

16. *Middeldorp*, 1854. Introduced the galvanic éraseur (*Schmidt's Jahrbücher*, Bd. 107-200.)
 17. *Nummely*, 1856. Introduced the suprathyoid use of the éraseur into England. Adopting Chassaignac's modification. (*Med. Times and Gaz.*, 1856.)
 18. *Girouard*, 1857. Employed circumpuncture with rods of caustic. (*Archives Gén.*, 1857.)

Division of the Cheek.

19. *Jaeger*, 1831. Was the first to divide the cheek for free access to the tongue. ("De Extir. Lingue," 1831.)
 20. *Maisonneuve*, 1858. Divided both cheeks from the angle of the mouth for same purpose.
 21. *Collis*, 1867. Reintroduced Jaeger's operation, using the éraseur. (*Dub. Quart. Journ.*, xliii., 1867.)

Division of the Lower Jaw.

22. *Roux*. Died 1836. Was the first to divide the lower jaw and lip in mid-line in order to gain free access to the floor of the mouth and tongue. (*Maisonneuve, Thèse*, p. 146.)
 23. *Sédillot*, 1844. Improved this method by dividing the bone by a serrated cut. (*Gaz. des Hôp.*, 1844, 83.)
 24. *Syme*, 1857. Divided the jaw in mid-line and excised with knife. (*Lancet*, 1858, vols. 1. and II.)
 25. *Billroth*, 1862. Divided the jaw and soft parts at the side in two places, and turned down the flaps of skin and bone so formed, replacing and wiring the bone afterward. (*Archiv f. klin. Chir.*, 1862.)
 26. *B. von Langenbeck*, 1875. Divided the jaw and soft parts opposite the first molar tooth on one side, in order to gain access to the side of the mouth for removal of tongue, glands, and part of palatal arch and tonsil.

Inframaxillary Operations.

27. *Regnoli*, 1838. Opened the floor of the mouth from below by an incision from middle of hyoid bone to chin, ending in another semilunar incision along the border of the jaw. The tongue was drawn through the opening and excised. (*Bull. Sci. méd. Bologna*, 1838.)
 28. *Czerny*, 1870. Modified Regnoli's procedure, forming lateral flaps.
 29. *Billroth*, 1871-76. Modified it still further, extending both ends of the curved incision much farther backward, and omitting the incision in mid-line. (*Archiv f. klin. Chir.*, Bd. 16, Hft. 2.)
 30. *Kocher*, 1880. Introduced a method of opening the mouth from behind and below the angle of the jaw to reach the base of the tongue and remove it with all the lymphatic glands situated there. (*Deutsche Zeitschrift f. Chir.*, Bd. xiii., 146, 1880.)

Results of the Operation.—The immediate results following excision of the tongue are fairly good, considering the severity of the operation. Whatever operation for excision of the tongue is practised, the mortality in a series of cases is about the same, so that the method of operating seems to have less effect on the result than the after-treatment. Still, certain operations are more favorable than others as regards the recurrence of the disease, and it is reasonable to suppose that when the disease is most completely removed it is least likely to return.

Whitehead in 139 operations had 20 deaths, or 14.3 per cent. *Butlin*³⁷ has collected 333 cases of excision of the tongue from the statistics of 4 operators, and finds that there were 42 deaths due to the operation. Of 202 uncomplicated cases only 14 died. In 109 cases in which there was either division of the lower jaw or excision below the jaw, the mortality was 25. About twenty per cent. of patients live three or more years after operation.

With regard to the frequency of recurrence it may be said that recurrence is the rule. *Barker*³⁹ has collected 170 cases in which the whole or part of the tongue was extirpated, and in only 17 cases was there non-recurrence after an interval of a year. According to the same author the duration of the disease, in cases not operated on, was 11.7 months, and in those operated on 19 months, a clear gain of 7.3 months. The longest period of freedom from the disease after operation seen by the writer was 28 months. It is to be hoped, with the modern methods of antiseptics which are now so universally practised, that the excision of the disease will be more complete, and hence the period of freedom from recurrence prolonged, and also the mortality after operations much decreased.

Dangers of Excision.—Formerly the danger most dreaded during and after operations on the tongue was hemorrhage, primary and secondary. Since the galvanic éraseur has been discarded, secondary hemorrhage is much less frequent, and both primary and secondary hemorrhage is avoided by preliminary ligature of the linguals. This procedure is a very simple one when the

tongue is removed by one of the submental operations, as *Billroth's*, *Kocher's*, etc. Even should the linguals not be previously ligatured, there is usually little danger from hemorrhage, owing to the facility with which a bleeding vessel can be seized by the modern artery forceps.

The greatest danger connected with excision of the tongue is without doubt septic pneumonia, or other lung affection, produced by direct infection from the fetid discharges of the decomposing wound. In some cases there is gangrene of a portion of the lung, or numbers of small, foul, circumscribed abscesses; in others a condition of bronchopneumonia. Whatever affections of the lung ensue after excision of the tongue or severe operations on the mouth and jaws, they are all due, either to the inhalation of fetid gases from the sloughing wound in the mouth, or to discharges from the same source passing down the trachea to the bronchi and lungs. In other words, the lung affection is produced by direct infection from a foul wound. *Barker*⁴⁰ has collected 52 cases of death following operation; of these 30 were fatal from some pulmonary affection; 12 from septic affections, in 6 of which no mention is made of the condition of the lungs; and in the remaining 10, death was due to various causes, as shock, collapse, asphyxia, exhaustion, etc. The passage of blood into the trachea during operation is another cause of lung affection, and, to avoid this, anaesthesia should not be too profound. Usually symptoms of pneumonia and bronchopneumonia appear soon after the operation. The case may go on favorably for two or three days, then there is a troublesome collection of rosy mucus in the mouth and the wound becomes very fetid, cough is complained of, the temperature and pulse run up, respirations are very rapid, and the patient becomes cyanosed and dies in a few days with symptoms of pneumonia. The breath during all this period has been horribly fetid. The autopsy discloses acute congestion of the trachea and bronchi, and in the lungs are numerous small foul-smelling abscesses with, in places, patches of gangrene. Cases occur also in which the patient dies of simple pneumonia threatening to become gangrenous.

