REGULATION OF SALT AND WATER BALANCE pdf

1: Osmoregulation - Wikipedia

Regulation of water and salt balance. The mechanisms of detoxication that animals use are related to their modes of life. This is true, with greater force, of the mechanisms of homeostasis, the ability of organisms to maintain internal stability.

Movement of water and ions in saltwater fish Movement of water and ions in freshwater fish Two major types of osmoregulation are osmoconformers and osmoregulators. Osmoconformers match their body osmolarity to their environment actively or passively. Most marine invertebrates are osmoconformers, although their ionic composition may be different from that of seawater. Osmoregulators tightly regulate their body osmolarity, maintaining constant internal conditions. They are more common in the animal kingdom. Osmoregulators actively control salt concentrations despite the salt concentrations in the environment. An example is freshwater fish. The gills actively uptake salt from the environment by the use of mitochondria-rich cells. Water will diffuse into the fish, so it excretes a very hypotonic dilute urine to expel all the excess water. A marine fish has an internal osmotic concentration lower than that of the surrounding seawater, so it tends to lose water and gain salt. It actively excretes salt out from the gills. Most fish are stenohaline , which means they are restricted to either salt or fresh water and cannot survive in water with a different salt concentration than they are adapted to. However, some fish show a tremendous ability to effectively osmoregulate across a broad range of salinities; fish with this ability are known as euryhaline species, e. Flounder have been observed to inhabit two utterly disparate environmentsâ€”marine and fresh waterâ€”and it is inherent to adapt to both by bringing in behavioral and physiological modifications. Some marine fish, like sharks, have adopted a different, efficient mechanism to conserve water, i. They retain urea in their blood in relatively higher concentration. Urea damages living tissues so, to cope with this problem, some fish retain trimethylamine oxide. Sharks, having slightly higher solute concentration i. In plants[edit] While there are no specific osmoregulatory organs in higher plants , the stomata are important in regulating water loss through evapotranspiration , and on the cellular level the vacuole is crucial in regulating the concentration of solutes in the cytoplasm. Strong winds , low humidity and high temperatures all increase evapotranspiration from leaves. Abscisic acid is an important hormone in helping plants to conserve waterâ€”it causes stomata to close and stimulates root growth so that more water can be absorbed. Plants share with animals the problems of obtaining water but, unlike in animals, the loss of water in plants is crucial to create a driving force to move nutrients from the soil to tissues. Certain plants have evolved methods of water conservation. Xerophytes are plants that can survive in dry habitats, such as deserts, and are able to withstand prolonged periods of water shortage. Succulent plants such as the cacti store water in the vacuoles of large parenchyma tissues. Other plants have leaf modifications to reduce water loss, such as needle-shaped leaves, sunken stomata , and thick, waxy cuticles as in the pine. The sand-dune marram grass has rolled leaves with stomata on the inner surface. Hydrophytes are plants in water habitats. They mostly grow in water or in wet or damp places. In these plants the water absorption occur through the whole surface of the plant, e. Halophytes are plants living in marshy areas close to sea. They have to absorb water from such a soil which has higher salt concentration and therefore lower water potential higher osmotic pressure. Halophytes cope with this situation by activating salts in their roots. As a consequence, the cells of the roots develop lower water potential which brings in water by osmosis. The excess salt can be stored in cells or excreted out from salt glands on leaves. The salt thus secreted by some species help them to trap water vapours from the air, which is absorbed in liquid by leaf cells. Therefore, this is another way of obtaining additional water from air, e. Mesophytes are plants living in lands of temperate zone, which grow in well-watered soil. They can easily compensate the water lost by transpiration through absorbing water from the soil. To prevent excessive transpiration they have developed a waterproof external covering called cuticle. In animals[edit] Kidneys play a very large role in human osmoregulation by regulating the amount of water reabsorbed from glomerular filtrate in kidney tubules, which is controlled by hormones such as antidiuretic hormone ADH , aldosterone , and angiotensin II. For example, a decrease in water potential is detected by osmoreceptors in the hypothalamus , which stimulates ADH release from the pituitary gland to increase the permeability of the walls of the collecting ducts in the kidneys. Therefore, a large proportion of water is reabsorbed from fluid in the kidneys to prevent too much water from being excreted. In protists[edit] Protist Paramecium aurelia with contractile vacuoles. Amoeba makes use of contractile vacuoles to collect excretory wastes, such as ammonia , from the intracellular fluid by diffusion and active transport. As osmotic action pushes water from the environment into the cytoplasm, the vacuole moves to the surface and disposes the contents into the environment. In bacteria[edit] Bacteria respond to osmotic stress by rapidly accumulating electrolytes or small organic solutes via transporters whose activities are stimulated by increases in osmolarity. The bacteria may also turn on genes encoding transporters of osmolytes and enzymes that synthesize osmoprotectants. Achieving osmoregulation in vertebrates[edit] Four processes occur:

