great that it will be impossible to do more than name a few classes or individual drugs, the action of which is most directly connected with the best-known digestive functions, leaving out of consideration such as, *e.g.*, the drastics and hydragogues. True, so practical a writer as Fothergill tells of a pill of the following composition given to a man twice daily for two months with benefit to his digestion, viz.: Ol. croton., ♏i.; gamboge, gr. iss.; pulv. capsici, gr. i.; strychnia, gr. $\frac{1}{60}$; Ext. aloes aquos., q. s.; but most patients are more helped by milder doses. He also quotes Lauder Brunton to this effect: "Purgatives prove useful in many ways. They hurry the food out of the alimentary canal, and thus lessen the injurious effects of over-eating. By expelling irritating substances from the intestine they arrest diarrhœa and remove headaches and other pains, caused either by the abdominal irritation or by the absorption of poisonous matters produced by imperfect digestion and decomposition of food." Thus it is enforced that cathartics are important aids to digestion alike when the disturbance is evidenced by constipation and by diarrhœa. Another condition in which the cathartic aids digestion is when the walls of the atonic or dilated stomach are covered by a coating of thick tenacious mucus, which also covers the bolus of food. The familiar morning draught of hot water, or the hot saline draught before breakfast, helps to liquefy and sweep away this mucus and leave the way unobstructed for the gastric secretions to reach the food. The natural saline mineral waters in all countries are immensely popular both with the profession and with people at large, and are perhaps the most largely used of all cathartics, whether taken habitually to secure a daily movement of the bowels or as a principal feature of occasional or periodic visits to the spas. No doubt, on the latter occasions the mineral waters themselves receive more credit than they deserve for the improved digestion, much being undoubtedly due to the influence of change of air, to regulated exercise and diet, to rest from customary labors or indulgences, and in some degree to the various external applications of the waters. Salines, other than as ingredients of the natural mineral waters, belong among the purges. The most important of them are sulphate and citrate of magnesia and sulphate and phosphate of sodium and, like castor oil, rhubarb, mercury, aloes, and senna, they promptly unload the bowel. The less active remedies, the effects of which are chiefly manifested on the lower bowel, include such as manna, sulphur, and cascara, and are classed as laxatives (Wood). It would be in vain to enter on a discussion of the many other cathartics, for the theories both of their many desirable combinations and of the ways in which they do good in the digestive system alone would fill volumes. One other method of treatment deserves attention at this point and that is *lavage*. Although it is essentially an evacuant, yet so good an authority as Hemmeter says: "Lavage, with solutions of sodium chloride, or of 0.04 per thousand of HCl, is most effective in starting the sensation of hunger." He specifies the following indications for its use: "(*a*) When the exit of the chyme from the stomach is hindered by a mechanical obstruction giving rise to decomposition, as in most forms of dilatation of the stomach; (*b*) where foreign or irritating collections are mixed with the gastric contents which sooner or later interfere with digestion. These may be of mucus or bile or abnormally increased gastric juice." For these purposes he uses warm alkaline and saline solutions, and subsequently solutions of bismuth or silver nitrate. Careful details for carrying out this mode of treatment, the introduction of the tube, etc., may be found in Hemmeter's treatise or in Foster's "Reference Book of Practical Therapeutics," *sub verbo*. In the treatment of acute indigestion lavage is often to be preferred to the administration of an emetic. The *stomach douche* is a more recent addition to the armamentum medicum of the same class.

Disinfectants include drugs of which the following are among those best known and which have been found most efficacious, viz.: Naphthalene, the sulpho-carbolates, the salts of bismuth, carbon finely divided, salol and its congeners, and probably the bichloride of mercury. They are believed to prevent putrefaction and abnormal fermentative processes in the contents of the bowels. As a result they often relieve pain, check diarrhœa, and prevent such auto-intoxication as may lead to irregular and persistent fever and to acute rheumatic affections of the joints. Salol, creosotal, and their kind have the recommendation that they pass through the stomach unchanged, to be dissolved only by the intestinal secretions, where they become active. The search for the ideal disinfectant for internal administration has not yet been crowned with success, owing to the difficulty of finding a drug which is sufficiently soluble and which will retain its disinfectant properties after meeting the intestinal fluids and yet not develop irritating or poisonous properties.

