# PHYSIOLOGY AND MEDICINE.

Series of Lectures delivered to probationer Nurses at Lahore Medical College, during Session 1909-10

BY

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## PHYSIOLOGY OF ALIMENTARY SYSTEM.

THE alimentary system or digestive apparatus includes, besides the alimentary canal extending from mouth to anus, the accessory organs—teeth, salivary glands, tonsils, liver and pancreas. As you have already attended a course of lectures on anatomy, I need say very little about the structure and relationship of these parts.

The temporary teeth begin to appear about the sixth month and are generally complete by the end of the second year. These teeth begin to be replaced by the permanent set about the sixth year, the last molars (wisdom teeth) appearing after the eighteenth year. The frequent association of a carious set of teeth with dyspepsia is well known to you all.

The tonsils, almond shaped bodies, situated between the folds of the soft palate, one on either side, are liable to become enlarged and inflamed when the teeth and mouth are not kept clean. The fœtid breath of people with these septic mouths (oral-sepsis) can often be traced to a decomposing mass of food which has lodged in one of the crypts of these bodies.

The salivary glands comprise the parotid, sub-maxillary, sub-lingual and buccal glands. The most important is the parotid. They all pour their secretion into the mouth, the mixture of secretions constituting saliva. Besides its special digestive action on food, saliva has other important functions: it keeps the mouth moist and is thus of service during the acts of mastication, swallowing and articulation.

### FOOD.

Food must contain substances capable of restoring and repairing the tissues and of keeping up the heat of the body: food is the source of the energy (work), heat and repair-material of the body. It is derived for the most part from other living organisms, vegetable and animal. Hence the chemistry of food-stuffs is also to a great extent the chemistry of the body. Experience has moreover taught us that a mixed diet (vegetable and animal) is the most suitable for man.

From a chemical point of view, food-stuffs are divided into four groups or classes—(1) proteids, (2) fats, (3) carbohydrates and (4) salts and water: these are the essential proximate principles of which a diet should be composed; and these must be given in sufficient quantities and in the right proportions.

*Proteids* are rich in nitrogen; they supply the nitrogen required by the body, and have as their particular function the repair of tissues. Food-stuffs

devoid of proteids cannot sustain life, so proteids are an essential constituent of every diet. Vegetable proteids are not digested so easily or to the same extent as animal proteids. Articles of food which contain proteids in considerable amount are—meats, *e. g.*, beef, mutton, pork, poultry and fish; milk and cheese; eggs; dal, peas and beans.

*Fats* are an important source of heat and energy. Butter, oils, suet, lard, etc., are fats.

*Carbohydrates* comprise sugars and starchy foods such as bread, rice and other cereals. Their nutritive value is lower than that of fats. They are, however, more easily digested than fats and can to some extent take the place of fats in a diet. Taken in excess, carbohydrates lead to an accumulation of fat in the body.

*Salts and water*, like proteids, are absolutely necessary constituents of a diet.

## DIGESTION.

The processes in the alimentary canal by which the different food-stuffs are prepared for absorption are known as digestion, or rather primary digestion as opposed to secondary digestion or assimilation (see below).

The two chief constituents of *saliva* are a ferment called *ptyalin* and mucous. The latter has merely mechanical properties, lubricating the mouth and throat and thus facilitating the swallowing of food. Ptyalin acts on carbohydrates, converting starch into sugar.

The *gastric juice* is secreted by glands in the wall of the stomach: it is acid in reaction, containing free *hydrochloric acid*, and contains two ferments—*pepsin* and *rennin*. Its chief action is on proteids. Pepsin in the presence of hydrochloric acid converts the crude insoluble proteids of the food into more soluble ones, called peptones, which are then capable of absorption into the blood. The hydrochloric acid of gastric juice, if normally secreted, is lethal to cholera and typhoid germs. Food-stuffs contain many living organisms; yet most of these are dead when the food leaves the stomach and enters the duodenum. Rennin is a milk-curdling ferment; it produces coagulation of milk which is quite different from mere precipitation of milk, such as occurs on adding hydrochloric acid. The latter (precipitate) can be redissolved by alkali.

Food, on entering the stomach, does not become acid for some 20 to 30 minutes, and during this period ptyalin is at work converting starch into a more soluble substance, sugar. As soon as the contents of the stomach become acid, peptic digestion begins and the food becomes broken up and churned by the contractions of the stomach wall. Only finely divided masses are driven from the stomach into the duodenum. The acid contents of the stomach as they enter the duodenum are called *chyme*.

The *pancreatic juice* is secreted by the pancreas and conveyed by a duct to the duodenum, where it meets the chyme. It is an alkaline secretion and contains two ready-made ferments—*amylopsin* and *steapsin*—and a ferment-forming substance called *trypsinogen*, which, on entering the intestine and

meeting a ferment named *enterokinase* secreted by the intestinal glands, becomes the ferment *trypsin*. Trypsin converts proteids into peptones and is more rapid and effective than pepsin, but only acts in an alkaline medium. Amylopsin acts on starches and is more powerful than ptyalin. Steapsin, a fat-splitting ferment, breaks up fats into glycerine and fatty acids.