2: Excretion - Regulation of water and salt balance | www.enganchecubano.com

The figure illustrates the regulation of water balance as a negative feedback regulatory system. The regulated variable is the ECF osmolarity. The sensors are the hypothalamic osmoreceptors, which modulate their frequency of action potential firing in response to changes in ECF osmolarity.

A man is holding a water bottle. It plays a role in normal blood pressure, regulation of blood volume, nutrient absorption, nutrient transport and maintenance of the cell membrane potential. The human body tightly controls amounts of these substances to prevent complications and promote normal function in the tissues and organs. Video of the Day Significance The amount of sodium in the blood has a close relationship to the amount of water in the body. MedlinePlus reports that blood sodium level depends on the amount of sodium and water you consume and the amount you excrete in your urine. Some sodium also leaves the body in sweat and fecal matter. Too little water and sodium levels increase. Too much water and sodium levels decrease. Both conditions cause complications. The hypothalamus, a gland in the brain, controls thirst. It also secretes a hormone that alerts the kidneys to conserve more water instead of excreting it in the urine. The kidneys respond to changes in blood volume by secreting a hormone that produces enzymes known as angiotensin I and angiotensin II. These enzymes play a role in thirst, blood pressure and water retention. Aldosterone, secreted by the kidneys, increases the reabsorption of water and sodium. Antidiuretic hormone reduces the amount of water excreted in the urine. This results in the conservation of body water and decreased urine production. The enzyme renin responds to low blood volume or decreased sodium levels. It also affects the release of aldosterone by the kidneys. Problems Dehydration occurs when fluid loss exceeds the amount of fluid you consume. Causes of dehydration include high fever, excessive vomiting and diarrhea, excessive sweating, burns and increased urination, according to MayoClinic. Hyponatremia, also known as low sodium levels, occurs in cases of vomiting, sweating, congestive heart failure, diarrhea, burns, cirrhosis of the liver, kidney disease and secretion of excess antidiuretic hormone. Hypernatremia occurs when the amount of sodium in the blood increases. Treatment for these conditions restores sodium levels to normal to prevent serious complications such as seizures, coma and death. Lifestyle Factors Drinking enough water prevents dehydration and abnormal sodium levels. East Carolina University reports that men ages 19 to 50 need 11 cups of water per day, while women in the same age group only need 8 cups of water per day. The amount of sodium you consume in your diet also affects sodium and water balance. If you have high sodium levels, your doctor may advise you to avoid high-sodium foods. Examples of high-sodium foods include canned soups, canned vegetables, frozen meals, processed luncheon meats, potato chips and salted nuts. Intense physical activity increases sweating and allows sodium and water to escape from the body. To prevent dehydration and hyponatremia caused by excessive exercise, replace lost fluids with water or sports drink.

REGULATION OF SALT AND WATER BALANCE pdf

3: Excretion and Salt/Water Balance

13 Regulation of body fluids and Salt water balance I K.A. Kirsch April The change in levels of serum proteins, hematocrit, and.