The Digestive Ferments are interesting physiologically as well as therapeutically, though when we confine ourselves to "remedies that aid digestion" there are but few of them that come within our purview. Thus the saliva contains an enzyme, *ptyalin*, the function of which is to change starch to sugar and to the products intermediate between starch and sugar. Its direct bearing upon our subject is to show the importance of *mastication* in salivary digestion, for it breaks open the starch-cellulose envelopes and thus exposes a larger surface to the action of the enzyme; but ptyalin itself is little used as a medicinal remedy. The most important of the amylolytic or starch-digesting class is *diastase*, which is obtained from germinating grain, and is familiar under the names of malt extract, Maltine, or Maltzyme, and with it belongs *taka diastase*, which is obtained from a fungus called Eurotium oryzæ, and is much more powerful than the malt extracts. Like the other digestive ferments diastase is much used to strengthen the weakened digestive secretions, but its province is less well defined than in the case of some others, for the existence of a condition deserving the name of "amylaceous dyspepsia" is certainly questionable. According to Osler, "Ptyalin and diastase are particularly indicated when the acid is excessive, and the malt diastase is often very serviceable when given with alkalies." Many of the preparations of malt diastase contain some percentage of alcohol, making them equivalent to a mild stout or beer (Cushny). Coming now to the proteolytic digestive ferments the most familiar one is *pepsin*. This is usually obtained from the stomach of the pig. It acts in an acid solution only, preferably one containing 0.2 per cent. of hydrochloric acid, which is nearly the same as the proportion of that acid in the gastric juice. Ewald is quoted to the effect that "the use of pepsin may be limited to the cases of advanced mucous catarrh and the instances of atrophy of the stomach." It has, however, been largely used with the view of reinforcing the digestive capacity of the stomach for proteids in other conditions, and doubtless its administration has often been superfluous, for it is found that "the gastric juice is almost always capable of digesting proteids if it is acid in reaction" (Cushny). Pepsin is best administered in powder or in solution with acid. *Pancreatin* is an extract of the pancreatic gland of the pig and should represent the various enzymes found in the pancreatic juice. These are *amylopsin*, which is amylolytic; *trypsin*, proteolytic, but requires an alkaline medium for its action; *steapsin*, which causes emulsification of fats in the alkaline solution (Hall). It is thus apparent that an efficient digestive aid can be expected from this preparation only when it can be brought to act upon the intestinal contents where their reaction is alkaline. It is therefore customary to combine it in tablets with bicarbonate of soda, to neutralize the destructive acidity of the gastric juice, or to enclose the drug in a coating of keratin to protect it from the gastric juice while passing through the stomach. Among the proteolytic ferments should also be mentioned *papain* or *papoid*, derived from the carica papaya or pawpaw. It is used to some extent as a substitute for pepsin or pancreatin, but has the peculiarity of acting either in warm or cold, in moderately acid, alkaline, or neutral solutions.

Upon milk it exerts the double action of curdling and then peptonizing. In this connection the following quotation from Hemmeter may not be inappropriate. "Predigested foods, such as somatose, Mosquera's beef meat and such others as are tasteless, when mixed with food so as not to be detected, are useful when the digestion of albumen in the food becomes insufficient, or when as in some cases of carcinoma or tuberculosis there is inadequate absorption of nitrogenous food."

The indication for *alkalies* as digestants is the presence or secretion of an excess of hydrochloric acid in the stomach. For this purpose they are used as ingredients of the fluid of lavage, as well as to liquefy tenacious mucus. While there is no doubt of the value of alkalies given half an hour to an hour after meals in cases of excessive acidity, on the other hand the most contradictory views are held by good authors as to the result upon the secretion of acid from giving alkalies before eating. Magnesia, carbonate of magnesia, and lime are commonly classed as *antacids*. They also are used in excessive acidity of the stomach and in acid putrefaction in the bowels, and it is believed that the magnesia salts produced in the intestinal canal under these conditions are less irritating than the lime salts and may have the additional advantage of acting as mild purgatives. Of *acids* by far the most important as an aid to digestion is *hydrochloric*, as the ingredient in which the gastric juice is most often lacking. *Nitric* acid is also used by itself and in combination with hydrochloric, and so is to some extent *phosphoric* acid. A consideration of the physiology of stomach digestion as already referred to in this article furnishes the explanation of their use. They are often given with the bitters, as strychnine or gentian, with pepsin and with carminatives such as cardamom, one enhancing the effect of the other in the combination. Dilute hydrochloric acid may be given in doses of ♏xv. to xx. after eating, although as much as a drachm or a drachm and a half has been recommended by some of the best authorities.

