

AN
INAUGURAL DISSERTATION

ON
Normal Digestion

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Normal Digestion.

Digestion is defined to be that function by means of which alimentary substances, when introduced into the digestive canal, undergo different alterations.

All animal bodies from the moment of their formation to the ultimate extinction of the vital or animate spark, are incessantly suffering decay and renovation—composition and decomposition—so that they do not at any two periods consist of the same composition. Hence the imperative necessity of food to supply the unceasing waste in the animal economy, which however is seldom found in the proper condition for absorption.

Wherefore it is necessary to prepare it;
by various actions in the digestive organs
to enable the nutritive matter to be
separated therefrom. These numerous
actions constitute the function of Digestion.

The many organs concerned in digestion
are complicated; and require just here
a brief description.

Anatomy of the Digestive Organs.

These differ much in animals: but the
human digestive organs consist of a long
canal, varying considerably in its dimen-
sions in different parts, and communicat-
ing externally by two outlets, - the mouth and
the anus. The mouth is the beginning of
this tube into which aliment is received,
and becomes subject to insalivation and
mastication. Mastication is essential

to complete digestion: and the neglect thereof
is the most common cause of dyspepsia.

The human organs of mastication hold an
intermediate place between those of the
carnivorous and herbivorous animals.

The tongue is also regarded as an organ
of mastication: it rests upon the floor of
the mouth, is free from attachment
save posteriorly and a portion of its inferior
surface. It is the organ of taste, ^{and} also of
articulation in man.

The apparatus of insalivation, secretes
saliva and other fluids which are poured
into the mouth. This admixture,
from the parotid, submaxillary, and sub-
lingual glands, lubricate the food prepar-
atory to deglutition.

The Pharynx and Oesophagus are the

media of communication between the mouth and Stomach, and convey the food from the former of these cavities to the latter. The Oesophagus is connected by its superior extremity, with the inferior extremity of the pharynx; being properly a continuation of the latter; the former constituting the direct communication between the pharynx and the Stomach.

The Stomach, is the most dilated portion of the alimentary tube; and is suspended in the anterior superior cavity of the abdomen.

"The blood-vessels and nerves of the Stomach^{ach} are more numerous than those of any other organ of the body." The many nerves of the Stomach, with the varieties in their derivations; constitute it in the lan-

gnage of another the: center of Sympathies.

The Stomach in man, as the Teeth, holds a place medium between that of the herbivorous, and the carnivorous in animals.

The intestines are that portion of the alimentary tract, which extends from the Stomach to the anus: they are musculo-membranous in texture; forming many convolutions in the abdomen; and are from six to eight times the length of the body.

They are attached by the mesentery to the anterior, middle and inferior portions of the vertebral column. Being in structure so much the same in their entire extent, "A mucous membrane lines them: immediately without this is a muscular coat: and externally a serous coat."

They are divided into small and large intestines: the former embracing much the greatest length: their convolutions, embrace the hypogastric and umbilical regions - "and terminate in the right iliac region." Its average caliber is stated to be about one inch. Again the small intestine is divided: "arbitrarily, into three parts; - duodenum, jejunum and the ileum. The duodenum is about twelve inches in length: which is of greater size than either of the other divisions. By some it is regarded as a second stomach: its structure is not dissimilar to the other portions of the canal. Within this division of the tube are many villi which give to the membrane its velvety character. It also has a large number of follicles which

secrete their characteristic fluid.

Their entire number, says Dr. Jungeleson, in the whole alimentary canal is estimated by Dr. Hermer to be 46,296,000.

"At about four or five fingers breadth from the pylorus, the duodenum is perforated by the biliary and pancreatic ducts, which pour the bile and pancreatic fluid into it." The other portions of this intestine are of much greater length: the jejunum, ^{begins} at the duodenum and extends to the ileum: the jejunum is generally empty, from which fact it receives its name: while the ileum is named from its many windings. That which mostly concerns us in these particulars

of the tube are the villi; which are the absorbents of the chyle; being the most numerous in the jejunum. "The mucous membrane of both is largely supplied with follicles; called the glands of Peyer, Brunner, and Lieberkühner."

"Gelat estimated the number of these glands, in the small intestine, at 40,000. The large intestine is the termination of the alimentary tract; its length is much less than that of the small; but more capacious; and is made the reservoir for the debris of the canal. "Like the small intestine it is divided into three portions; the caecum, the colon, and the rectum."