As an Amazon Associate I earn from qualifying purchases. Water and salt along with potassium regulate the water content of the body. Drinking water without adequate salt and potassium intake will not correct dehydration! Drinking water will temporarily treat the symptoms of dehydration, but the balance of salt intake is what makes the real difference in health and hydration. For some reason, the importance of salt intake took a long time for me to digest and comprehend. I believe most of us have been programmed for years to believe that all salt is bad. The fact is that refined white salt, such as commercial table salt, IS bad for our health. I consider it a toxic poison for the human body. However, unrefined natural salt provides many health benefits. It is a vital element for all living things. In some cultures, salt is literally worth its weight in gold. Water and Salt Balance in the Body Water itself regulates the water content inside our cells. Water delivers nutrients to the cells and helps remove toxins and metabolic wastes from the cells. Once water gets into the cells, potassium is what holds it there. Where does potassium come from? It is found in abundance in fruits and vegetablesâ€"another important reason to eat 5 to 10 servings of fresh fruits and vegetables daily! One ocean is held inside the cells of the body and the other ocean is held outside the cells. Good health depends on a delicate balance between the volumes of these two oceans. Some of the best sources of potassium include apricots, avocados, bananas, dates, figs, garlic, nuts, potatoes, raisins, spinach, winter squash, yams, and brown rice. I do not recommend taking potassium supplements unless your potassium levels are being checked by a health practitioner. I recommend drinking filtered water that is free of contaminants but still contains the natural minerals in the water. However, please note that the addition of natural salt is ONLY recommended if you are actually drinking half your body weight in ounces of water. If you are not drinking enough water daily to be fully hydrated, adding the natural salt may not be beneficial. This may be sufficient for some people, some of the time. However, more salt is needed during hot weather and after exercising since we lose excess electrolytes through sweating. In fact, this is a much better way to replenish electrolytes in the body than by drinking sport drinks, which tend to be full of sugar and are highly acidifying. Or check out our Homemade Electrolyte Enhanced Water recipe. With a little self-awareness, you will begin to intuitively know how to maintain the water and salt balance in your body. These salt intake recommendations are for unrefined natural salt only, not refined salt. If you have been told to restrict your salt intake or if you have a serious health condition, consult with your health practitioner before increasing your water or salt intake. The Problem with Refined Salt The biggest problem with refined table salt is that it is devoid of minerals and contains harmful additives. Refined table salt is typically Refined table salt is unhealthy. Refined salt contains additives, such as 0. Other harmful chemicals, such as inorganic iodine, dextrose, and bleaching agents, are often added during processing. People who eat refined salt often develop a craving for salt because their bodies are not getting the type of natural salt that it needs. They then tend to consume more and more refined salt, burdening the kidneys and adrenal glands and blocking the absorption of calcium. Medical studies have shown that an excess intake of refined salt interferes with the absorption of nutrients and depletes calcium. Many functions in the body are dependent upon calcium uptake. Calcium is critical for the health of the nerves and the heart, as well as the muscles and bones. Refined salt also creates a major imbalance in water regulation inside and outside the cells, especially when the body is dehydrated. Inadequate water intake along with refined salt intake leads to many serious health issues, most notably high blood pressure and water retention. This is partly how salt got such a bad rap. The bottom line is, if you value your health, do not take any form of refined white salt. Unrefined Natural Salt Is Best Choice Unrefined natural salt, which contains sodium as well as many other minerals the body needs, is the best type of salt to take. Mineral salts are mined from thousands of feet below the ground surface in areas where there is a deep layer of mineral salts. Sea salt is harvested by different methods, but it basically involves sunlight and the evaporation of ocean water. The most notable mineral salt many health advocates recommend is Himalayan crystal salt. Natural Celtic sea salt is considered by many to be the healthiest sea salt available. Natural sea salt is not white and it is not dry. It is a little gray or pink in color due to the mineral content and it retains some of its moisture even when stored in the refrigerator for long periods of time. Both the Celtic sea salt and the Himalayan crystal salt contain many health promoting minerals and trace elements that are utilized in the human body. My salt preference at this time is Celtic sea salt, but I believe Himalayan crystal salt is just as beneficial although usually more expensive.