Availing ourselves of the anæsthetic action of *cocaine*, we may sometimes employ that drug to check vomiting when threatened in irritation of the stomach. *Arsenic* has a specific action in causing fatty degeneration of the epithelium of the stomach and intestines, and the effects attributed to it of increasing appetite and promoting digestion may perhaps be due to a mild degree of the same action on the epithelium (Cushny). Be that as it may, we often see nutrition improve under the use of the drug, especially when given with iron. The sedative action of the *bromides* is also made use of to diminish the irritability of the stomach which prevents the retention of an adequate quantity of food. *J. Haven Emerson.*

BIBLIOGRAPHY.

H. C. Wood: Therapeutics; Its Principles and Practice, 11th edition, Philadelphia, 1900.
A System of Practical Therapeutics, edited by Hobart Amory Hare, Philadelphia, 1891.
Arthur R. Cushny: A Text-book of Pharmacology and Therapeutics, Philadelphia and New York, 1899.
F. P. Foster: Reference Book of Practical Therapeutics, New York, 1896.
Winfield S. Hall: Text-book of Physiology, London, 1900.
J. Milner Fothergill: The Practitioners' Handbook of Treatment, Philadelphia, 1877.
William Osler: The Principles and Practice of Medicine, 3d edition, New York.
John C. Hemmeter: Diseases of the Stomach, 2d edition, Philadelphia, 1900.

DIGESTION.—The purpose of digestion is to prepare the food for absorption and assimilation, so that it may form a suitable nutriment for the tissues of the body.

During the process of digestion the food lies within the alimentary canal, along which it is gradually moved by appropriate contractions of the muscular walls.

Here the food-stuffs, through the agency of the digestive juices, undergo chemical and physical modifications which render the various constituents in the end more soluble and capable of easy absorption by the columnar cells of the intestine.

A complete account of digestion would accordingly deal with the movements of the various parts of the alimentary canal and with the mode of secretion and chemical properties of the digestive fluids, in addition to describing the action of these digestive secretions upon the food-stuffs.

It is, however, more appropriate, for facility of reference, to treat of the mechanics of digestion under the various headings of mastication, deglutition, intestinal movements, and defecation; while the properties of the various digestive juices will be found under their names and those of the ferments which they contain.

In this article we shall, therefore, chiefly consider the action of the digestive juices upon the food in the different parts of the alimentary canal.

Buccal Digestion.—The chief function of the saliva undoubtedly is that of facilitating the swallowing of solid food. This is shown by the fact that *mucin*, the most important of the organic constituents and one which is invariably present, has no chemical action whatever on any of the food-stuffs. On the other hand, *ptyalin*, which is the only chemically active substance, is absent in certain classes of animals, such as all the typical carnivora. The water of the saliva, which is intimately mixed with the food in the process of mastication, makes the mass of much softer consistence, while the mucin at the same time coats it over with a slippery envelope, so that the subsequent passage along the œsophagus is for both these reasons rendered easier.

The more important effects exerted upon the food in the mouth are hence physical in character, viz., a comminution by the teeth, a softening by imbibition and mixing with the water of the food, and a slippery surface conferred by the mucin of the saliva. In addition to these, however, a chemical action is initiated in man and most mammals upon any starches present in the food, which is of some importance because of the rapidity of the action, and of the fact that the activity is continued for a considerable time after the food passes into the stomach.

This action on the starches is due to a diastatic enzyme, which has been named *ptyalin;* although like all other enzymes it has not yet been isolated as a chemical individual. The chemical action is typical of that of the entire class of diastatic enzymes, such as malt diastase or amylopsin of the pancreatic juice, and hence merits a short description.

In the reaction, the ptyalin is not itself chemically involved, but it sets up a catalytic change in which the elements of water are taken up by the complex starch molecule, which at the same time becomes resolved into simpler bodies. The first evidence of this *hydrolysis* and accompanying degradation of the starch molecule is physical in character and consists in the formation of soluble starch, or *amidulin*. Starch paste to which saliva has been added loses at this stage its viscid character, the common property of colloidal solutions containing giant molecules, and becomes limpid and more like a true solution. The solution still retains, however, the chemical properties of starch, as is shown by its giving the usual deep blue coloration on the addition of iodine. This first stage of the action of ptyalin upon starch takes place very rapidly, especially when the starch granules have been burst by previous cooking, as short a time as thirty seconds being sufficient to render a stiff starch paste completely fluid, when a few drops of saliva are added at body temperature. This first action is hence of considerable importance, for under proper conditions of mastication practically all the boiled starch of the food ought to enter the stomach as *soluble starch*. When the starch has not been previously boiled the action is infinitely slower, since there is a thin membrane of *starch cellulose* surrounding each starch granule, and this membrane retards the action of the ptyalin upon the enclosed *starch granulose*.

