SESSION 5  

THE CONCEPT OF HOMEOSTASIS

HOMEOSTASIS PHYSIOLOGICAL PSYCHOLOGICAL AND SOCIAL

Many factors contribute to the development of substance use dependency. One of those factors is a physiological process that happens over time with continued substance use. It may not be noticed by the user because it happens so incrementally. Awareness of a problem only arises when the person experiences an inability to stop using. Therefore, understanding how the physiological development of dependency occurs is important.

We are all born with an internal regulating system that maintains stability in body temperature, blood pH, and glucose levels, among many other things. The body strives to maintain its systems of functioning within a normal range. This process is the phenomenon of homeostasis and is essential to our survival.

Homeostasis is the physiological process that maintains equilibrium in our bodies and allows us to function normally. Our bodies strive to maintain homeostasis when systems fluctuate. The body accomplishes this through "complaining." For example, one way our bodies complain is to shiver when it's cold. Shivering produces heat and is our body's attempt to increase temperature. Likewise, when the body overheats, it complains by sweating to decrease temperature.

When alcohol and/or drugs are ingested, the body tries to return to its normal homeostasis by processing them through the liver, kidneys, and lungs. If substances are consumed to a point of intoxication, the body reacts with an upset stomach or possibly vomiting in order to stop the person from consuming more. This is the body's effort to buy time in order to process and/or purge what it perceives to be poison in its attempt to return to homeostasis.

The problem occurs when a person continues to use despite the body's complaints. Through continued use a person's homeostasis can become "reset." The same process still happens, but with a new homeostasis set to the substance levels the body has become accustomed to. Now, when the new, reset homeostasis fluctuates, the body again complains. Only instead of complaining when the level of the substance is increased, the body complains when the substance level decreases. These complaints are known as withdrawal symptoms. Common withdrawals from alcohol can be irritability, tremors, clamminess, headache, and nausea. These symptoms are the body's attempt to return to the new homeostasis. One way to reduce withdrawal symptoms is to re-use the substance, like having a mimosa

during Sunday brunch after a Saturday night of drinking in order to alleviate hangover symptoms. The substance has now become the medicine for the symptoms it actually created.

A particularly dangerous withdrawal symptom from alcohol abuse is the possibility of a seizure. Anyone experiencing high levels of continued alcohol consumption should consult a professional for a safe, medically monitored detoxification process.

Nicotine withdrawal symptoms can typically be headache, nausea, anxiety, insomnia, and fatigue. Withdrawal symptoms from marijuana can be headache, nausea, anxiety, insomnia, disturbance of appetite, paranoia, and irritability. Cocaine withdrawal is experienced by tiredness, depression, anxiety, and moodiness. Opiate withdrawal can be all the above, but also include muscle aches, high blood pressure, increased heart rate, and intense cravings. Sometimes withdrawal symptoms are confused with chronic pain. (This list is not exhaustive or definitive.)

Understanding how the process of substance dependence develops is important, but it's also crucial to listen to our bodies. Our bodies constantly send us information on what is working and what isn't working for us. It's an individual experience. We need to ask ourselves if the substances we are using have become the medicine for symptoms they have caused.

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Describe the concept of homeostasis and the homeostatic mechanisms that regulate heart rate, breathing rate, body temperature and blood glucose levels. Definition of Homeostasis The actual word homeostasis means "steady state". Homeostasis describes how the body regulates its process to keep its internal conditions as stable as possible. Homeostasis is necessary because human cells are efficient but very demanding. The phrase "steady state" is a bit confusing; the conditions inside our bodies are not constant but are kept within a narrow range. Some factors such as core temperature and blood pH change slightly while others such as blood glucose vary considerably throughout a normal day without producing any harmful effects. A very brief description of homeostasis is that it is the maintenance of a constant internal environment in response to a change in external environment. Internal environment The conditions that prevail within the body of an organism, particularly with

respect to the composition of the tissue fluid. To function properly they need to be bathed in tissue fluid that can provide the optimum conditions. Nutrients and oxygen must be delivered and waste needs to be removed. To maintain the internal environment there are 3 things that need to be done: * Organisms keep conditions in their bodies fairly constant to live. * Metabolism in organisms is almost always constant. * Conditions include temperature, water levels and salt levels. Salt levels Salt is a chemical compound that combines sodium and chloride.