Treatment after Excision.—The most important point in the after-treatment is to preserve a condition of aseptis in the wound, for, as has been shown above, the greatest danger is due to direct septic infection from the wound itself. Again, the swallowing of blood at the time of operation, tainted with the foul discharges of the cancerous ulcer, should be carefully guarded against by having the mouth thoroughly and frequently washed out with some antiseptic solution, as Condy's fluid, carbolic acid, etc., before operation, and, during operation, avoiding a condition of too profound anaesthesia. After operation the wound in the mouth should be packed with sticky iodoform gauze as recommended by *Billroth*, painted over with alcoholic solution of iodoform and resin, or at least dusted with iodoform crystals. *Billroth*, as already mentioned, had seventeen cases of excision without a death or even a serious symptom, owing to the mouth being kept thoroughly aseptic by the packing with sticky iodoform gauze, which in a day or two becomes incorporated with the wound. The writer has found great difficulty in keeping the gauze in the mouth after the first day; he has found that it becomes loose and covered with mucus, and that the patient finds it very troublesome. He has used with good results the following paint, advocated by *Weir*, of New York, to impregnate gauze: Iodoform, 5 parts; resin, 10 parts; castor oil, 6 parts; and alcohol, 15 parts. When painted on, the alcohol evaporates and leaves the resin and iodoform behind coating the surface of the wounds. This should be painted on twice daily. The first three or four days after operation the patient should be fed entirely by the rectum, and occasionally allowed to rinse out his mouth with water to allay thirst. After this, feeding should be by the mouth through a tube introduced into the oesophagus. A very good arrangement is a soft catheter with a piece of rubber tubing attached to it, and to this again is attached a glass funnel; by pouring liquid food into the funnel the patient can be easily and

comfortably fed. Should any fætor appear in the wound, the mouth should be frequently washed out with a solution of Condy's fluid, carbolic acid, or chlorate of potash. Washing out is much facilitated if there is a drainage tube through the incision in the submaxillary region.

Palliative Treatment of Cancer of the Tongue.—The object is to relieve pain and lessen fætor and salivation. To relieve pain, division of the lingual nerve is advised, and also the administration of opium. Fætor and salivation may be controlled by frequent washings with some antiseptic solution, as Condy's fluid or carbolic acid, and afterward the dusting on of iodoform or salicylic acid. Bleeding, which so frequently terminates the case, may be controlled by styptics, or by lint soaked in tincture of the muriate of iron and kept continually pressed against the bleeding points with forceps. Should the bleeding be distinctly arterial, then ligature of the lingual artery of that side is the only remedy.

Excision or Stretching of the Lingual Nerve.—Division of the lingual nerve was first put in practice by *Hilton*⁴¹; then *Moore*⁴² advised a more simple procedure than *Hilton's*. This was to make an incision with a curved bistoury through the mucous membrane in a line from the last molar tooth to the angle of the jaw. The simplest method is as follows, and this method is suitable for division, excision, or stretching. The writer has practised it and found no difficulty in reaching the nerve. The mouth should be opened with a suitable gag, then a ligature is to be passed through the tongue near the tip, and the tongue drawn out to the side opposite to that on which it is desired to stretch the nerve; this puts the nerve on the stretch and it can be felt standing out as a cord at the side of the tongue; a sharp hook is passed under it, and then the nerve is exposed by a small incision, pulled out by a blunt hook, and excised or stretched as the necessities of the case may indicate. *Mr. Clement Lucas*⁴³ was the first, as far as the writer's knowledge goes, to put this plan in practice.

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⁵ Legouest: Traité de chir. de l'armée, 1872.
⁶ Diseases of the Tongue.
⁷ Lancet, August 26th, 1857, quoted by *Fairlie Clark*.
⁸ Histoire de l'Acad. Roy. des Sciences, 1742, p. 247 of Memoirs, quoted by *Barker* in *Holmes' System of Surgery*, vol. ii., 1883.
⁹ Chalk: Transactions of Pathological Society of London, vol. viii., p. 305.
¹⁰ Fehleisen: Berlin. klin. Woch., No. 50, 1887.
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¹² Pitha and *Billroth*, Band 6, 1866-73.
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¹⁶ Transactions of the Pathological Society, vol. xii., p. 234.
¹⁷ Ibid., vols. xv. and xviii.
¹⁸ Loc. cit., p. 213.
¹⁹ Loc. cit., p. 247.
²⁰ Loc. cit., p. 250.
²¹ Loc. cit., p. 95.
²² Loc. cit., p. 107.
²³ Loc. cit.
²⁴ Loc. cit., p. 590.
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²⁶ Loc. cit.
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²⁸ Practice of Surgery, fourth edition, vol. i., p. 603.
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³⁸ Loc. cit.
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⁴⁰ Med. Chir. Trans., vol. xiv., 1862.
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TONICS.—Tonics are medicines that promote nutrition and thus increase the strength of the body when it is reduced. The term tonic is derived from the Greek word *tonos*, tension, and was applied to agents that restore the normal strength, because it was supposed that they specially increase the tone or tension of the contractile tissues, that is, restore the constant, active, but weak,

involuntary contraction normally existing in all organs containing such tissues. They were held to act either directly upon the contractile tissues, or upon the nerves by which they are innervated. This view is no longer entertained, as it is evident that the tone or strength of all organs and tissues depends upon the state of their nutrition, any diminution of which becoming manifest in more or less weakness and loss of functional power.

For practical purposes all tonic medicines may be divided into three classes: *gastric tonics*, *blood tonics* or *hamatinics*, and *general tonics*. Gastric tonics improve the digestive process when it is enfeebled, thus enriching the blood, and supplying all the organs and tissues with an abundance of nutritive material. Blood tonics, or hamatinics, supply the blood with material in which it is deficient, especially increasing the number of red blood corpuscles. General tonics increase the nutrition and weight of the body by augmenting or otherwise modifying the process of assimilation in the tissues.

GASTRIC TONICS.—Some of the medicines that improve the process of digestion when it is weak or imperfect, act directly upon the organs of digestion, enabling them to perform their function more powerfully; others, however, have no direct influence upon the stomach and intestines, and act only upon the substances undergoing digestion, hastening this process. The latter are distinguished from the former by the term *digestives*.

Nearly all gastric tonics have an intensely bitter taste, and act similarly upon the digestive organs. Hence they are called *bitter tonics*. Since they closely resemble one another in action, it is unnecessary to consider them separately, with the exception of the principal alkaloids of cinchona and nux vomica, which are supposed to promote nutrition by acting also upon other organs.

BITTER TONICS.—All bitter tonics increase the secretion of saliva, and, soon after coming into contact with the gastric mucous membrane, produce a feeling of hunger. In consequence of the stronger appetite a larger quantity of food is eaten. In cases of atonic dyspepsia the digestion of the large meal is not attended by the feeling of heaviness and discomfort, and other symptoms which usually result from slow and imperfect digestion, showing that the bitter tonics cause some decided improvement in the digestive process. This improvement, however, follows only when the bitter tonics are given in moderate doses; excessive doses, especially if frequently repeated, soon causing symptoms of gastro-intestinal catarrh, nausea, vomiting, and diarrhoea.

In regard to the mode of action of bitter tonics the following facts have been ascertained:

1. They increase the salivary secretion. The saliva hastens the digestion of amylaceous food and stimulates the gastric glands, and thus excites an abundant secretion of gastric juice. It has been held that this sufficiently accounts for their utility in cases of atonic dyspepsia (*Leube*).

2. They gently irritate the gastric mucous membrane, and thus, it is supposed, excite the feeling of hunger. As the larger quantity of food consumed is digested more easily and speedily in cases of dyspepsia, it may be assumed that the secretion of gastric juice becomes augmented, either directly by the moderate irritation, or indirectly by the greater relish of the food. It is supposed that in many cases of dyspepsia due to slight catarrh of the stomach, the moderate irritation gradually restores the normal circulation of the gastric mucous membrane.