Pancreatic secretion is indirectly induced by the gush of acid chyme into the duodenum. Under the influence of this acid stimulus, a substance, *secretin*, is formed in the mucous membrane of the upper part of the small intestine and absorbed into the blood. Secretin, carried in the blood stream to the pancreas, is the normal excitant of pancreatic secretion.

The *intestinal juice* is secreted by glands in the wall of the small intestine, and is alkaline in reaction. It has no action on proteids, fats or starch, but contains an inverting ferment, *invertin*, which transforms complex sugars with large molecules into simple sugar with smaller molecules and so capable of easier absorption. The ferment *enterokinase* which converts trypsinogen into trypsin has already been mentioned. A third ferment called *erepsin*, which splits peptones into amido-acids, etc., is regarded by, some as a normal and by others as an accidental constituent of intestinal juice.

*Bile* is secreted by the liver, stored in the gall-bladder and conveyed by the common bile duct to the duodenum, which it enters at the same spot as does the pancreatic secretion. It is a viscid fluid, brown, green or yellow in colour, and faintly alkaline in reaction. It is sometimes credited with antiseptic properties; but some microbes, particularly the typhoid bacillus, grow luxuriantly in it. At the same time, however, it is capable of retarding the growth of certain bacteria, *e.g.*, the common bacillus of the gut. Bile excites peristalsis or contraction of the bowel and is thus a natural purgative. By virtue of this action food-stuffs are less likely to be unduly retained in the bowel and consequently microbes are less likely to cause excessive fermentation in the intestine. In this way may be explained the reputed antiseptic power of bile.

The alkalies of the pancreatic secretion and bile not only neutralize acid of the chyme but render the contents of the small intestine alkalin permitting pancreatic digestion to proceed and fats to be emulsified (' up into minute globules) and absorbed. Where bile is absent fi intestines, the white colour of the stools is due not so much to the la bile pigment as to the presence of fat, owing to the loss of the emulsify action of bile and the consequent non-absorption of the ingested fats.

After the entrance of pancreatic juice and bile into the intestine, the lymphatic vessels of the bowels (lacteals) become filled with a white milky fluid. called *chyle*, which consists of the emulsified fats absorbed from the intestine

### ABSORPTION.

Proteids (peptones), carbohydrates (sugar) and salts are for part absorbed by the blood vessels in the wall of the intestin

carried in the blood-stream of the portal vein to the liver. Fats, on the other hand, enter the lymphatic vessels (lacteals) of the intestine and are conveyed in the lymph-stream to the thoracic duct which pours its milky contents direct into the blood-stream of the left subclavian vein in the neck.

ASSIMILATION.

Many substances are absorbed which are incapable of taking part in the nourishment, or repair of the tissues of the body. Other substances, however, on absorption can be converted into compounds similar to those normally present in the tissues of the body and can thus help to nourish the body by building up and repairing its tissues. The process by which these substances after absorption are transformed and utilised in the formation and repair of the tissues of the body is known as assimilation or secondary digestion.

*(To be continued.)*

## REVIEW.

MISS YSSABELLA WATERS, of the Nurses' Settlement, New York City, has compiled a very interesting record of Visiting Nursing in the United States. The book comprises a Directory of all the Associations which are carrying on Visiting and School Nursing in the United States, as far as it was possible to collect the information. It also gives their scope and plan of work, number of nurses, with what religious, philanthropic, or municipal organizations they are affiliated, etc. This takes up much the greater part of the book, but "Part I", giving the History, Principles, Organization and Administration of Visiting Nursing has very valuable information for those wishing to organize such work in any country. Societies having nurses who are neither graduates of training schools nor pupil nurses are not included in the record, however admirable their service may be.

Visiting, or as it is perhaps better known, "District," Nursing originated in England, where its adoption was general after the beginning of the ...ment in 1859. In America it did not take root till 1877, and it was ...ntil 1894 that any real impetus was given to the work. Now there ... Associations with a staff of 1,413 nurses. There is one association ...d hourly nursing to meet the requirements of people of moderate ...s who cannot afford to pay for a nurse's whole time.

Some of the headings in the chapter on "Principles" give an idea of the detail with which the work is explained, "The Nurse, Her Qualification," "Calls for the Nurse," "Night Duty," "Fees," "Uniforms," "The Physician." 'Relief." Miss Waters also gives the Organization and Administration of the ...rses' Department of the well-known Henry Street Nurse's Settlement. There ...strations of the Nurses' Bag which is in use there, and its contents.

... book is published by the Charities Publication Committee, 105, East ...ond Street, New York, and the price is $1.25 postpaid (about Rs. 4).