That part of the great intestine into which the ileum opens or terminates

is the caecum; it is about four inches in length; and connects the ileum with the ileo-caecal valve. A great portion of the large intestine is embraced in the division known as the colon. The coats of the intestines are the same: being much thinner, however in the large than in the small.

A pouch-like arrangement obtains in the great which does not in the small; these pouches are subservient as temporary reservoirs for the excrements, which from absorption of their fluid parts become more indurated in this part of the canal; sometimes constituting Scybala & not unfrequently (it is said) the exciting cause of dysentery. In the rectum we reach the terminus.

of the alimentary canal: it extends from the colon to the anus.

It is not as its name indicates straight but commencing at the fifth lumbar vertebra it descends vertically into the pelvis, following the concavities of the sacrum and coccyx.

The rectum becomes wider and thicker in its downward course, the widest portion being immediately within the verge of the anus: in this dilatation are sometimes found impacted faeces; consequent upon loss of muscular tone in the expulsive powers of defecation.

In the abdomen are situated the principal digestive organs. It is divided by arbitrary lines into

several regions; not important to be mentioned just here however. Likewise the liver and spleen, we will omit to describe; as they can be mentioned in their several functions more appropriately elsewhere.

Of the food of man.
It has already been stated that the digestive organs of man are intermediate between the carnivorous and the herbivorous animals.

His food is likewise intermediate between the two; embracing the common stock of both. It is generally supposed that the articles of nourishment proper for man are embraced in the animal and vegetable kingdoms: but others believe that there is

no just reason for rejecting "certain mineral substances which are necessary for the healthful construction of the body." It is common to designate animals by the quality of the food upon which they live. Hence we have the carnivorous, the piscivorous, the frugivorous, the granivorous, the herbivorous, and Man which is emphatically omnivorous; for there is nothing of which he does not eat. By the culinary art, many substances are rendered edible to Man, which are not so in their natural state; wherefore man's dietetic list is extended almost "ad infinitum." Notwithstanding the omnivorous adaptation of the human species, some Physiologists have advocated

an exclusively vegetable diet for him, and portray man's primitive state as peculiarly felicitous; and conceive that his diet was then exclusively vegetable; "His food the fruits: his drink the crystal well," and assign the eating of flesh: as the cause of man's cruelty and ferocity. But experience demonstrates the fact that man is more fully developed; both mentally and corporeally; when he subsists upon an admixture of animal and vegetable food. Buffon affirms that man could not exist; in this climate without animal food.

Durghlison says: The Tribes, which feed altogether on animal food, as the Laplanders, the Samoièdes, the

Esquimaux, &c. - are far inferior both
respecting mental and corporeal
ability - to the European or Europeo-
American tribes; a similar remark
is made respecting those who live
exclusively on vegetables. The great
importance of an admixture of
diet is illustrated by the experiments,
which Dr. Stark made upon himself;
and to which he became a martyr.

Having given a brief description of
the alimentary tube: and also a short
notice of the food of Man: - I shall
now "address" myself to the varied
changes which are wrought upon
the food in passing through this canal.

But it will be mostly to solid
food, that I shall give attention, in

This brief summary: of digestion.

Hunger. Hunger is an internal sensation: the manifestation of which is through the stomach. It is exclusively an internal sensation, and is never produced by external cause. The first approach of hunger is generally spoken of as appetite; but if this be unheeded, a painful sensation follows; which is acute, and in some lancinating; but which is speedily relieved when a sufficiency of food is taken into the stomach.

Hunger is recurrent; and generally within a few hours after digestion; occurring about the time at which the stomach is accustomed to receive its normal supply.

This sensation may be repelled by various causes: viz; hope, fear, joy, sorrow or any intense mental emotion.

Disease generally lessens or entirely banishes a sense of hunger, while it increases that of thirst. The degree of exercise taken modifies or controls the appetite. The stomach is the organ in which the sensation of hunger is effected: it is conveyed to the brain: the pneumogastric nerve is regarded as the agent of this transmission.

As to the efficient cause of hunger nothing is known that is satisfactory.

All admit it to be a sensation referable directly to the stomach, which is proved to be true: by the experiments made by Dr. Beaumont: in which

The sensation of hunger, was immediately dispelled by the immediate introduction of food into the stomach,

"The nerves of the stomach proceed from two essentially different sources, - from the eighth pair and from the great Sympathetic." Persons who perish from inanition are differently affected: in some the most acute pain supervenes: while others suffer but little.

Prehension of food.

