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B.Sc HONS Part III Paper - V

Topic: Physiology of excretion in Mammals.

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Q. Give an account of physiology of excretion in mammals.

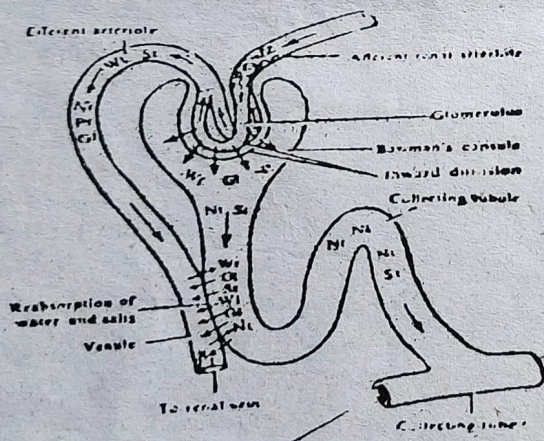
Ans. As a result of carbohydrate and fat metabolism in the body waste products or by products are formed which are of no immediate use. These are CO_2 and water. The CO_2 is easily removed from the respiratory organs while protein metabolism (catabolism) gives off nitrogenous end products i.e. ammonia, urea, uric acid etc. These end products are harmful to the body. Hence their removal is essential from the body. Thus excretion results in the maintenance of healthy internal environment.

On the basis of secretory waste products excretion may be of three types—

(i) Ammonotelic Excretion: In this type, end product is ammonia. It is characteristic of aquatic animals.

(ii) Ureotelic Excretion: It is characterized by the production of urea as excretory product. The ammonia is quickly converted into a less harmful compound, the urea in the liver.

(iii) Ureotelic Excretion: Unicellular animals normally live in relatively dry environments and develop from protected eggs. In them the chief excretory product is uric acid which is also nitrogenous and product.



Physiology of Renal Excretion: The entire physiological process occurs as follows:

1. Ultra filtration or physical filtration and diffusion in the glomeruli. Ludwig (1844) proposed the physical filtration theory according to which filtration of non-colloidal constituents of the blood plasma occurred through the thin (endothelial) membranes of the glomeruli into the cavity of Bowman's capsule. It is due to high blood pressure (55 mm to 90 mm) in the glomerular capillaries than the osmotic pressure of the blood colloids (25 mm. Hg) which acts against the former that the above filtration occurs. Capsular hydrostatic pressure (10 mm

ity) also helps in this process. Thus the urine having water and solutes enter the tubule from the Bowman's capsule and in the tubule urine is concentrated by reabsorption of water.

Glomerular Filtration : The blood brought by afferent renal arteriole consists of blood corpuscles. Fluid plasma, sugars, plasma proteins nitrogenous end products like urea, uric acid, ammonia etc. This blood comes into the glomerulus under great blood pressure with the result that non colloidal constituents as sugars (glucose salts, same water and nitrogenous and products diffuse out through highly permeable endothelial layer of glomerular vessels into the space of Bowman's capsule. Only colloidal plasma proteins and blood cells remain in the glomerular vessels which pass into different renal arteriole. Hence glomerulus functions simply as a filter and it discriminates, between the different molecules in the plasma on the basis of size only. For this selective process is called filtration.

2. Selective Tubular Reabsorption : The filtered fluid into Bowman's capsule is called glomerular filtrate or primary filtrate. Glomerular filtrate passes down into proximal convoluted tubule where selective reabsorption of various constituents takes place. As a result of this process useful substances such as glucose, certain salts such sodium, potassium, calcium, chlorides, etc. amino acids water and other constituents required by the body are reabsorbed by diffusion and osmosis by the blood capillaries surrounding the proximal convoluted tubule. This reabsorbed material into the blood restores the normal composition of blood when it leaves the kidney. The loop of Henle is an adaptation for better reabsorption of constituents in case of mammals and birds.

3. Tubular Secretion : The epithelium of the tubules also has the ability to the tubules also has the ability to transfer certain substances from the blood plasma into the lumen of the tube. Ammonia and creatinine is secreted by the tubular epithelium. Foreign substances such as diodrast and para-amino hippuric acid are secreted by the cells of the tube into its lumen. The fluid in the collecting tube is called urine. It through the way of ureter, usually becomes stored in urinary bladder and is freed from the body from time to time.

The urine consists of solid constituents (0.7 to 1.1 percent) and possesses specific gravity 1.003 to 1.04. Sometimes urine secretion is markedly increased and this process is called diuresis. Urine of average adult male consists of an inorganic salts (Magnesium, sulphate phosphate ammonia, calcium magnesium etc.) Water carbohydrates, creatinine, uric acid, hippuric acid etc. As regards blood glucose, it is completely reabsorbed if it is not above 150 to 180 mg. per 100 ml. and if its percentage is high it is partially reabsorbed in tubule and hence glucose appears in urine. This condition is known as diabetes mellitus.

4. Micturition : The wall of the urinary bladder contains layers of smooth muscle known as detrusor muscle. The smooth muscle in the portion of the

urethra act as internal sphincter. In males there is a external sphin eter ma of striated muscle.

Hormonal Control of the Kidney : The rate of uric formation and concentration are controlled by hormones i.e. aldosterone or mineral cortico and antidiuretic hormone.