3. In experiments it has been found that bitter tonics retard fermentation and putrefaction. The small doses usually effectual in atonic dyspepsia may doubtless exert some antiseptic influence, but it is improbable that their utility is chiefly due to this action.

4. *Cetrarin* and *calumbin*, injected into the jugular vein of animals, cause a rise of the general blood pressure by exciting the vaso-motor centre (*Koehler*). Hence it has been supposed that possibly all bitter tonics may to some extent act like *digitalis*, which, in indigestion dependent upon enfeebled heart action, improves the

digestive process by causing the supply of arterial blood to the stomach to be increased. But no changes of the blood pressure have been observed after the administration of bitter tonics until a notable improvement of the general nutrition of the body has resulted. It seems probable, however, that the action of quinine and strychnine upon the digestive organs is in part due to an improvement of the general circulation.

The bitter tonics display their therapeutic power most markedly in atonic dyspepsia, that is, in cases of dyspepsia in which the slow and imperfect digestion results solely from weakness of the stomach. In such cases the appetite is feeble, and the tongue clean or only thinly coated, and generally pale and flabby. Unless only very digestible food be eaten, in moderate quantities, the meals are soon followed by a feeling of weight in the epigastrium, and often by fulness and eructations which sometimes have a rancid taste. But decided pain in the region of the stomach, and thirst, fever, and vomiting are absent.

The bitter tonics are also employed in dyspepsia due to chronic catarrh of the stomach; generally small doses, in slight or mild cases, soon cause a notable abatement of the symptoms; but they generally aggravate severe catarrh, and are decidedly injurious in ulcerative affections of the stomach. They should therefore not be used when there are present severe pain and tenderness of the epigastrium, a heavily coated tongue, and vomiting of blood or large quantities of mucus.

As the bitter tonics improve general nutrition and strength solely by their action upon the digestive organs, they are useless in all forms of general or local debility which are not attended by enfeebled or disordered digestion.

As a rule, the bitter tonics should be given a short time before meals, so that a keen appetite may set in as soon as food is taken. Of the official preparations, the tinctures are the most useful in atonic dyspepsia; generally the compound tincture of gentian, the compound tincture of cinchona, the tincture of quassia, and the tincture of calumba are sufficiently active in doses of one-half to one drachm. The tincture of nux vomica is effective in doses of five to ten drops, and even smaller quantities sometimes in slight catarrh of the stomach.

If no other morbid state is present requiring active remedies, the bitter tinctures may be prescribed undiluted, the patient being told to take each dose in a small quantity of water or sweetened water. Sometimes they are ordered with a small quantity of syrup or with an aromatic water to modify their taste. The following formulæ illustrate the usual modes of prescribing in atonic dyspepsia: \mathcal{R} Tinct. cinchon. comp., \mathfrak{z} iss.; syrapi, \mathfrak{z} ss. M. Sig.: A teaspoonful in water before meals. \mathcal{R} Tinct. gentian. comp., \mathfrak{z} iss.; syrup. aurantii, \mathfrak{z} ss. M. Sig.: A teaspoonful in water before meals. \mathcal{R} Tinct. quassia, \mathfrak{z} iss.; syrup. zingiberis, \mathfrak{z} ss. M. Sig.: A teaspoonful before each meal. \mathcal{R} Tr. nucis vom., \mathfrak{z} i.; aq. menth. pip., aq. destill., \mathfrak{aa} \mathfrak{z} i. M. Sig.: A teaspoonful before each meal.

Quinine.—In dyspepsia due to weakness of the stomach the salts of quinine seem to act in the same manner as other bitter tonics. But they are more efficient than the latter when dyspepsia is associated with malarial affections, or is consequent upon pulmonary and cardiac diseases. Probably this is due to the fact that, given in moderate tonic doses, they somewhat increase the general blood pressure.

The opinion is prevalent that quinine may sustain the strength of the body under circumstances contraindicating bitter gastric tonics, such as prolonged fevers with a high temperature. Very commonly doses of two or three grains are given three or four times daily, or even more frequently, in typhoid fever, pneumonia, pleuritis, and other similar diseases. Whether this use of quinine is ever beneficial is very doubtful, and there is reason to suppose that in typhoid fever, especially if the quinine be not given in acid solution, it may increase the tendency to hemorrhage and perforation.

As gastric tonics the salts of quinine should be given in small doses, one-half to one grain, or at most two grains, preferably in solution. \mathcal{R} Quin. sulph., gr. xvi.; acid. hydrochl. dil., q.s.; tinct. cinchon. comp., syrup. aurantii, \mathfrak{aa} \mathfrak{z} i. M. Sig.: A teaspoonful before each meal. \mathcal{R} Quininae hydrochl., gr. xvi.; glycerini, \mathfrak{z} ss.; aq. menth. pip., \mathfrak{z} iss. M. Sig.: A teaspoonful before meals.

Strychnine.—The salts of strychnine are frequently employed as gastric tonics, and are very efficient. They are preferred to all other bitter medicines when feeble digestion is associated with diseases of the respiratory organs impairing the breathing process, such as phthisis, chronic bronchitis, and emphysema. Doses of one-thirtieth grain often notably ameliorate both dyspnea and dyspepsia. In those diseases of the heart which are productive of disorder of the general circulation, and of slow and feeble digestion, strychnine also should be preferred to those bitter tonics which act solely on the digestive organs. In cases of dyspepsia complicated with habitual constipation, small doses of strychnine sometimes restore normal intestinal peristalsis. As a gastric tonic it should be given in solution or in powder. \mathcal{R} Strychn. sulph., gr. ss.; acid. hydrochl. dil., \mathfrak{z} ss.; tinct. gentian. comp., syr. aurantii, \mathfrak{aa} \mathfrak{z} i. M. Sig.: A teaspoonful before meals. \mathcal{R} Strychn. sulph., gr. ss.; sacch. lactis, \mathfrak{z} i. M. Div. in partes æquales xvi. Sig.: One powder before each meal.

Alcohol.—As a tonic no substance is more beneficial when properly used, or more detrimental when abused, than alcohol. Taken in small quantities well diluted, as contained in some alcoholic beverages, especially light wines and malt liquors, it is doubtless the most pleasant and active remedy in cases of atonic dyspepsia. It was observed from time immemorial that wine, taken very moderately with meals, enables a weak stomach to digest food more easily and speedily, and increases the general vigor of the body. Hence the advice of St. Paul to Timothy: "Drink no longer water, but use a little wine for thy stomach's sake, and often infirmities."

