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***ANSWER NO 1***

*Smell begins at the back of nose, where millions of sensory neurons lie in a strip of tissue called the olfactory epithelium. The tips of these cells contain proteins called receptors that bind odor molecules. The receptors are like locks and the keys to open these locks are the odor molecules that float past, explains Leslie Vosshall, a scientist who studies olfaction at Rockefeller University.*

*People have about 450 different types of olfactory receptors. (For comparison, dogs have about two times as many.) Each receptor can be activated by many different odor molecules, and each odor molecule can activate several different types of receptors. However, the forces that bind receptors and odor molecules can vary greatly in strength, so that some interactions are better “fits” than others.*

*"Think of a lock that can be opened by 10 different keys. Two of the keys are a perfect fit and open the door easily. The other eight don’t fit as well, and it takes more jiggling to get the door open," explains Vosshall.*

*The complexity of receptors and their interactions with odor molecules are what allow us to detect a wide variety of smells. And what we think of as a single smell is actually a combination of many odor molecules acting on a variety of receptors, creating an intricate neural code that we can identify as the scent of a rose or freshly-cut grass.*

*Odors in the Brain*

*This neural code begins with the nose’s sensory neurons. Once an odor molecule binds to a receptor, it initiates an electrical signal that travels from the sensory neurons to the olfactory bulb, a structure at the base of the forebrain that relays the signal to other brain areas for additional processing.*

*One of these areas is the piriform cortex, a collection of neurons located just behind the olfactory bulb that works to identify the smell. Smell information also goes to the thalamus, a structure that serves as a relay station for all of the sensory information coming into the brain. The thalamus transmits some of this smell information to the orbitofrontal cortex, where it can then be integrated with taste information. What we often attribute to the sense of taste is actually the result of this sensory integration.*

*"The olfactory system is critical when we're appreciating the foods and beverages we consume," says Monell Chemical Senses Center scientist Charles Wysocki. This coupling of smell and taste explains why foods seem lackluster with a head cold.*

*You’ve probably experienced that a scent can also conjure up emotions and even specific memories, like when a whiff of cologne at a department store reminds you of your favorite uncle who wears the same scent. This happens because the thalamus sends smell information to the hippocampus and amygdala, key brain regions involved in learning and memory.*

*A Better Smeller*

*Although scientists used to think that the human nose could identify about 10,000 different smells, Vosshall and her colleagues have recently shown that people can identify far more scents. Starting with 128 different odor molecules, they made random mixtures of 10, 20, and 30 odor molecules, so many that the smell produced was unrecognizable to participants. The researchers then presented people with three vials, two of which contained identical mixtures while the third contained a different concoction, and asked them to pick out the smell that didn’t belong.*

*Predictably, the more overlap there was between two types of mixtures, the harder they were to tell apart. After calculating how many of the mixtures the majority of people could tell apart, the researchers were able to predict how people would fare if presented with every possible mixture that could be created from the 128 different odor molecules. They used this data to estimate that the average person can detect at least one trillion different smells, a far cry from the previous estimate of 10,000.*

*The one trillion is probably an underestimation of the true number of smells we can detect, said Vosshall, because there are far more than 128 different types of odor molecules in the world.*

*No longer should humans be considered poor smellers. In fact, new research suggests that your nose can outperform your eyes and ears, which can discriminate between several million colors and about half a million tones. “It’s time to give our sense of smell the recognition it deserves*



***ANSWER NO2 (A)***

***HAEMOSTASIS***

Haemostasis is the human body's response to blood vessel injury and bleeding. It involves a coordinated effort between platelets and numerous blood clotting proteins (or factors), resulting in the formation of a blood clot and subsequent stopping of the bleed.

Tissue factor is a protein that is exposed to blood once a blood vessel is injured (causing bleeding). The process of haemostasis starts when the exposed tissue factor binds to a certain coagulation protein called factor seven (FVII) which circulates within the blood stream. This causes the subsequent activation of FVII to FVIIa. The binding of tissue factor and FVIIa is only the first step in a process that will in the end lead to the development of a strong, stable blood clot that will stop and prevent further bleeding.

Generally in healthy people without bleeding disorders, control of bleeding is achieved very quickly and without the need for medical treatment. In major trauma or surgery, doctors often need to help patients to reach normal haemostasis in order to minimise blood loss and further injury.