4: What Hormone Is Responsible for the Maintenance of Salt & Water Balance? | Healthy Eating | SF Gate

Regulation of Sodium and Water Balance Three major hormones are involved in regulating sodium and water balance in the body at the level of the kidney. (1) ADH (antidiuretic hormone) from the posterior pituitary acts on the kidney to promote water reabsorption, thus preventing its loss in the urine.

Water serves as the primary component of the fluids that circulate in your body. Depending on your age and muscle mass, water makes up anywhere from 45 to 75 percent of your body weight. Your body possesses two main fluid compartments: Salt, an electrolyte, plays a major role in extracellular fluids as the most abundant ion group. Your kidneys play a critical part in maintaining sodium and water balance. Water for Fluid Balance The balance of water and sodium is critical to your health. Your kidneys regulate the volume of water and sodium along with other electrolytes. The goal is for the amount of water you consume to remain in balance with the amount excreted. If your body has excess water, the kidneys increase urinary output to bring things back into balance. Likewise, your kidneys can conserve water if the volume is low. Anti-diuretic hormone controls how much water your kidneys excrete. It allows your body to reabsorb water and triggers thirst. Sodium Balance Critical to Osmolarity Sodium balance is tightly regulated to avoid extreme variations in concentration, which can disrupt normal cell function. Osmolarity is the process of controlling the amount of soluble substances per volume. Balancing sodium input and output with water plays a central role in maintaining osmolarity. When you become dehydrated, your body must conserve water and excrete sodium to prevent the sodium concentration from increasing. When you have excess water, your body retains sodium and excretes water to prevent sodium dilution. Balancing sodium plays a critical role in regulating blood pressure and blood volume. Effects of Sodium Imbalance In addition to maintaining blood pressure, sodium is needed for proper function of your nerves, muscles and other body tissues. Problems occur when too much or not enough sodium is in your body. Diuretic medicines, drinking too much water, excessive sweating, heart failure and kidney disease, among other conditions, can disrupt the balance of sodium to water. An imbalance can cause symptoms such as fatigue, headache and muscle spasms. Too much sodium constantly "strains" your system, and can lead to high blood pressure, poorer bone health and more.

REGULATION OF SALT AND WATER BALANCE pdf

5: What Is the Importance of Water & Salt in Body Homeostasis? | Healthy Eating | SF Gate

Regulation of salt and water balance Regulation of salt and water balance Michell, A. R. ABSTRACT In the period the key features of the regulation of salt and water balance seemed to have emerged yet the next 20 years revealed an increasing disparity between physiological theory and clinical fact.