In experiments it has been found that alcohol, applied in small quantity to the gastric mucous membrane, causes a more copious secretion of gastric juice than any other substance. Doubtless it is this action, a decided increase of the secretion of gastric juice when wine is taken with full meals, which augments the appetite and enables the stomach easily to dispose of the larger quantity of food. Taken in excessive quantity alcohol retards digestion and causes gastric catarrh. This effect always results if large quantities are rapidly imbibed so as to produce decided intoxication. It is frequently observed also in individuals who habitually drink to excess, especially in those who take ardent spirits before meals. Some persons, however, who indulge excessively in beer or light wine, do not exhibit any symptoms of gastric disorder.

In cases of atonic dyspepsia only light wine or malt liquor should be recommended for prolonged use, as the danger of excessive indulgence and hence injury to the stomach is much greater from ardent spirits. If it become necessary to use whiskey or other strong alcoholic, the patient should be warned against taking it undiluted before meals.

Alcohol is superior to other gastric tonics not only because it is more agreeable, but because it exerts a more favorable influence on general nutrition. It is now well established that alcohol is nearly completely consumed in the body, and that in undergoing oxidation it yields heat and other force, and thus behaves in the same manner as other non-nitrogenous food. Robust persons with strong digestive organs, who easily dispose of sufficient food to maintain perfect nutrition, do not require alcohol as a nutrient; but those who naturally have a weak stomach and "often infirmities," are decidedly benefited by moderate quantities.

Alcohol displays its greatest utility in diseases so profoundly disordering the digestive organs that little or no ordinary food can be digested. In typhoid fever it is often the means of saving life. As it requires no diges-

tion and is quickly absorbed, it may be given when no gastric juice is secreted. In chronic wasting diseases in which the digestive process gradually becomes more and more enfeebled, alcohol is capable of maintaining for a long time a fair state of the general nutrition.

The quantity of alcohol to be taken for therapeutic purposes varies with the nature of the disease. In atonic dyspepsia a few ounces of wine with the principal meal often suffice. Many persons having a weak stomach prefer to take a small quantity of wine with a little bread or other light food between the ordinary meals. Thus they eat more frequently, but never overload the stomach.

In febrile diseases, when little or no ordinary food can be digested, alcohol should be administered, like other medicines, at regular intervals. The quantity to be given will depend chiefly upon the temperature and general condition of the patient. If the temperature is very high and ordinary food cannot be digested, more will be required than when the temperature is less elevated and the digestive power is somewhat better preserved. So, too, more is usually required when the patient is very weak than when he is in a fair state of strength. Whiskey or other form of spirits should always be diluted before administration.

In all cases in which patients seem to require the prolonged use of alcohol in any form, and its recommendation is deemed advisable, they should be informed that its excessive use will surely produce serious pathological changes, and that "1 gm. of absolute alcohol per kilogram (two pounds) of body weight is the average limit per diem that cannot safely be exceeded." (See article on *Alcohol*.)

Digestives.—Digestives are medicines that act directly upon the food in the digestive organs, causing it to digest more rapidly and perfectly. They are used when the stomach is unable to secrete a sufficient quantity of gastric juice, or when the juice secreted has an abnormal composition. The digestive power of the gastric juice depends upon the presence of hydrochloric acid and pepsin. If either one of these be deficient, digestion may become tardy and imperfect, and the symptoms of dyspepsia supervene. Recently cases have been reported in which digestion seemed perfect, although no trace of free hydrochloric acid could be detected in the gastric contents. In other cases prolonged superacidity was found without any notable gastric disorder.

Hydrochloric acid is sometimes secreted in insufficient quantity in cases of atonic dyspepsia. Usually the bitter tonics, especially the preparations containing alcohol, excite a more abundant secretion, and hence suffice to allay the symptoms of defective digestion. But sometimes the symptoms persist notwithstanding their proper and continued use. When this is the case, recourse should be had to hydrochloric acid, which is generally followed by rapid improvement.

It is best, as a rule, to administer the acid soon after meals, and, if necessary, to repeat the dose once or twice at intervals of two hours.

Some writers hold that in cases of dyspepsia in which acid eructations frequently occur, the acid should be given before meals, as by its astringent action upon the gastric mucous membrane it will tend to diminish the excessive secretion of acid. The presence of an excess of acid in the stomach during the digestive process is usually due to fermentation which gives rise to abnormal acids; generally the administration of hydrochloric acid after meals prevents such fermentation. Should, however, this method of administration fail to give relief, the acid may be given before meals, as, of course, it is not impossible that an excess of it may be secreted.

The dose of the official dilute hydrochloric acid may vary from ten to thirty drops. It should be diluted with several ounces of water, and may be given in mixture with a bitter tincture and a small quantity of syrup. \mathcal{R} Acid. hydrochlor. dil., \mathfrak{z} ij.; tinct. gentian. comp., syrapi, aurant., \mathfrak{aa} \mathfrak{z} i.; aq. destill., q.s. ad \mathfrak{z} vi. M. Sig.: A tablespoonful after meals.

Pepsin, like hydrochloric acid, is essential for normal di-

gestion. But, inasmuch as it is a ferment, a small amount may suffice to digest very large quantities of albumen if there be constantly present a sufficient quantity of acid. As a digestive it is indicated when the stomach is unable to secrete a sufficient amount; but it is impossible to state when this is the case. The contents of the stomach of dyspeptic patients, removed at various intervals after meals, were rarely found to digest fibrin more rapidly after the addition of pepsin, while this almost invariably took place after the addition of hydrochloric acid (Leube). So, also, the contents of the stomach of typhoid-fever patients, while constantly found destitute of hydrochloric acid, always seemed to contain a sufficient amount of pepsin (Gluzinski). Hence, in cases of dyspepsia, if hydrochloric acid, properly given, have failed to improve digestion, pepsin may be used together with the acid. The dose of pepsin is about ten grains, and is administered soon after meals. The official solution of pepsin, containing some hydrochloric acid, is given in doses of half an ounce.

Extract of malt, when properly prepared, contains a small quantity of diastase, and hence may promote the digestion of amylaceous food. For this purpose it may be taken with the meals, in quantities of one to four drachms, either alone or mixed with milk, bouillon, or wine. It has been recommended as a nutrient in wasting diseases, but should not be employed unless it is not possible to administer more useful substances.

Pancreatin has been recommended in cases of imperfect intestinal digestion. It is doubtful whether it can pass through the stomach without losing its activity. In some cases of dyspepsia it has been found to give relief when administered together with a little soda about two hours after meals.

Papain, a ferment obtained from the juice of *carica papaya*, digests fibrin and albumen more readily than pepsin does, and has therefore been recommended in dyspepsia in doses of five to ten grains.

HÆMATINICS.—This term is applied to medicines that increase the coloring matter of the blood, the hæmoglobin. The most important of these are the preparations of iron or the

Chalybeates.—Iron is an efficient remedy in most forms of anæmia. Usually the symptoms due to the defective state of the blood gradually vanish when it is properly administered for some weeks; the integuments lose their waxy pallor and resume a healthy glow; the pulse again becomes full and forcible; the vertigo and headache cease; and the languor and depression give way to the normal strength and vigor. This remarkable action was observed long before it was known that iron is a component of the hæmoglobin of the red blood corpuscles. Since it has been ascertained that a diminution of the coloring matter of the blood indicates a deficiency of iron, it has been held that chalybeates cure anæmia by supplying material necessary for the rapid regeneration of the red blood corpuscles.