Middle

B) Loss of heat by the body- Radiation, conduction, convection, evaporation: For anything to maintain a stable body temperature it is important that heat loss is equal to heat gain. Heat can be gained or lost in 4 different ways: Radiation: This is the energy that travels through air/space in the form of particles or waves. It is the loss of heat into the surroundings. Conduction: This involves the transfer of heat between two objects that in contact with each other. Heat is always conducted from a region of higher temperature to a region of lower temperature. Convection: This is when you warm up the layer of air next your skin and it moves upwards to be replaced by colder air from the ground. Evaporation: When liquid water is converted into water vapour it requires heat energy to do so. C) Role of the hypothalamus: The receptors for temperature both heat and cold are located in the peripheral skin and around internal organs. These are

specially adapted cells with nerve fibres that run up the spinal cord to the temperature control centre in the hypothalamus of the brain. It sends nerve impulses to muscles, sweat glands and skin blood vessels to cause changes that counteract the external changes. C) Roles of the nervous system-sympathetic and parasympathetic: The parasympathetic has so important role in the thermoregulation although it helps the unstriated muscle coats of the skin arterioles to relax, but it controls both sweat glands and the calibre of the arterioles. D)

Conclusion

4) Breathing rate: A) Role of internal receptors Internal receptors can be stretch receptors in muscles and tissues that relay nervous impulses to the brain about the status of ventilation from the degree of stretch of muscles and other tissue. The intercostal muscles are the site of many stretch receptors. B) Role of the autonomic nervous system-sympathetic and parasympathetic nerve supply: Most internal organs have a dual autonomic supply. Like I explained earlier sympathetic always causes contraction and parasympathetic causes relaxation of muscles. However it can be different in this situation. In the case of bronchial muscle it is opposite, the sympathetic nerve allows it to relax and parasympathetic causes contraction which makes the bronchi narrower. Most of these fibres run in the vague nerve in serving the heart. C) Role of the respiratory center, diaphragm and intercostal muscles: In the upper

part of the brain called cerebral cortex voluntary control for breathing takes place. The involuntary center is known as the respiratory centre is in the medulla and the area just above is known as the pons, these are both at the base of the brain. The internal receptors send information to each of the centres regarding the state of ventilation. There are two groups of nerve cells known as the inspiratory and expiratory centers and when one is active the other one is deactivated. It clearly shows that the inspiratory center is actively sending nerve impulses to the nerve to the diaphragm, the phrenit nerve and the thoracic nerves are sending impulses to the intercostal muscles to make contraction take place which results to inspiration.

Unit 5 P5- Explain the Concept Homeostasis with Reference to the Control of Heart Rate, Breathing Rate, Body Temperature and Blood Glucose.

By naomiward11101 | Feb. 2013

- Explain the concept homeostasis with reference to the control of heart rate, breathing rate, body temperature and blood glucose. introducing a formal report that is based on an investigation into how the body responds to exercise and which analyses the results from the investigation. The investigation involves myself and other pupils in my class. I will be doing the Harvard step test. the other pupils in my class will be monitoring my heart rate, breathing rate and temperature before and after the test. The actual word

homeostasis means "steady state". Homeostasis describes how the body regulates its process to keep its internal conditions as stable as possible. Homeostasis is necessary because human cells are efficient but very demanding. The phrase homeostasis is a bit confusing; conditions inside our bodies are not constant but are kept within a narrow range. some factors such as temperature and blood PH change slightly while others such as blood glucose very considerably throughout a normal day without producing any harmful effects. A brief description of homeostasis is that it is maintenance of a constant internal environment in response to a change in external environment. Negative feedback as a form of regulation

Negative feed makes sure that as levels return to normal, corrective mechanisms are scaled down. it's when the body maintains conditions within particular limits. the body will do this by opposing a change that deviates from the normal. core temperature falls.

Core temperature rises.

Drop detected by hypothalamus . brain sends signals to the body that brings out shivering and vasoconstriction. Temperature turns to normal.

Normal body temperature: 36.9c

Rise detected by hypothalamus. Brain sends signals to body that brings out sweating and vasodilatation.

Negative feedback comes when an important variable, sometimes known as a key variable such as the pH of blood and tissue fluid.

Homeostasis

As a human being, it is not hard to recognize that a body's internal environment is maintained separately from its external environment. Simply imagine yourself on a cold winter's day where the outside temperature has plummeted to -5°C. Your body does not simply succumb to this temperature but, in fact, does its very best to otherwise maintain your body temperature near its optimal 37°C. The idea of the balance between the internal and external environments of a living system was originally explained by the French physiologist Claude Bernard in the mid-1800's. Bernard described this idea as "*milieu intérieur*," the process of maintaining the stable internal environment despite the conditions of the external environment (Gross, 1998). The concept was later expanded upon by the American physiologist Walter Bradford Cannon who termed it "homeostasis" which translates to "steady state" or "unchanging."

Many variables within the human or animal body are maintained with little room for fluctuation. Temperature control is one that often comes to mind, and will be discussed below, but there are many other aspects of

animal life that are very tightly controlled. We control the pH of blood to a pH of 7.4, only allowing it to deviate by a tenth of a unit (7.3-7.5.) and changes beyond this range can render some enzymes nonfunctional and disrupt cellular activities. Other events or variables that are controlled by homeostatic processes include blood pressure, heart rate and blood oxygen levels, among many others.