Advanced Search Background Mangroves are a group of highly salt-tolerant woody plants. The high water use efficiency of mangroves under saline conditions suggests that regulation of water transport is a crucial component of their salinity tolerance. Scope This review focuses on the processes that contribute to the ability of mangroves to maintain water uptake and limit water loss to the soil and the atmosphere under saline conditions, from micro to macro scales. Conclusions Mangroves are inherently plastic and can change their structure at the root, leaf and stand levels in response to salinity in order to exclude salt from the xylem stream, maintain leaf hydraulic conductance, avoid cavitation and regulate water loss e. However, much is still unknown about the regulation of water uptake in mangroves, such as how they sense and respond to heterogeneity in root zone salinity, the extent to which they utilize non-stomatally derived CO_2 as a water-saving measure and whether they can exploit atmospheric water sources. Mangroves tolerate a wide range of soil salinity Lugo and Snedaker, ; Odum et al. While salinity has long been recognized as an important factor that limits mangrove growth and productivity Clough and Sim, ; Lin and Sternberg, ; Ball, mangroves are nonetheless highly adapted to salt concentrations in soils that exceed concentrations tolerated by most other plant species Ball, Saline habitats represent a physiological challenge for plants because of the highly negative water potentials of the soil pore water, making water acquisition more energetically unfavourable than in non-saline soils. The ability to maintain water uptake in saline conditions is key to salt tolerance. Another physiological challenge is ion toxicity, as high concentrations of salt are potentially cytotoxic to all plants, including mangroves. The high water use efficiency of mangroves under saline conditions suggests that regulation of water transport, in conjunction with managing ions, is a crucial component of their salinity tolerance. Occurrence of salt glands, leaf pubescence and relative salinity tolerance of mangrove tree species. Salt glands occur in four genera. Leaf pubescence has been noted in seven genera. Where leaf pubescence has been assessed in multiple species within a genus e. Avicennia and Bruguiera , species within the genus appear to have similar leaf pubescence. High levels of salinity tolerance occur in species with and without salt glands and in species with and without leaf pubescence. The global distribution is from Duke High salinity tolerance indicates growth is observed in soil salinities that exceed those of seawater. Pubescence is based on Stace , Tomlinson , Das and Wilson

REGULATION OF SALT AND WATER BALANCE pdf

6: Regulation of Sodium and Water Balance

Drinking water will temporarily treat the symptoms of dehydration, but the balance of salt intake is what makes the real difference in health and hydration.

Regulation of Water Balance Water Reabsorption The figure at right summarizes water reabsorption along the nephron. Water reabsorption is a passive process: In most of the nephron, water reabsorption is unregulated and coupled to solute reabsorption. In response to dehydration increased ECF osmolarity the kidneys can save water and produce concentrated urine. The ability to excrete urine that is more concentrated than the extracellular fluid ECF depends on the creation of a hyperosmotic environment in the medulla. As the collecting duct descends through the medulla, the increasing osmolarity in the interstitial fluid drives water reabsorption. However, there is a tremendous variability in water excretion. The urine produced can be either concentrated, or very dilute. How do the kidneys vary their urine concentrating ability? They do so by regulating water reabsorption in the collecting duct. High Osmolarity in the Medulla The ability to concentrate urine depends upon the generation of a hyperosmolar environment in the medulla. The loops of Henle are set up so as to concentrate osmolarity in the deepest part of the medulla. This occurs because the ascending and descending limbs have different permeabilities to salt and water. In the thick ascending limb, there is active reabsorption of ions, but this segment is relatively impermeable to water. As a result, these cells can make the interstitial fluid hyperosmotic relative to the fluid inside the tubule the filtrate. In the descending limb, the opposite occurs. This causes the filtrate in the descending limb to become concentrated. Now, add to this system the countercurrent flow that occurs in the loop of Henle. Countercurrent flow causes the osmolarity differences to multiply as the renal tubule descends into the medulla. The filtrate inside the descending limb becomes progressively more concentrated, but then as it ascends back toward the cortex, active reabsorption of ions causes it to become progressively less concentrated. Effectively, the thick ascending limb transfers osmolarity to the descending limb and medullary interstitial fluid. The result is that osmolarity becomes trapped in the medulla. Blood flow to the medulla is set up so as to maintain the osmotic gradient. The vasa recta are capillaries that flow in parallel to the loops of Henle. The blood flow in the vasa recta is sluggish, allowing time for the plasma in the vasa recta to equilibrate with the surrounding interstitial fluid. The osmolarity of the plasma inside the vasa recta increases as it descends into the medulla, and then decreases again on the ascending side. This allows blood to flow to the medulla, without eliminating the osmotic gradient. Regulated Permeability in the Collecting Duct In humans, the osmotic gradient in the medulla allows the kidneys to produce urine that can be roughly 5 times as concentrated as the ECF. Urine concentration can be varied through the regulation of water permeability in the collecting duct. The permeability of cell membranes to water depends upon the presence of water channels known as aquaporins. There is a family of aquaporin proteins, with different types being expressed in different tissues. AQP3 blue in figure is constitutively expressed on the basolateral surface of cells in the collecting duct. AQP2 is found on the apical surface of these cells, but the number of AQP2 channels on the membrane is regulated by the hormone vasopressin also known as antidiuretic hormone. When vasopressin binds to its receptor on the collecting duct cells, it stimulates the translocation of AQP2 to the membrane by causing vesicles containing the protein to fuse with the plasma membrane. Regulation of Vasopressin Secretion Vasopressin is a hormone that is produced by magnocellular cells, neurosecretory cells whose cell bodies are in the hypothalamus and whose terminals are located in the neurohypophysis posterior pituitary. The main control of vasopressin secretion is by the hypothalamic osmoreceptors, neurons that sense changes in the osmolarity of the extracellular fluid. If the osmolarity of the ECF increases, the osmoreceptors increase their frequency of action potential firing, and more vasopressin is secreted. Increased action potential firing by the osmoreceptors also stimulates thirst. If the osmolarity of the ECF decreases, the osmoreceptors decrease their action potential frequency and less vasopressin is secreted. It can be helpful to remember that an increase in osmolarity reflects a decrease in water concentration. When increased ECF osmolarity stimulates increased vasopressin secretion, the response in the kidneys is increased reabsorption of water to restore water concentration back to the normal level.