It is generally supposed that the preparations of iron produce little or no effect in healthy persons, if given in such forms as not to cause serious gastric disorder. But careful observations recently made (see *Therapeutische Monatshefte*, Bd. ii., p. 11, 1888) show that even minute doses of chloride of iron, repeated day after day for several weeks, may induce notable disorder of the stomach, accelerate the heart's action, and cause severe attacks of dyspnea, a feeling of general heat, occasional flushing of the face, itching of the skin, acneiform eruptions, and slight conjunctivitis.

In anæmia, if the cause of the defective state of the blood be irremediable, iron fails to produce any marked or permanent increase of the red blood corpuscles. Hence its use in chronic wasting diseases and in organic affections is generally futile. Its utility is most strikingly manifested in chlorosis; often a steady increase of the hæmoglobin from day to day is observed, and in a few weeks the blood again contains the normal number of red blood corpuscles. It is also very efficient, though usually less essential, in the anæmia remaining after severe

acute diseases and after hemorrhages; but is almost powerless in pernicious or idiopathic anæmia.

In all cases of anæmia it is essential for success in the use of iron that all the circumstances influencing nutrition be favorable; that the patient have a plain nutritious diet, that he take a sufficient amount of bodily exercise, that he spend a considerable part of each day in the open air, and that he be regular in all his habits.

Iron is contraindicated as a hæmatinic when the temperature is abnormally elevated, when there is present an organic disease of the stomach, or any affection of the lungs attended with congestion of the pulmonary circulation.

The official preparations of iron are excessively numerous, and young practitioners are often in doubt as to the most efficient ones. When the object is simply to hasten the regeneration of the red blood corpuscles, it is immaterial which preparations are selected, as all, if given in such doses and forms as not to disorder the digestive organs, act equally well.

The dose should be small, even of those preparations which have little local action. The quantity of iron contained in the food daily consumed by a vigorous person is about one grain; it is doubtful whether a much larger quantity can be assimilated when iron is given as a medicine. It may be observed, even when small doses are given, that the greater part is not absorbed and is voided with the feces.

The preparations most frequently used are reduced iron, saccharated carbonate, mass of carbonate, citrate, pyrophosphate, iodide, and tincture of the chloride.

Reduced iron is given in doses of one to two grains, generally in pill or powder. \mathcal{R} Ferri reducti, 5.0 (gr. lxxv.); pulv. rad. althææ, 4.0 (3 i.); gelatin., q. s. ut ft. pil. No. 90. Sig.: At first one and gradually two or three pills three times daily. If properly prepared these pills are soft, and hence well borne by the stomach (Leube). \mathcal{R} Ferri reducti, gr. xij.; sacch. albi, 3 i.; ol. menth. pip., gtt. ij. M. Div. in part. æqual. xij. Sig.: One powder after each meal.

Saccharated carbonate of iron is given in doses of from five to ten grains. In cases of atonic dyspepsia with anæmia, it may be given together with quinine as follows: \mathcal{R} Ferri carb. sacch., 3 i.; quin. sulph. gr. xij. M. Div. in part. æq. No. xij. Sig.: One powder after each meal. It may also be administered in the form of an effervescent draught as follows: \mathcal{R} Ferri carb. sacch., sodii bicarb., aa \mathcal{D} iv. M. Div. in part. æqual. viij. Sig.: No. 1. \mathcal{R} Acid. tartarici, \mathcal{D} ij.; sacch. albi, \mathcal{D} ij.; ol. limonis, gtt. ij. M. Sig. No. 2. Dissolve one powder of No. 1 in some water, add one powder of No. 2, and drink while effervescing.

Mass of carbonate of iron is given in pill. It is frequently ordered together with quinine as follows: \mathcal{R} Quin. sulph., gr. x.; mass. ferri carb., \mathcal{D} ij. M. Ft. pil. No. xx. Sig.: One or two pills after meals.

Citrate of iron is usually ordered in solution, and sometimes in powders and pills. The bitter wine of iron is an excellent preparation in atonic dyspepsia and anæmia, given in doses of one or two teaspoonfuls after meals. Pyrophosphate of iron is given like the citrate, in doses of five to ten grains after meals, usually in solution.

The syrup of the phosphates of iron, quinine, and strychnine is frequently employed in atonic dyspepsia and anæmia, in doses of one or two teaspoonfuls.

The tincture of chloride of iron contains about five per cent. of metallic iron. It is given in cases requiring an astringent preparation, in doses of ten to thirty drops, largely diluted. Glycerin modifies its taste very markedly. \mathcal{R} Tinct. ferri chlor., 3 ij.; glycerini, 3 xiv. M. Sig.: A teaspoonful in a wineglassful of water after meals.

GENERAL TONICS.—Some general tonics act chiefly as nutrients, gradually increasing the weight of the body, and invigorating all the organs by supplying needed material; others seem to exert a stimulating or modifying action upon the tissues, in consequence of which

they assimilate the nutritive material of the blood more rapidly.

Cod-liver Oil.—In chronic wasting diseases and in various kinds of malnutrition, cod-liver oil displays remarkable power. Usually it improves the appetite, invigorates the digestive organs, augments the number of red blood corpuscles, and increases the body weight.

Besides the ordinary constituents of oil, it contains free fatty acids, the quantity varying with the kind of oil. According to a recent analysis, the quantity of free oleic acid in the pale variety of oil varies from 0.18 to 0.71 per cent., and in the dark variety from 2.54 to 5.07 per cent. Cod-liver oil contains also traces of iodine, bromine, chlorine, phosphorus, sulphur, ammonia, and trimethylamin, and the dark variety, biliary matter.

The superior digestibility of cod-liver oil has recently been satisfactorily explained (Buchheim, 1874). It had long been observed that this oil diffuses itself through animal membranes more rapidly than do other oils. As the presence of bile greatly increases the diffusibility of other oils, and the early analyses of cod-liver oil had shown the presence of bile in it, the remarkable digestibility of the oil was attributed to the biliary matter. But Buchheim showed that the pale oil contains no bile, and that its digestibility is solely due to the free fatty acids. The modifying influence of the fatty acids can be readily observed by placing a small amount of dilute solution of soda (3 to 1,000) in a test tube and adding a few drops of cod-liver oil. In a very short time the mixture becomes milky, the union between the soda and the fatty acids completely emulsifying the oil.

It is well known that all fats and oils, before they can be absorbed, must undergo a similar process in the small intestine. This is accomplished chiefly through the influence of the pancreatic juice, which contains a peculiar ferment having the power to decompose fats into glycerin and free fatty acids. The free fatty acids, coming into contact with the alkali present in the intestinal juices are quickly saponified and thus enabled to emulsify any undecomposed fat.