However, some people are born with a bleeding disorder (congenital) so that haemostasis does not work properly. Most of these bleeding disorders are hereditary passed on from parents or run in families. An example of this is haemophilia.

Sometimes people who have never experienced any bleeding problems themselves or in their families, can develop a condition that causes them to bleed, known as acquired haemophilia. In this disorder, even minor cuts and bruises can require medical treatment.

***Hematopoiesis***

Uncontrollable bleeding, dead internal organs and continuous bacterial infections: that would be the state of our bodies if we didn't have blood cells. Lucky for us, we do! They carry oxygen, defend the body against pathogens, and stop bleeding.

Blood cells are created throughout our life time in order to make sure that we have healthy ones at all times. Can you imagine how worn out our blood cells would be if the ones we were born with were still working in our bodies? New blood cells are created at the same rate as the ones that die.

The process of producing new blood cells is called hematopoiesis. Hematopoiesis started taking place long before you ever able to read this lesson - it began when you were a developing fetus inside of your mom. The process took place in your liver and spleen during that time. Once you were born - and ever since - it takes place in your bone marrow, found at the ends of your long bones

***Homeostasis,***

 Homeostasis is a key concept in understanding how our body works. It means keeping things constant and comes from two Greek words: 'homeo,' meaning 'similar,' and 'stasis,' meaning 'stable.' A more formal definition of homeostasis is a characteristic of a system that regulates its internal environment and tends to maintain a stable, relatively constant, condition of properties.

Homeostasis is happening constantly in our bodies. We eat, sweat, drink, dance, eat some more, have salty fries, and yet our body composition remains almost the same. If someone were to draw your blood on ten different days of a month, the level of glucose, sodium, red blood cells and other blood components would be pretty much constant, regardless of your behavior (assuming fasting before drawing blood, of course).

No matter how much water you drink, your body doesn't swell up like a balloon if you drink tons, and it doesn't shrivel like a raisin if you drink very little. Have you ever wondered about this? Somehow, our bodies know how much fluid we need to keep, and then maintain a constant level regardless of how much water we drink.

This maintenance of body size is an example of homeostasis. And we don't even have to think about it for this to happen! Aren't our bodies amazing?

There are several other examples of homeostasis. For example, our concentration of salts and glucose (sugar) is constant; our body temperature is usually around 37 degrees Celsius (98.6 degrees Fahrenheit); the amount of blood in our bodies is about 5 liters, the osmolarity (number of solutes) of our blood remains about 300mOsm. The normal value of a physiological variable is called its set point.

***(B)***

***Erythroblastosis fetalis***

The adult human body is home to trillions of red blood cells, also known as RBCs or erythrocytes. These blood cells carry oxygen, iron, and many other nutrients to the appropriate places in the body. When a woman is pregnant, it’s possible that her baby’s blood type will be incompatible with her own. This can cause a condition known as Erythroblastosis fetalis, where the mother’s white blood cells (WBCs) attack the baby’s RBCs as they would any foreign invaders. This condition is highly preventable and the typical, severe form is now very rare in developed countries. Catching it early can ensure a successful pregnancy for mother and child. If left untreated, however, it can be life-threatening for the baby. Erythroblastosis fetalis is now known as hemolytic disease of the newborn

***ANSWER NO 3:- (A)***

 ***Definition:***

Immunity is the ability of the body to protect against all types of foreign bodies like bacteria, virus, toxic substances, etc. which enter the body.

Immunity is also called disease resistance. The lack of immunity is known as susceptibility.

The science dealing with the various phenomena of immunity, induced sensitivity and allergy is called immunology.

Types of Immunity:

There are two major types of immunity: innate or natural or nonspecific and acquired or adaptive.

(A) Innate or Natural or Nonspecific Immunity (L. innatus = inborn):

Innate immunity is inherited by the organism from the parents and protects it from birth throughout life. For example humans have innate immunity against distemper, a fatal disease of dogs.

As its name nonspecific suggests that it lacks specific responses to specific invaders. Innate immunity or nonspecific immunity is well done by providing different barriers to the entry of the foreign agents into our body. Innate immunity consists of four types of barriers— physical, physiological, cellular and cytokine barriers.

(B) Acquired Immunity (= Adaptive or Specific Immunity):

The immunity that an individual acquires after the birth is called acquired or adaptive or specific immunity. It is specific and mediated by antibodies or lymphocytes or both which make the antigen harmless.