Diabetes Insipidus Diabetes insipidus is the disorder that occurs when there is a defect in the ability to concentrate urine. Diabetes insipidus can be due to a lack of vasopressin central diabetes insipidus or due to a defect in the ability of the kidney to respond to vasopressin nephrogenic diabetes insipidus. Central diabetes insipidus may be caused by a genetic mutation where vasopressin is missing or defective. Head trauma, a tumor, or injury to the posterior pituitary may also cause central diabetes insipidus. Central diabetes insipidus is treated with vasopressin replacement therapy. Nephrogenic diabetes insipidus may be caused by a defect in the vasopressin receptor. Another type of mutation that causes the disorder involves a defect in the gene for AQP2. This defect prevents the proper localization of AQP2 proteins on the apical membrane of collecting duct cells. The drug lithium, which is used in the treatment of bipolar disorder can cause acquired nephrogenic diabetes insipidus. Homeostasis of ECF Osmolarity The figure illustrates the regulation of water balance as a negative feedback regulatory system. The regulated variable is the ECF osmolarity. The sensors are the hypothalamic osmoreceptors, which modulate their frequency of action potential firing in response to changes in ECF osmolarity. The effector system that restores ECF osmolarity to its set point involves vasopressin and its effects on water reabsorption in the collecting duct.

7: Excretion | biology | www.enganchecubano.com

Water balance is achieved in the body by ensuring that the amount of water consumed in food and drink (and generated by metabolism) equals the amount of water excreted. The consumption side is regulated by behavioral mechanisms, including thirst and salt cravings.