Cod-liver oil, containing free fatty acids, becomes emulsified more readily than other fats in the alkaline intestinal juice; hence many persons, who are soon disordered by other fats, perhaps from defective secretion of pancreatic juice, readily digest cod-liver oil.

Perhaps the utility of cod-liver oil is not fully explained by its great digestibility; it may after absorption differ in action from other fats. It is said to have been observed in horses that the fat laid on from corn is tolerably permanent, while that produced by feeding on grass is soft and quickly disappears when the animal is put to work (Brunton). Possibly cod-liver oil is so useful in some wasting diseases by promoting the growth of cells more rapidly than do other fats and oils. It certainly, in many cases of anæmia, rivals iron in the rapidity with which it causes an increase in the number of red blood corpuscles.

Cod-liver oil is indicated in all chronic diseases attended by anæmia and emaciation. It has been found, by the most careful observers, to be the best means of sustaining and increasing nutrition in chronic pulmonary affections, especially phthisis and chronic bronchitis. Often, soon after its use is begun, the symptoms of phthisis greatly abate, and in some cases, when little pulmonary tissue is invaded and injured, a complete cure results. It is also successfully employed in debility of the nervous system resulting from prolonged overwork, and in hysteria and neuralgia. Usually it is strikingly beneficial in diseases of the bones, rickets, chronic rheumatism, and tertiary syphilis; in malnutrition of the heart with defective general circulation, and in scrofulous affections of the glands, mucous membranes, skin, and bones.

The dose of the oil should at first be small, about a teaspoonful. As soon as the stomach has become accustomed to it, and eructations having the taste of the oil have ceased, the quantity should be rapidly increased to one or two tablespoonfuls three times daily. Children rarely require more than a dessertspoonful. As the

alkaline intestinal juices are most abundantly secreted after meals, the oil should be taken a little while after eating. As a rule, the various means used to disguise its taste, except perhaps alcoholics, soon become repulsive. Children, and many adults, soon become accustomed to its taste, and often take it with a relish.

Liparin.—This term has recently been applied by J. von Mering, of Strasburg (see *Therapeutische Monatshefte*, Bd. ii., p. 49), to a substitute for cod-liver oil, consisting of pure olive oil and six per cent. of oleic acid. Like cod-liver oil, it speedily emulsifies in weak solutions of soda. It has an agreeable taste, and hence is readily taken even by fastidious patients. In numerous cases it was found to agree well with the stomach, even during the summer months, and in no instance did it cause nausea, vomiting, or diarrhoea. Given to adults in doses of from two to six tablespoonfuls daily, it notably increased the general strength and the body weight. J. von Mering concluded, after observing its action in numerous patients, that it is well adapted to all affections in which cod-liver oil is successfully used, and especially to cases in which a deficiency of pancreatic juice and bile in the small intestine renders the absorption of ordinary fats difficult or impossible.

Probably other oils, to which oleic acid has been added, such as cotton-seed oil, will be found to be equally digestible and useful.

Arsenic.—Arsenious acid and Fowler's solution, given in minute doses in cases of impaired general nutrition, slowly increase the body weight and the power of all the functions. Under their prolonged use, diseases due to malnutrition, especially those of the skin, nervous system, lungs, and stomach, generally improve, and sometimes completely subside.

Even in the healthy state of the body, arsenic may increase nutrition. Thus Kopp, who had been experimenting with arsenic and could not entirely prevent its access to his organism, in two months gained twenty pounds in weight. It is now well established that in Styria some peasants have the habit of consuming arsenic at regular intervals for the purpose of increasing their powers of endurance. In numerous careful experiments upon animals, Gies (*Arch. f. exper. Path. u. Pharm.*, Bd. viii., p. 175) found that arsenious acid greatly promoted nutrition and decidedly increased the weight of the animals, and especially hastened the growth of osseous tissue.

In doses but little larger than those which promote nutrition, arsenic may cause incipient symptoms of poisoning—thirst, nausea, pain in the epigastrium, headache, sleeplessness, fever, conjunctivitis, and œdema of the eyelids. Usually these symptoms quickly subside when the use of arsenic is discontinued.

Arsenic is employed in numerous diseases due to malnutrition—the early stage of phthisis, chronic diseases of the skin, irritability of the stomach from catarrh, ulcer, or cancer, chorea, and in various forms of neuralgia. In malarial affections it is often used successfully, even when quinine fails, especially in the anomalous forms known as masked ague. According to late reports, it has proved more useful in idiopathic or pernicious anæmia than iron, cod-liver oil, and other remedies which augment the number of red blood corpuscles.

As a rule, the dose of arsenious acid should at first be minute; if necessary it may be gradually increased until the pathological condition for which it is given has improved, or until the incipient symptoms of its poisonous action become manifest. As soon as any of these take place, especially gastric irritation or conjunctivitis, the dose should be diminished or discontinued. In some cases, especially diseases of the skin, small doses should be given for some time after the symptoms of disease have disappeared, in order to prevent their recurrence. The minute dose of one-fiftieth grain of arsenious acid, or two drops of Fowler's solution, given after each meal, will usually produce a notable effect upon the general nutrition in one or two months. Prudence requires that Fowler's solution be ordered in a dilute form. \mathcal{R} Liq. potassii arsen., ʒ ss.; aq. menth. pip., aq. destil., aa ʒ i.

M. Sig.: A teaspoonful after meals. \mathcal{R} Liq. potassii arsen., ʒ ss.; tinct. gentian. comp., ʒ iss.; syr. aurant., ʒ ss. M. Sig.: A teaspoonful after meals.

Phosphorus.—In minute doses phosphorus markedly promotes the growth of osseous tissue. In larger doses it augments the interstitial tissue of the stomach and liver, and induces chronic inflammation of these organs with atrophy of the secreting cells. Poisonous doses rapidly cause fatty degeneration of the stomach, pancreas, liver, kidneys, heart, muscles, and blood-vessels. As it forms a chemical component of nervous tissue, it has been supposed to be specially useful as a nutrient for the nervous system; but nothing indicating such action has been observed after the prolonged administration of minute doses, except that functional nervous diseases sometimes improve during its use.

Phosphorus is indicated in diseases of the bones requiring a more rapid or perfect growth of osseous tissue, such as osteomalacia, rickets, and insufficient ossification after fractures. It has been recommended also in various diseases of the nervous system, and seems sometimes to have been successful in those of a functional nature, such as neuralgia, nervous debility, incipient dementia, and impotence. It has been used with alleged success in obstinate skin diseases, and in leucocythæmia.

The dose of phosphorus ranges from gr. $\frac{1}{100}$ to gr. $\frac{1}{12}$. In rickets a daily dose of gr. $\frac{1}{100}$ was found sufficient. In neuralgia and other functional diseases of the nervous system, some practitioners have succeeded with doses of gr. $\frac{1}{100}$ to gr. $\frac{1}{60}$ given thrice daily. As much as gr. $\frac{1}{12}$ every four hours for twenty-four hours has been given in severe neuralgia.