The further stages in the action of ptyalin upon starch consist in a gradual advance of the process of hydrolysis. As a result there is formed a variable mixture of maltose and iso-maltose, with dextrins, of which the constituent individuals have never been satisfactorily isolated. The hydrolysis never becomes complete no matter how prolonged be the interval of time allowed. There is indeed no complete conversion of dextrins into sugars, not even when the dextrins finally formed are precipitated from solution and treated anew in fresh solution with saliva.

The blue coloration with iodine ceases to be obtainable when the starch has all been converted, and is replaced by a red color which is said to be given by a hypothetical substance, called from the red color, *erythrodextrin*, although no chemical substance corresponding to this name has ever been isolated. At a later stage no coloration is obtained with iodine, and for this reason the dextrins then in solution are spoken of as *achroödextrins*. There are probably several dextrins at this final stage, as is indicated by the fact that fractional precipitation with alcohol yields products of varying rotatory power for polarized light. No sufficient isolation of these bodies has yet been accomplished, although the names of α, β, and γ achroödextrin have been applied to products of different physical properties obtained from the mixture.

The sugars formed are maltose and a closely allied sugar named iso-maltose; inversion of these disaccharides into monosaccharides by ptyalin does not take place to any appreciable extent, but various observers describe the presence of a *small* percentage of dextrose.

From the fact that maltose appears early in the process of hydrolysis, even at the stage of erythrodextrin, and increases in amount as achroödextrin is formed, it has been concluded that a certain percentage of maltose is formed early in the decomposition of the starch molecule, and the process is hence usually represented schematically thus:

```
                 Starch.
                    |
              Soluble starch.
                    |
   ┌────────────────┴────────────────┐
Erythrodextrin.       Maltose and iso-maltose.
        |
   ┌────┴─────────────┐
Achroödextrins.       Maltose and iso-maltose.
```

There is, however, as has been pointed out by Lintner and Dull,* no logical basis for such an assumption, for in such a chemical reaction, of considerable time duration, there is absolutely no reason to believe that the starch molecules are all attacked at the same rate by the ferment and at any given moment are all equally advanced in hydrolytic cleavage. There is no reason why the maltose simultaneously present with the erythrodextrin should not be the product of more advanced hydrolysis of other starch molecules, rather than split off in the formation of erythrodextrin in the beginning. It is in fact more probable that there is formed a series of more and more simple dextrins which give rise in the end to the disaccharides, than that such simple molecules should be split off in the early stages of cleavage as congeners to much more complex bodies.

No particular effect is exerted on proteids and fats in the mouth, since the saliva contains no ferments which act upon either of these classes of food-stuffs.

Gastric Digestion.—The primary office of the stomach, and that which undoubtedly led to the development of that organ, is to afford storage for the food until it can be taken up for digestion and absorption by the intestine. That fraction of the food taken in at a full meal which is capable of being accommodated and acted upon in the intestine is a small one; the chief part of the meal must accordingly be temporarily stored in some receptacle and passed on through the pylorus from time to time as intestinal digestion and absorption proceed. This important use of the stomach is illustrated by the fact that the stomach can be completely removed in the dog, provided the animal when it has recovered from the operation be frequently fed with very small portions of food. At first only a very little food at a time can be retained, and the animal requires to eat almost continuously, but after a time a distention forms in the alimentary canal at the former situation of the stomach, and the animal can retain a meal for almost as long a time as before the operation. The stomach has also been practically completely removed in man, as a consequence of malignant disease, with similar results. By these cases it is demonstrated that the chemical activity of the stomach is not essential to digestion; while the tendency to the formation of a distended portion and the fact that small quantities of food can only be borne at first after complete gastrectomy indicate the primary use of the stomach as a storehouse for the food after a meal.

As soon as the food passes the cardiac orifice the sphincter closes, and as the pyloric sphincter is also normally closed, the stomach thus forms during the greater part of the time a closed sac which is completely occluded from the remainder of the alimentary canal. In this receptacle the food is churned about by very active contractions of the muscular coats, which movements serve to intimately mix the food into a more or less homogeneous, semifluid mass.

The mixed mass produced by this churning action is termed *chyme*. Its character, both in physical appearance and chemical composition, naturally varies widely with the extent of previous mastication and the nature of the food, and hence the usual description of a semifluid mass of the consistence and appearance of pea soup is often very wide of the mark. (See article on *Chyme*.)