Bring fact-checked results to the top of your browser search. Regulation of water and salt balance The mechanisms of detoxication that animals use are related to their modes of life. This is true, with greater force, of the mechanisms of homeostasis , the ability of organisms to maintain internal stability. A desert-living mammal constantly faces the problem of water conservation; but a freshwater fish faces the problem of getting rid of the water that enters its body by osmosis through the skin. At the level of the individual cell , whether it is the cell that constitutes a unicellular organism or a cell in the body of a multicellular organism , the problems of homeostasis present themselves in similar ways. To continue its intracellular processes a cell must maintain an intracellular chemical environment in which the concentrations of various ions see below are kept constant in the face of changing concentrations in the medium surrounding the cell. This is the task of the cell membrane. In the higher animals the task is easier since cells in the interior of their bodies are bathed in an internal mediumâ€”the blood â€”whose composition is regulated so as to minimize the effects of changes in the external medium. This regulatory function is undertaken by specialized cells or organs such as the kidney , thereby lessening the regulatory burden of the other cells of the body. The biological necessity for homeostatic mechanisms is particularly urgent for controlling the inorganic components of cells and body fluids. Inorganic salts can exert even greater osmotic pressure against membranes impermeable to them than urea. This is so because, under the conditions in the body, they are almost completely dissociated into their component ions. For example, a molecule of common salt sodium chloride is dissociated into two inorganic ionsâ€”a positively charged sodium ion and a negatively charged chloride ionâ€”both of which can exert osmotic pressure. Aside from their osmotic effects, inorganic ions have profound effects upon metabolic processes, which in general will take place only in the presence of appropriate concentrations of these ions. The most important inorganic ions in organisms are the positively charged hydrogen, sodium, potassium, calcium, and magnesium ions, and the negatively charged chloride, phosphate, and bicarbonate ions. The membranes of cells are not completely impermeable to these ions and are in fact endowed with the ability to transport ions between the inside and outside of the cell, whereby they control the concentrations of ions within the cells; when such transport is in the direction that requires a supply of energy, it is called active transport see cell: Osmotic regulation is the maintenance of the normal concentration of the body fluids; i. Osmotic regulation controls the amount of water in the body fluids relative to the amount of osmotically active solutes. Ionic regulation is the maintenance of the concentrations of the various ions in the body fluids relative to one another. There is no consistent distinction between the two processes; organs that participate in one process at the same time participate in the other. Principal excretory structures Whereas the kidney is the principal organ subserving both nitrogenous excretion and osmotic and ionic regulation in the mammalian body, these functions are not always performed by a single organ in other animals. As indicated earlier, primitive aquatic animals do not require any special provision for nitrogenous excretion. But by reason of their permeable skins they may have serious problems of osmotic and ionic regulation, especially in fresh water, where cells covering the surface of the body have the ability to actively transport salts into or out of the animal. In some cases these nonkidney regulatory activities are performed by certain specialized cells; e. In other cases, specialized cells are assembled into organs of salt uptake or salt elimination; e. This dispersal of the regulatory function may be the primitive condition, for it is only in the more highly evolved terrestrial animals that the regulatory function is restricted to an excretory system proper. This is readily understandable in view of the need of terrestrial animals to conserve water. This evolutionary development toward one system reaches its climax in the birds, reptiles, and terrestrial insects, in which all the processes of elimination that might involve loss of waterâ€”defecation, nitrogenous excretion, and ionic regulationâ€”converge upon the same final channel. For the excretory organs of a wide variety of vertebrate and invertebrate animals, there is evidence that the primary process of urine production is nonselective, in that in those animals all substances dissolved in their body fluids, with the possible exception of proteins, are found in the primary urine. In many animals the primary urine is produced by filtration from the blood. At a later stage, substances in the primary urine that are useful to the body are selectively reabsorbed. In addition, a few substances are known to be actively transported secreted into the urine. The nonselective formation of primary urine serves another aspect of excretion: Mechanisms of active transport are highly specific to the substances transported.

8: Fluid and Electrolyte Balance

The balance of water and sodium is critical to your health. Your kidneys regulate the volume of water and sodium along with other electrolytes. The goal is for the amount of water you consume to remain in balance with the amount excreted.