The official *phosphorated oil*, containing one per cent. of phosphorus, and the *pills of phosphorus*, each containing gr. $\frac{1}{100}$, are convenient forms for administration. \mathcal{R} Olei phosphorati, ʒ xvi.—xxxvi.; mist. amygdalæ, ʒ ij.; ol. gaultheriæ, gtt. viij. M. Sig.: A teaspoonful one hour after meals.

Phosphate of zinc contains one-fourth its weight of phosphorus and is given in pill, in doses of gr. $\frac{1}{100}$ to gr. $\frac{1}{4}$.

Mercury.—Until recently it was supposed that mercury in minute as well as in large doses, given for some time, always exerts a deleterious influence on the general nutrition. In 1869 Liégeois reported that he had observed that subcutaneous injections of minute doses of corrosive sublimate had increased the body weight of healthy men. Bennet (1874) found that small doses increased the weight of dogs. Keyes (1876) carefully investigated the effect of small doses of mercury upon the red blood corpuscles and the general nutrition, and concluded that mercury acts as a tonic upon persons in fair health and not syphilitic, increasing the number of red blood corpuscles and the body weight. Schlesinger (1881), who made numerous careful experiments upon rabbits and dogs, fully confirmed the facts found by the above-mentioned observers.

Although no physician will be inclined to use mercury as a tonic in ordinary forms of emaciation and debility, yet it seems rational to employ it when the low state of nutrition occurs in persons who present symptoms of syphilis. According to Keyes ("Venereal Diseases," p. 119, New York, 1880), tonic doses may be continued steadily during several years without injury to the patient.

Samuel Nickles.

TONSILS, THE.—(Facial tonsils. Amygdalæ. Tonsillæ.) (Tonsils of Luschka. Lymphoid or adenoid tissue at vault of pharynx.) (Tonsils of the Tongue. Lymphoid tissue at base of tongue.)

These organs are essentially collections of lymphoid tissue, differing in location and somewhat in appearance and function, but composed largely of the same elements. They are so situated as to form an interrupted circle extending completely around the pharynx. In the normal condition their presence is hardly perceptible.

Pathologically, while each may be affected by diseases peculiar to itself, there are many conditions from which all may suffer alike, since their histological structure is

identical. It will be convenient, therefore, to study in one of them the minute anatomy and the pathological conditions common to them all, thus avoiding unnecessary repetition. The one most available for this purpose is the faucial tonsil.

I. FAUCIAL TONSILS.

GENERAL ANATOMY.—The faucial tonsils are two glandular organs situated one on each side of the fauces, and between the anterior and posterior pillars of the soft palate. They consist essentially of reduplications, more or less extensive, of the oral mucous membrane, in which are enclosed an abundant deposit of adenoid or lymphoid elements, the whole organ having an identity and a special function of its own. The gross structure of the tonsil varies. Its usual shape is ovoid, and it more or less completely fills the triangular space between the anterior and posterior pillars of the palate. Its base is generally defined clearly, and corresponds with the greatest antero-posterior diameter of the tonsil. Its average vertical diameter is 20 mm., and its transverse diameter is 13 mm. Often a collection of lymphoid tissue lies below the tonsil, and sometimes above it, large enough to look like a small additional tonsil. Sometimes it extends as a narrow but slightly elevated strip far lower down in the pharynx than the usual limit. The gland is sometimes divided by a deep sulcus running across its antero-posterior diameter, generally above the centre, and thus separating it apparently into two distinct lobes. A supernumerary tonsil, the *tonsilla accessoria*, has been described.

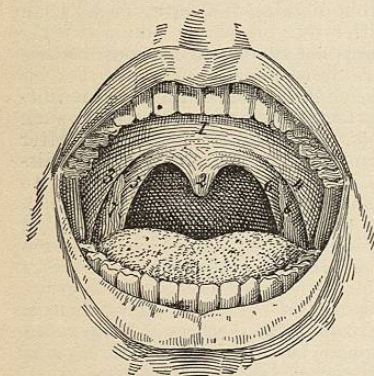


FIG. 4729.—The Tonsils. 1, Hard palate; 2, uvula; 3, 4, anterior pillars; 5, 6, posterior pillars; 7, 8, tonsils.

In early infancy it is sometimes impossible to demonstrate the presence of the tonsil, or, in fact, of the lymphoid ring, at all, while in other cases all of the elements of the latter have been found in a condition of marked hypertrophy soon after birth. Its period of greatest activity is just before puberty. It tends to atrophy with old age.

The surface of the tonsil is perforated by a varying number of depressions, slit-like or circular, the common orifices of the system of cavities which it contains. If the tonsil of the rabbit be considered as a single lingual follicular gland, we have in man a multiplication of this to the number of from eight to eighteen, the interval between any two adjacent glands forming a lacuna tonsillar, crypt, or one of the system of cavities mentioned above. Many of them are spacious in extent, and they often penetrate deeply into the substance of the gland, sometimes almost reaching to its hilum. Often there are found in the interior of the tonsil single larger cavities, each of which includes several follicular folds and secures their common discharge at the periphery. The crypts of largest size and greatest depth are, as a rule, found in the middle part of the tonsil. By reason of this arrangement of the crypts the surface of the tonsil is thrown into numerous and extensive folds, and an extraordinary increase in the superficial extent of the gland is obtained. The crypts generally are filled more or less with a yellowish substance, composed of fat molecules, loosened pavement epithelium, lymph corpuscles, small molecular granules, and cholesterol crystals. Opening into the

supratonsillar fossa, the triangular space at the top of the tonsil, are often numerous crypts, sometimes of large size. They are apt to be the exciting cause of acute or chronic inflammatory conditions of the tonsils, or of the parts in their vicinity, and they constitute an important feature of the anatomy of the part. In all examinations of the pharynx the supratonsillar fossa should be carefully studied.

In its minute anatomy the tonsil is for the most part like other so-called lymphoid glands. In common with the rest of the oral cavity it is invested with a thick covering of pavement epithelium. Proceeding from without inward, the surface epithelium is scaly, each cell having a flattened, circular nucleus. Beneath this the cells and their nuclei become less flattened. Still lower are found several layers of polyhedral cells, which have spherical nuclei and are connected together by intercellular cement substance. Among them are a certain number of prickly cells. The whole rests upon a single layer of columnar epithelial cells with oval nuclei, and is furnished abundantly with simple papillae. Under the epithelium is a delicate endotheloid basement membrane. Following this is a tolerably compact mucosa formed of interlacing bands of fibrous connective tissue and containing many connective-tissue corpuscles. In the normal adult tonsil this structure is so delicate that sometimes it is hardly recognizable. In chronic disease of the gland it may become enormously increased. From it bands of connective tissue extend centrally into the larger tonsillary folds, and the whole forms essentially both an enclosure and a framework for the adenoid tissue or proper substance of the gland, as well as a nidus for its vessels. The lymphoid tissue consists of a dense meshwork of fine, homogeneous fibrils which contains, besides occasional endotheloid connective-tissue cells, a large number of lymph corpuscles. These are small, round cells, each of which has a distinct spherical nucleus surrounded by a very thin covering of cell protoplasm. Near the cortex the lymph corpuscles are collected by means of delicate septa given off from the inner stratum of the capsule into a single row of oval masses called lymph follicles. Throughout the rest of the gland the lymph cells are diffused without any particular arrangement. Occasionally they extend so near the periphery as to penetrate the mucosa and encroach upon the epithelial layers. This is particularly the case in the interior of the crypts, where the epithelial layer is, as a rule, either wanting altogether or to be found only in occasional patches and in modified form, and where its thickness tends to decrease as the bottom of the lacuna is approached. In other words, the epithelial and subepithelial layers, thick at the periphery, become rapidly more delicate the deeper we trace them down the crypt wall, until, toward the lowest depth of the lacuna, they generally disappear. The tonsil is supplied abundantly with racemose mucous glands.