From time to time, and always at the close of a contraction of the muscular coats, a portion of the chyme is passed into the duodenum by a temporary relaxation of the pyloric sphincter. The rate of passage of food from the stomach to the duodenum is regulated reflexly, and the afferent impulses appear to be controlled by the condition of the intestine as regards the presence of food undergoing digestion.

Thus, a primary function of the stomach is to act as a normally closed temporary reservoir for the food, from which it is doled out into the intestine as the progress of intestinal digestion and absorption warrants. Other functions than this have, however, developed in connection with the stomach, and these may be briefly enumerated as follows:

1. The hydrochloric acid of the gastric juice neutralizes the alkali of the saliva, and in the end the chyme acquires a strongly acid reaction. As a result of this the conversion of starch into sugars and dextrin, as described above, is brought to a standstill by the complete destruction of the ptyalin.

2. The hydrochloric acid acts at body temperature as a strong inverting agent, thus changing practically the whole of any cane sugar which may be present into invert sugar, *i.e.*, a mixture in equal proportions of dextrose and lævulose.

3. The hydrochloric acid acts as a powerful disinfectant, arresting putrefaction if that has already commenced in the proteid food, preventing or minimizing acetic or lactic fermentation of carbohydrates, and destroying many pathogenic bacteria or their spores, thus reducing the danger of infection of the intestine and hence of the organism as a whole by many classes of bacteria.

4. The pepsin (*q. v.*) of the gastric juice has a powerful digestive action upon all forms of proteid.

5. The rennin, or milk-curdling ferment, also present, influences specially the digestion of milk by previously coagulating it; as a result it is retained for a longer period in the stomach and intestine and hence undergoes a more complete digestion.

The exact period of time after a meal at which the reaction of the chyme changes to acid, has been the subject of much debate. It is probably a very variable period,—one that alters with the character of a meal, the amount of mastication and accompanying insalivation, and the vigor of secretion of the hydrochloric acid of the gastric juice. A meal rich in carbohydrate increases the length of this period, and one rich in flesh meat diminishes it. As an

* Quoted by Neumeister, Physiol. Chemie, 2te Auflage, 1897, S. 287. (Lintner and Dull., Ber. d. deutschen chem. Gesellsch., Bd. xxvi., 1893, S. 2539.)

average the time until free hydrochloric acid is present may be placed at from twenty minutes to half an hour. During this period conversion of starches into dextrins and sugars proceeds with unabated rapidity, for ptyalin is still more active in a neutral or nearly neutral reaction than in a strongly alkaline one. As soon as any free hydrochloric acid is present the ptyalin is rapidly destroyed.

It is not improbable, however, that a certain amount of conversion of starch goes on by means of the hydrochloric acid, for, after feeding dogs on starch, a considerable amount of maltose and dextrin is found in the stomach contents, although dog's saliva contains no ptyalin. This subject still requires investigation.

The inversion of cane sugar proceeds much more slowly in the presence of the products of proteid digestion, and if all the acid present be combined with such products it comes practically to a standstill. In the absence of proteid products the inversion proceeds so rapidly as to render it probable that almost complete inversion takes place during the stay of food in the stomach (Lusk).

It has been stated by various authors that a very considerable conversion of neutral fats into free fatty acids and glycerin takes place in the stomach. Experiments by the writer have given the result that practically no such hydrolysis takes place at the temperature of the body, under the action of pure solutions of hydrochloric acid alone of a strength comparable to that of the gastric juice. Since the gastric juice contains no fat-splitting ferment it is indeed difficult to understand the above-mentioned experimental results.

The important use of the hydrochloric acid as a disinfectant is illustrated by the evils attendant upon subacidity of the stomach, or still more by entire absence of hydrochloric acid secretion. Under these conditions the interrupted gastric digestion of proteids produces far less baneful effects than does the infection of the stomach by bacteria, which flourish upon the carbohydrate food, setting free gas which causes distention of the stomach and intestine, and also free organic acids such as acetic, lactic, and butyric, which vitiate intestinal digestion and set up chronic gastric and intestinal catarrh. The value of hydrochloric acid as a germicide is also considerable; and undoubtedly sub-normal acidity is a powerful predisposing cause to those diseases in which the intestine becomes a prey to specific bacterial infection, such as typhoid and cholera. It has been shown that certain spores are more resistant to the action of the gastric hydrochloric acid than are the bacteria themselves; this has been found, for example, in the cases of the spores of cholera and anthrax.