Fluid and Electrolyte Balance The kidneys are essential for regulating the volume and composition of bodily fluids. This page outlines key regulatory systems involving the kidneys for controlling volume, sodium and potassium concentrations, and the pH of bodily fluids. A most critical concept for you to understand is how water and sodium regulation are integrated to defend the body against all possible disturbances in the volume and osmolarity of bodily fluids. Simple examples of such disturbances include dehydration, blood loss, salt ingestion, and plain water ingestion. Water balance Water balance is achieved in the body by ensuring that the amount of water consumed in food and drink and generated by metabolism equals the amount of water excreted. The consumption side is regulated by behavioral mechanisms, including thirst and salt cravings. While almost a liter of water per day is lost through the skin, lungs, and feces, the kidneys are the major site of regulated excretion of water. One way the the kidneys can directly control the volume of bodily fluids is by the amount of water excreted in the urine. Either the kidneys can conserve water by producing urine that is concentrated relative to plasma, or they can rid the body of excess water by producing urine that is dilute relative to plasma. Direct control of water excretion in the kidneys is exercised by vasopressin, or anti-diuretic hormone ADH , a peptide hormone secreted by the hypothalamus. ADH causes the insertion of water channels into the membranes of cells lining the collecting ducts, allowing water reabsorption to occur. Without ADH, little water is reabsorbed in the collecting ducts and dilute urine is excreted. ADH secretion is influenced by several factors note that anything that stimulates ADH secretion also stimulates thirst: By special receptors in the hypothalamus that are sensitive to increasing plasma osmolarity when the plasma gets too concentrated. These stimulate ADH secretion. By stretch receptors in the atria of the heart, which are activated by a larger than normal volume of blood returning to the heart from the veins. These inhibit ADH secretion, because the body wants to rid itself of the excess fluid volume. By stretch receptors in the aorta and carotid arteries, which are stimulated when blood pressure falls. These stimulate ADH secretion, because the body wants to maintain enough volume to generate the blood pressure necessary to deliver blood to the tissues. Sodium balance In addition to regulating total volume, the osmolarity the amount of solute per unit volume of bodily fluids is also tightly regulated. Extreme variation in osmolarity causes cells to shrink or swell, damaging or destroying cellular structure and disrupting normal cellular function. Regulation of osmolarity is achieved by balancing the intake and excretion of sodium with that of water. Sodium is by far the major solute in extracellular fluids, so it effectively determines the osmolarity of extracellular fluids. An important concept is that regulation of osmolarity must be integrated with regulation of volume, because changes in water volume alone have diluting or concentrating effects on the bodily fluids. For example, when you become dehydrated you lose proportionately more water than solute sodium , so the osmolarity of your bodily fluids increases. In this situation the body must conserve water but not sodium, thus stemming the rise in osmolarity. If you lose a large amount of blood from trauma or surgery, however, your loses of sodium and water are proportionate to the composition of bodily fluids. In this situation the body should conserve both water and sodium. As noted above, ADH plays a role in lowering osmolarity reducing sodium concentration by increasing water reabsorption in the kidneys, thus helping to dilute bodily fluids. To prevent osmolarity from decreasing below normal, the kidneys also have a regulated mechanism for reabsorbing sodium in the distal nephron. This mechanism is controlled by aldosterone, a steroid hormone produced by the adrenal cortex. Aldosterone secretion is controlled two ways: The adrenal cortex directly senses plasma osmolarity. When the osmolarity increases above normal, aldosterone secretion is inhibited. The lack of aldosterone causes less sodium to be reabsorbed in the distal tubule. Remember that in this setting ADH secretion will increase to conserve water, thus complementing the effect of low aldosterone levels to decrease the osmolarity of bodily fluids. The net effect on urine excretion is a decrease in the amount of urine excreted, with an increase in the osmolarity of the urine. The kidneys sense low blood pressure which results in lower filtration rates and lower flow through the tubule. This triggers a complex response to raise blood pressure and conserve volume. Specialized cells juxtaglomerular cells in the afferent and efferent arterioles produce renin, a peptide hormone that initiates a hormonal cascade that ultimately produces angiotensin II. Angiotensin II stimulates the adrenal cortex to produce aldosterone. Because aldosterone is also acting to increase sodium reabsorption, the net effect is retention of fluid that is roughly the same osmolarity as bodily fluids. The net effect on urine excretion is a decrease in the amount of urine excreted, with lower osmolarity than in the previous example.

9: Sodium & Water Balance in the Body | www.enganchecubano.com

Aldosterone and antidiuretic hormone help control sodium and water balance in the body. Aldosterone, secreted by the kidneys, increases the reabsorption of water and sodium. Antidiuretic hormone reduces the amount of water excreted in the urine.

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