The arteries which supply the tonsil are larger and more abundant toward its lower part. They accompany the connective-tissue sheath and its septa, give off a branch to each follicle and to the papillae of the mucous membrane, and divide into a network of capillaries which unite to form one or more veins.

The relations of the tonsil with the internal carotid artery are not so intimate as is commonly supposed. Both carotids are behind it, the internal carotid a little over half an inch and the external carotid three-quarters of an inch distant from its lateral edge. The supply of blood conveyed to the tonsils is, if the size of these bodies be considered, remarkably large. They are nourished by the tonsillar and palatine branches of the facial artery, and by branches from the descending palatine, and from the ascending pharyngeal and dorsalis linguae.

The ascending pharyngeal is often anomalous, for it not only varies greatly in its place of origin from the carotid, springing occasionally from the occipital or the internal carotid, and now and then being double; but also that branch which is distributed to the pharynx is often much larger than normal when the ascending palatine branch of the facial artery is unusually small. Cases are not infrequently observed in which the pulsations of the artery, enlarged as above stated, are plainly visible upon inspection of the pharynx. The vessel seems, generally, to lie directly behind the tonsil, and to be of considerable size.

PHYSIOLOGY.—The physiological function of the tonsil has never been established. From the experiments of Goodale and others it would seem that one of its offices is the arrest and destruction of pathogenic micro-organisms, although the extent to which it is capable of this is limited, and when the limit is exceeded, the tonsil becomes a potent carrier of infection.

ACUTE INFLAMMATION.—*Tonsillitis.*—In the tonsil, as in other parts of the body, the general term inflammation includes a great variety of affections. Not only do we find in this organ the ordinary inflammatory conditions, general and specific, which may attack its various structures, but besides these there may occur special affections not commonly met with in other parts. The study, therefore, of the inflammations of the tonsil becomes a matter of unusual interest.

Acute inflammations of the tonsil are undoubtedly due to the influence of various micro-organisms. In a certain number of cases the Klebs-Loeffler bacillus is found, although the clinical signs of diphtheria may be absent. More commonly are found the streptococcus, the staphy-

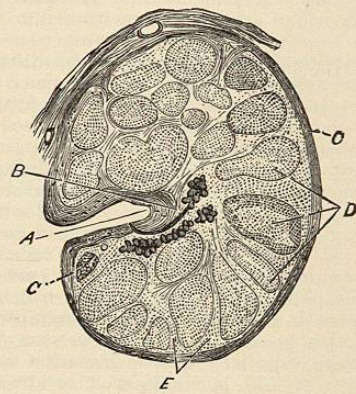


FIG. 4730.—Section of Normal Tonsil. (Morell Mackenzie.) A, Hilum; B, mucous gland; C, epithelial covering; D, lymphatic follicles; E, stroma.

lococcus, the diplococcus, the tetracoccus, and sometimes the pneumococcus. The presence of the Klebs-Loeffler bacillus does not seem necessary to render the disease infectious, and even when it is absent the risk of infection to other persons is to be considered. When paralysis follows tonsillitis, it is probable that diphtheria bacilli were present.

While acute inflammations of the gland in general possess characteristics of greater or less similarity the one to the other, the symptoms being quite uniform, it is nevertheless important to understand what symptoms are common to all cases, and what indications they offer for treatment, and also to appreciate the special conditions and needs which may exist in a given case.

Owing to the similarity in structure of the different parts of the lymphoid ring the inflammations which may affect them are practically the same. The conditions which are present in tonsillar inflammation, therefore, will well describe them all.

In general proliferative tonsillitis the follicles become enlarged through increase in the number of their lymphoid cells, particularly in the direction of the nearest crypt, and of the endothelial cells of the reticulum. According to Goodale, the proliferation of these endothelial cells gives rise to large phagocytic epithelioid cells that are characterized by a relatively large amount of markedly acidophilic cytoplasm, and an irregular, lightly staining, eccentrically situated nucleus. They contain in their interior from one to ten or fifteen cell fragments, which are generally lymphoid cells or red blood corpuscles in various stages of digestion. The lymphoid cells between the follicles are increased in number and closely packed together. The blood-vessels are dilated, filled with red and white blood corpuscles, and show more or less marked proliferation and exfoliation of their endothelial cells.

The epithelium of the crypts is diminished in bulk, from a widening of the intercellular spaces, which are crowded with escaping lymphoid and plasma cells. Bacteria, chiefly cocci, occur superficially in the epithelial lining of the crypts, but apparently they are absent in the lymphoid tissue. The crypts are filled with exfoliated epithelial cells, leucocytes, bacteria, amorphous debris, and in severe cases fibrin, which encloses cells and bacteria in a delicate network. At times the fibrin may extend from the crypts into and even beyond the epithelium, penetrating most deeply in the interfollicular region. Bacteria are most abundant near the surface of the crypt, gradually diminishing in numbers toward the base.

Suppurations below the mucous membrane may be local or diffuse. In some cases of tonsillitis abscesses form in the interior of the follicles, and finally discharge into the crypts. They have been found particularly in association with the streptococcus pyogenes. The growth of the abscess is usually in the direction of the nearest crypt. Sometimes peritonsillar inflammation is the result of the discharge of the intratonsillar abscess into the efferent lymph channels.

In diphtheria a diffuse necrosis of the epithelium may occur, or there may be a necrosis or ulceration extending into the lymphoid tissue from the crypts. Tuberculosis may affect all the parts of the ring, as may syphilis and mycosis.

Pathology.—Chronic enlargement of the tonsils is a true hypertrophy or hyperplasia, in which, according to Virchow, there is not only increase in volume of the gland, but an actual multiplication of all of its constituent parts. The epithelium covering the tonsil usually shows little change, but the papillae underneath are often more numerous and less elevated than in the normal state; while, in the crypts, there seems to be a tendency for the membrane to become thinner as the bottom of the crypt is approached.

The substance of the gland may show one of two varieties of alteration. Either the lymphoid elements alone may be increased in amount, the stroma of the gland being little affected, or the fibrous tissue which constitutes

More commonly are found the streptococcus, the staphy-