissue makes up the walls of these important blood vessels.

• neuron - neurons are special cells in the nervous system which are very ~~to~~ irregular in shape.

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Neurons have a spindly structure with branching arms like dendrites, axon, etc. This unusual structure allows neurons to perform their job of receiving and transmitting nerve impulses. The long + numerous outreached segments can attract electric currents and stimuli to send the message on to the spinal cord and brain.

(b) villus - as part of the digestive system, the villi play an important role in the small intestine. When food is digested, it goes through the small intestine which is lined with villi. These structures (with their large ~~and~~ permeable surface area) absorb certain ~~and~~ nutrients ~~and~~ components which are then added to the bloodstream. Without villi, all the food we eat would be passed through our bodies without leaving any benefits or serving any purpose. The fact that the villi are small, numerous, and porous accounts for the fact that we can absorb more nutrients than if we relied on the smooth walls of the intestine alone.

• capillary - capillaries ~~are~~ form a network of tiny blood vessels which connect arteries (containing oxygen-rich blood) ~~to~~ with veins (containing

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oxygen-poor blood). At the capillary net, oxygen and carbon dioxide are exchanged. This is possible because of the thin, permeable walls of capillaries. Capillaries play a vital role in the blood flow in the circulatory system.

Gas and mineral exchange would be almost impossible if blood only traveled through arteries and veins (thicker, larger vessels). Without the specialized structure of capillaries, we could very well be poisoned ~~because~~ by toxins building in our blood.

neuron - as one of the smallest units of the nervous system, neurons are responsible for messages and impulses received by the brain. Their fibrous, spindly structure is perfectly suited for transmitting impulses, receiving messages, connecting with receptors & sensors, and responding to stimuli. The structure of neurons is responsible for our ability to respond to almost any stimulus.

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The alveolus is found within the lungs of most terrestrial species. In humans, they have been studied greatly. The alveolus is a sac-like tissue on the end of the bronchial tubings in the lungs. They are responsible for the CO_2/O_2 gas exchange. ~~Blood~~ Because gas exchange must be done quickly and efficiently or else the organism will have to raise the respiration rate to replenish its supply of O_2 and release CO_2 , the surface area of the alveolus must be maximized. ~~Curved structures~~ The curvature of the alveolus allows this to be possible. Along with the maximization of the surface area, volume is also minimize to save space.

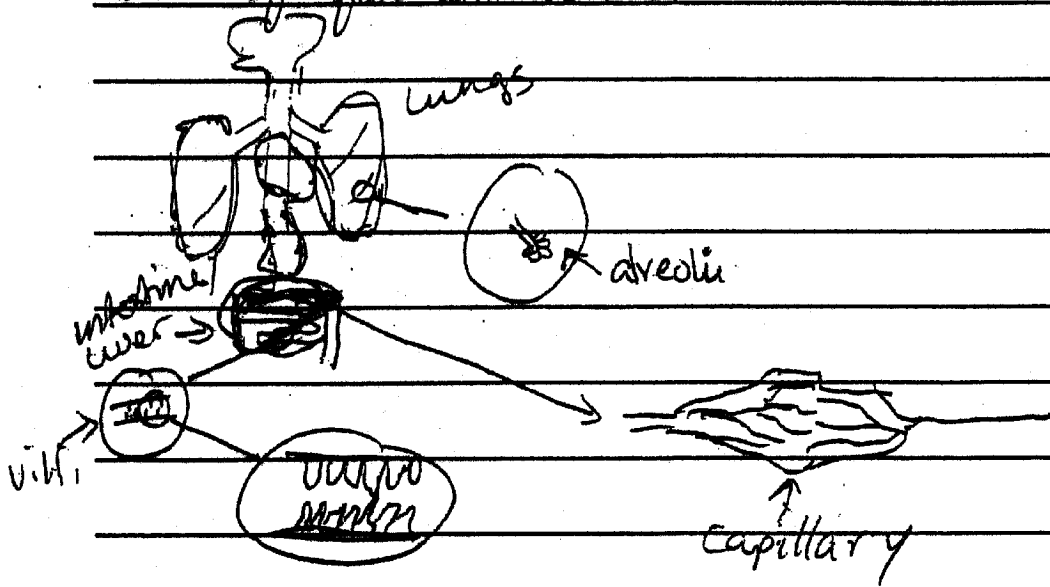
The villus are the projects located within the small intestines. The structure of the villi ~~are~~ is also curved to maximize the surface area for nutrition absorption. The villi is responsible for the uptake of nutrition previously

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broken down by the gastric fluids of the stomach.

The projections are able to sway by the currents of the fluid in the intestine. When the projections sway, crevices between the projections widen to allow even more surface area to be exposed for nutrient absorption.

The capillaries are a network of ~~small~~ small blood vessels. The blood vessels limit the flow of blood to only allow red blood cells to flow through. By doing so, each ^{red-} blood cell is able to maximize its exposure to the oxygen it needs to take in and the carbon dioxide it needs to release. Capillaries are found in any major organs and serve as the exchange site of food and waste.



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1. a) A capillary is a very small blood vessel consisting of only a single layer of coating making it easy for substances to pass through. The capillaries are used to transfer molecules to and from cells like glucose, oxygen, and carbon dioxide. There are also hormones that can affect capillaries. They can cause them to dilate or constrict depending on what is happening like if there's an inflammation or if the environment is too cold or hot, the capillaries will respond. Even phagocytes can pass through when there's an inflammation because of the dilation. Capillaries can only allow a single blood cell to pass through at a time because of the size of it compared to arteries and veins. The various sizes allow the blood to circulate fast due to the pressure differences in the different types of blood vessels.

An alveolus is important in the lungs and contributes to the high surface area needed for gas exchange. Alveoli are surrounded

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by capillaries to transfer O_2 or CO_2 in and out of the blood then the blood is sent back to the heart for systemic circulation. The high surface area is needed for high oxygen intake needed by our body cells to function properly.

Neurons in our body is used to quickly transfer signals from brain to cells and also used in cell to cell communication. Neurons contain long axons to transfer signals. It is even possible for it to be several feet long if it contains axons.

D) Because of the structure of the capillary, it is able to do many jobs in the circulatory system and can help in signalling and body defense. Capillaries usually function by providing all cells with oxygen and takes away CO_2 from cells by using the hemoglobin in red blood cells. These are then sent to lungs for removal of CO_2 and renewal of O_2 . Another function of the capillaries is to provide cells with the nutrition that is needed by providing glucose and other essential nutrients. The whole body can be controlled by help from capillaries because of the hormones that are transferred in blood, secreted by various glands in the body. Capillaries can help in digestive system and excretory system too. Thanks to its thin layer, it has many capabilities making it essential to our body. Capillaries located in the glomerulus in the kidneys are used to filtrate urea from the blood and urea is created by the liver by doing metabolic processes. Capillaries mainly function in transport of many molecules throughout the body to all cells.

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The structure of alveoli allows it to help in the respiratory system. Its high surface area allows transfer of oxygen into the body and carbon dioxide out of the body, with help from the circulatory system. The capillaries around it does the transfer of O_2 and CO_2 in part of the lungs into the circulatory system.