The first stage in the action of pepsin upon proteid is the formation of acid albumin; the proteid being dissolved during this first stage if it is not initially in a state of solution. Since acid is present it might be supposed that in this stage the pepsin takes no part, and that the action is a conversion of native proteid into acid albumin by the hydrochloric acid alone acting at body temperature. This, however, is not the case, for although pepsin is inactive in the absence of the acid, the latter merely confers a favorable medium upon the pepsin which then acts upon the proteid and causes or at least initiates the transformation. This is shown experimentally by the fact that a coagulated proteid, such as fibrin, is only infinitely slowly converted into acid albumin at body temperature by hydrochloric acid alone when it is of the same degree of concentration as the gastric juice, whereas on the addition of pepsin the transformation is a rapid one. It is possible that the change to acid albumin takes place in two stages, viz.: first, an action of the pepsin upon the proteid, giving a soluble modified proteid; and, secondly, a conversion of the product of this first action into acid albumin by the acid as it is formed in the nascent condition in the presence of the acid. This view is rendered probable by the fact that in the action of trypsin upon proteid which takes place in an alkaline medium, alkali albumin is similarly formed; and the fact indicates, further, that most probably the proteid is subjected to an initial modification by the action of the trypsin, which is acted upon as it is formed by the alkali present and converted into alkali albumin.

The stage of formation of acid albumin can be demonstrated just as the proteid has disappeared into solution, or at any time before this stage, by filtering and neutralizing, when a precipitate is obtained. With a very active pepsin solution, the amount of acid albumin so precipitable at any period is very small, for the acid albumin is attacked further by the pepsin and hydrochloric acid, and changed into albumoses which are not precipitable on neutralization. With weaker solutions of pepsin also, after all the proteid has passed into solution, the amount of acid albumin, as demonstrated by the amount of neutralization precipitate, gradually diminishes, and, if the pepsin solution has not been too weak, finally disappears. If, however, the pepsin solution is very weak, the action becomes identical with that of very dilute acids acting alone for a prolonged time, and there is produced a very stable form of acid albumin which undergoes no further change. In the normal action of pepsin and hydrochloric acid this does not take place and all the acid albumin first formed is afterward changed into albumoses. This change takes place by action upon the portions of acid albumin first formed, simultaneously with the production of further acid albumin, so that, even before complete solution has taken place, both acid albumin and albumoses are present together in solution.

The albumoses are formed, according to Neumeister, in two successive stages: first, proto- and hetero-albumose are formed, and accordingly these are termed primary albumoses; at a later stage these become converted into deutero-albumoses, which are therefore called secondary albumoses. The primary albumoses are precipitated from solution on saturation with sodium chloride; to precipitate the deutero-albumoses a further addition of acetic acid is required.

Finally, a certain percentage of deutero-albumose becomes changed into peptone, which is distinguished by not being precipitated on complete saturation with ammonium sulphate.

The process, like the action (described above) of ptyalin upon the starches, never becomes complete, but the final result is always a mixture of albumose and peptone which cannot be further peptonized by pepsin. The albumoses, in so far as they are not absorbed as such, are, however, converted into peptones and amido-acids by the trypsin of the pancreatic juice in the course of intestinal digestion.

There is a considerable variation in the length of time occupied by the stomach, after a meal, in discharging its contents, the period varying with the character of the meal, the previous state of nutrition, and most of all with the character of the animal. In herbivora, for example, the stomach, except in very prolonged inanition, is never empty of food, while in a carnivorous animal (especially after a previous period of starvation) the stomach may be found empty one or two hours after a meal. A fatty meal is retained longest in the stomach; a light meal, such as bread or rice, passes on to the intestine rapidly; while lean meat remains in the stomach for a period of time intermediate between these two. The mean period in man may be approximately stated at from four to six hours. A distended or relaxed condition of the stomach increases the interval, and under pathological conditions the stomach may never become completely cleared of food. Diminished acidity of the gastric mucous membrane also tends to increase the period of gastric digestion.

Intestinal Digestion.—The chyme, as it is passed out at intervals through the pylorus into the duodenum, has always under normal conditions a strongly acid reaction, due to hydrochloric acid, but becomes at once immersed in a strongly alkaline bath which has been prepared for it in advance by the secretion into the duodenum of bile, pancreatic juice, and *succus entericus*. As a result of this the free hydrochloric acid is almost at once neutralized, and usually the intestinal chyme acquires an alkaline re-