The basics of biology teach that homeostatic control systems contain three individual components that work together to control a variable within the organism. The three parts of the system are the receptor, the control center and the effector. The receptor serves to sense a change in a certain condition of the organism's (i.e., animal's) internal environment. The control center interprets this information from the receptor and directs a response to the situation that is enacted through the effector. The simplest non-biological illustration of this is temperature regulation inside of a house. The thermostat is set at 22°C, but the temperature in the house drops to 19°C. The thermometer (i.e., the receptor) within the thermostat measures the temperature and recognizes the change away from 22°C, the control center within the thermostat determines whether how to correct the deviation. The heater (i.e., the effector) is turned on and raises the temperature back to 22°C until the thermometer recognizes the temperature is correct and turns off the heater.

This same type of course correction regarding temperature also occurs within the human body. When the temperature of the human body deviates from 37°C, a modification is made to heat/conserve heat or cool the body. For example, upon a drop in temperature, one response of the

human body is to begin to “shiver”. Shivering is caused by increased activity of skeletal muscles that uses energy and therefore creates heat to help protect internal core temperature of the vital organs. Alternatively, when the temperature rises much above 37°C, sweat glands begin releasing moisture that increases evaporation and therefore cools the surface of the skin. Temperature regulation is a type of negative feedback where the direction of the change in the variable, in this case temperature, is counteracted by a physiological response. In other words, if the temperature is too high, the body responds by attempting to lower the temperature.

Another negative feedback mechanism is involved in regulating the amount of glucose in the blood, a process that involves a balance of pancreatic hormones that store or release glucose when needed. Blood sugar levels are typically maintained at ~90 mg of glucose/100 ml of blood (Marieb, 1995). Should the level of glucose in the blood rise, cells within the pancreas are stimulated to produce and secrete insulin into the blood. Insulin is responsible for increasing cellular uptake of glucose as well as storing glucose as glycogen in the liver; therefore the surplus of glucose is not “wasted” but instead is reserved for a time when it will be needed. In an occasion where there is too little glucose in the blood, glucagon, a separate hormone is secreted by the pancreas. Glucagon causes the liver to convert glycogen back into glucose and releases it into the blood thereby raising the blood glucose level. Hence, when blood glucose levels are too high, insulin decreases the amount of glucose and when blood glucose levels are too low, glucagon increases it. This negative feedback mechanism counteracts inappropriately high or low blood

sugar levels and allows for a relatively stable level of glucose to be available to the body for energy production.

The opposite of the negative feedback mechanism is termed positive feedback, where the physiological response to a change in the variable serves to enhance or encourage the response instead of working in the opposite direction. Given that positive feedback mechanisms tend to exacerbate the change in the variable, driving it further in the same direction, it is reasonable that these mechanisms are not typically used for maintaining balance. While the majority of mechanisms involved in homeostasis are regulated by negative feedback processes, there are examples of positive feedback playing a role. One such example is that of regulating blood clotting following damage to a blood vessel. Following a break or a tear in a vessel, platelets soon begin to attach to the site of injury and release chemicals that attract even more platelets. Therefore, an event that causes the recruitment of platelets ultimately causes the recruitment of even more platelets. The accumulation of all of these platelets begins the process of forming a clot in order to seal off the injury.

It is important to caveat the significance of maintaining a constant internal environment with the idea that there are special circumstances that call for deviations from the mean and are considered acceptable within a narrow range. For instance, human females experience a cycling of hormone levels and therefore these hormones are not held at a "constant" level. Additionally, one of the body's responses to infection is to purposefully raise the body temperature (i.e., fever) in an attempt to help fend off the infection. However, it should be noted that even in the case

of a fever, the body does not stray far from the set point of 37°C and serious consequences can occur should the proper mechanisms not keep the extent and duration of the fever under control.

Animal bodies are highly complex by nature. They are able to overcome many obstacles and various conditions. The ability of the body to regulate itself and maintain a comparatively stable internal environment despite outside conditions, traumatic actions, food supply or other ongoing events embodies the "wisdom of the body" that physiologist Walter Bradford Cannon referred to when he described its ability to reach homeostasis.

Homeostasis

Definition

noun

(Science: Biology)

(1) The tendency of an organism or a cell to regulate its internal conditions, usually by a system of feedback controls, so as to stabilize health and functioning, regardless of the outside changing conditions

(2) The ability of the body or a cell to seek and maintain a condition of equilibrium or stability within its internal environment when dealing with external changes

(3) homeostasis is the maintanance of the constant internal environment which include the function of kidney,liver,skin... **Supplement**

In humans, homeostasis happens when the body regulates body temperature in an effort to maintain an internal temperature around 98.6 degrees Fahrenheit. For example, we sweat to cool off during the hot summer days, and we shiver to produce heat during the cold winter season.