It not only relieves the victim of the infectious disease but also prevents its further attack in future. The memory cells formed by В cells and T cells are the basis of acquired immunity. Thus acquired immunity consists of specialized В and T lymphocytes and Antibodies

***(B):-***

***Differences Between Antigen and Antibody***

Antibodies, also called immunoglobulins, Y-shaped molecules are proteins manufactured by the body that help fight against foreign substances called antigens. Antigens are any substance that stimulates the immune system to produce antibodies. Antigens can be bacteria, viruses, or fungi that cause infection and disease. Following are some of the differences between Antigen and Antibody:

Antigen and Antibody

1 Generally proteins but can be lipids, carbohydrates or nucleic acids. Antibodies are proteins.

2 Triggers the formation of antibodies. Variable sites has the antigen binding domain.

3 There are three basic kinds of antigens. (Exogenous, Endogenous and Auto antigens) There are five basic kinds of antibodies. (Immunoglobulins M, G, E, D and A)

4 The region of the antigen that interacts with the antibodies is called epitopes. The variable region of the antibody that specially binds to an epitope is called paratope.

5 Cause disease or allergic reactions. Protects the body by immobilization or lysis of antigenic material.

***ANSWER NO 4 (A) :-***

 ***Functions of Antibody***

1. IgG provides long term protection because it persists for months and years after the prescence of the antigen that has triggered their production.
2. IgG protect against bacteris, viruses, neutralise bacterial toxins, trigger compliment protein systems and bind antigens to enhance the effectiveness of phagocytosis.
3. Main function of IgA is to bind antigens on microbes before they invade tissues. It aggregates the antigens and keeps them in the secretions so when the secretion is expelled, so is the antigen.
4. IgA are also first defense for mucosal surfaces such as the intestines, nose, and lungs.
5. IgM is involved in the ABO blood group antigens on the surface of RBCs.
6. IgM enhance ingestions of cells by phagocytosis.
7. IgE bind to mast cells and basophils wich participate in the immune response.
8. Some scientists think that IgE’s purpose is to stop parasites.
9. IgD is present on the surface of B cells and plays a role in the induction of antibody production.

***B)***

***DIFFERENCE BETWEEN PRIMARY AND SECONDARY RESPINCE TO AN ANTIGEN:-***

 • The primary immune response occurs when an antigen comes in contact to the immune system for the first time. During this time the immune system has to learn to recognize antigen and how to make antibody against it and eventually produce memory lymphocytes.

• The secondary immune response occurs when the second time (3rd, 4th, etc.) the person is exposed to the same antigen. At this point immunological memory has been established and the immune system can start making antibodies immediately.

***ANSWER NO5:-***

 Differences between antibody mediated immunity and Cell-Mediated Immunity

Following are the main points which display the difference between the humoral and the cell-mediated immunity:

1. The antibody mediated immunity is associated with the B-lymphocytes and is responsible for destroying the pathogens by producing antibodies against it, whereas the cell-mediated immunity is associated with the T-lymphocytes and is responsible for the destroying the pathogens or microorganism which have invaded the cells without producing antibodies.
2. Antibody mediated immunity is intimately associated with B-lymphocytes, T-lymphocytes, and macrophages, on the contrary, the cell-mediated immunity is associated with T-lymphocytes, helper T cells, natural killer cells, and macrophages.
3. Antibody mediated immunity plays a major role in recognizing antigen or any foreign particle and in producing antibodies against it. It is known for working against extracellular pathogens.
4. Cell-mediated immunity is related to T-lymphocytes, which work by identifying viruses and microorganisms, thus destroying them by the cell lysis or phagocytosis or pinocytosis. It is known for working against intracellular pathogens.
5. Antibody mediated immunity secretes antibodies to fight against antigens, whereas cell-mediated immunity secretes cytokines and no antibodies to attack the pathogens.
6. Antibody mediated immunity is rapid or quick in their action against antigens, while the Cell-mediated immunity show delay though permanent action against any pathogens.
7. Humoral immunity mediates hypersensitivity type I, II, and III, whereas cell-mediated is delayed in response and mediates hypersensitivity type IV.
8. Antibody mediated immunity is involved in an early stage of graft rejections due to the formation of antibodies against any foreign particle, while Cell-mediated immunity is involved in the rejection of organ transplants after a certain time as they show delayed response***.***