The hands and mouth are the organs of prehension with man: the hands to convey the food to the mouth: and the mouth to receive and retain it. Most animals collect their food with the mouth alone: but as man is the man

perfect animal he is provided with hands: than which it is difficult to imagine any thing more befitting our necessitous condition.

Oral Digestion.

The comminution reduction and insalivations of the food while in the mouth is preparatory not only to deglutition; but also for the functions performed by the stomach. If the former be complete; the labours of the latter will be more easily done: but if incomplete; as it too often is; the latter viscus may be insufficient to do the labours intended for both: wherefore indigestion is the result. I conceive comminution and insalivation to be the most important changes wrought upon

The food while in the mouth. The latter of which is accomplished by the glandular secretions, elsewhere stated to be of a very compound nature. Jurglison speaking of these functions says, both mastication and insalivation are of great moment in order that digestion shall be accomplished in perfection; and accordingly, we find that they who swallow the food without due mastication or waste the saliva by constant and profuse spitting, are more liable to attacks of dyspepsia or imperfect digestion.

Deglutition. "The act of swallowing" performed in a very brief space of time: is nevertheless a digestive function: requiring the conjoint actions of the mouth and oesophagus as likewise that of the pharynx.

"It has been divided into three stages: viz. In the first, the food passes from the mouth into the pharynx: in the second, it closes ^{ears} the apertures of the glottis and nasal fossae, and attains the oesophagus: and in the third, it clears the oesophagus and enters the stomach."

Chymification.

The food having been masticated and insalivated reaches the stomach and is soon subjected to the gastric juices of that viscus: by which it is reduced to a pulsatious pasty mass: to which the name of chyme is given: "and to the process chymification." It is now pretty evident that the gastric juices; the main agent of chymification; is not found in the stomach in its empty state. To this belief the valuable experiments of Dr. Beaumont, made upon

Alexis san Martin; give almost indisputable testimony. He found that there was no gastric fluid secreted in this viscus; until its cavity was partially filled with food; its natural stimulus: but immediately after food was taken the secretion began; a pure, limpid, colourless, slightly viscid fluid was distilled being distinctly and invariably acid. But on applying the tongue to the mucous coat in its empty unstimulated state no acid taste could be perceived.

The chyme which is a homogenous mass, of grayish colour: and of an acid taste: is upon its formation conveyed into the duodenum; passing through the pyloric orifice; after which it assumes the name of chyle. There have been almost numberless theories as to the "modus operandi," of

chymification: the principal of which are:
Coction; Putrefaction; Trituration; Fermen-
tation: and Chymical Solution: the last
Theory is most plausible of any given: and
has met with more support from Physiologists
generally. In the existing state of our knowl-
edge, however, regarding, this wonderful and
mysterious process, we would perhaps be
justified in adopting the well known,
"pithy and laconic observation of Dr. William
Hunter: "Some Physiologists will haul it,
that the stomach is a mill: others, that
it is a fermenting vat; others, again that
it is a stewpan; - but in my view of
the matter, it is neither a mill, a ferment-
ing vat; nor a stewpan; - but a stomach,
gentlemen a stomach." There are various
organs to which, the food is subject

during chymification viz: First the food is mixed with the secretions of the Stomach. Secondly it is subject to the peristaltic motion of the Stomach and neighbouring organs: and Thirdly to 100° Temperature: all of which are necessary in joint-agency to speedy and thorough chymification. The relative digestibility of numerous articles of diet might here be given: but I deem it quite sufficient only to refer to the list as given in Jungleson's Medical Dictionary.

Chylification. After the chyme is passed into the small intestines it is termed chyle. Important changes are wrought upon the aliment in the duodenal portion of the Tube. Indeed its function is so great: as to give it the name of the second Stomach. 'Tis here that the biliary and pancreatic juices mix with the food: the presence of which most probably give to the chyle its peculiar fitness for absorption:

conduction and distribution of the lacteals: "the fluid destined for the renovation of the blood. As the food passes on wards through the jejunum and ileum it gradually loses its grayish tinge and acid taste.

... Action of the large intestine.

Although chylification is not mainly effected in this part of the canal, the importance of such a reservoir is obvious: without it, we should be subjected to the inconvenience of evacuating the feces incessantly. Defecation is accomplished by the expulsive power of the diaphragm, abdominal and pelvic muscles. - In prehension, mastication, deglutition, chymification, as also in defecation: we see the manifestations of the wisdom and power and goodness of Him who created all that is, and whose hand is ever open to supply all his needy creature's real wants. Andrew A. Padgett.

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