lymphangitis in which the inflammation is produced by the invasion of the lymphatic channels by the streptococcus of erysipelas. If the inflammation is extensive there may be a considerable lymphatic œdema and the circumference of a limb may be much increased. Some cellulitis accompanies all lymphangitis, and some lymphangitis, on the other hand, attends all cellulitis. Which element preponderates is very often a matter of uncertainty, but the question is not an important one, because both require the same treatment.

The tubular variety shows itself most plainly when the superficial vessels are involved. These latter appear in the skin as wavy red lines travelling toward the neighboring lymphatic glands. They are very tender to the touch, slightly raised from the surface, with a cord-like beaded feel, due to the infiltration and plastic thrombosis in and around them. Sometimes they are quite narrow; sometimes, when the poison is very active, an inch or more in breadth, from extension of the inflammation to the surrounding cellular tissues. At the same time the glands are swollen and tender, and, if the affection is extensive, the limb below may be œdematous. Here and there the red lines disappear, where the superficial lymphatics empty themselves into the deeper set, or swell out and become broader opposite plexuses and valves. In cases of virulent infection the inflammation may result in the formation of small abscesses at intervals along the course of the vessels before the glands are reached.

When the deeper vessels are affected, the diagnosis may not be easy if no superficial inflammation be present. Usually, however, faintly outlined patches of redness are visible here and there upon the skin, where the superficial plexuses communicate with the deep ones. In any case deep pressure along the course of the affected vessels is painful, but otherwise most of the usual signs are wanting. Diagnosis between it and ordinary cellulitis is difficult. In both varieties the glands are apt to be swollen and tender.

The constitutional symptoms will vary according to the extent of the local inflammation, the severity of the cause, and the general health and resisting power of the patient. Simple lymphangitis is accompanied by a varying degree of fever, with the usual results thereof—malaise, thirst, headache, anorexia, etc. When suppuration sets in, the general symptoms become much aggravated, pain is severe and prostration extreme, and high fever with possibly chills and sweating makes itself evident. In severe cases septicæmia may develop.

Prognosis.—Simple lymphangitis is rarely serious and runs its course in from a few days to several weeks; the general health and robustness of the patient have a marked influence, recovery being slow in the subjects of alcoholism, chronic gout, diabetes, and renal disease, and in those debilitated by poor living and overwork. When suppuration supervenes (leading to a cellulitis) or when some virulent septic poison is the cause of the trouble, the illness may assume a grave character, viz., that of septicæmia. If the vessels which run in groups are extensively destroyed, a condition of solid œdema is likely to persist which may leave the limb more or less crippled.

Diagnosis.—Phlebitis is closely related to lymphangitis in its symptoms, but a thrombosed vein forms a deeper-seated, coarser cord than does a similarly affected lymph vessel, the cutaneous redness is not so vivid, the pain is less acute, the general fever is not so intense, and the tendency to glandular involvement is much less. Inflammation of the deep lymphatics may at times be differentiated from ordinary cellulitis by an earlier involvement (in the case of the former of these two inflammations) of the neighboring lymphatic glands, by the presence of lymphatic œdema, and by the appearance of patches of superficial reticular lymphangitis at points of anastomosis with deeper trunks.

Treatment.—The first indication is to remove the cause, if that can be detected. All possible sources of infection should be sought for and appropriately treated. Pustules and abscesses should be opened and drained, unhealthy wounds are to be cleaned thoroughly and opened further if drainage is not sufficiently free. These avenues of infection should be encased in compresses which are kept wet with some antiseptic solution. The part should be put at rest, and the limb elevated to diminish the amount of blood entering it, as well as to facilitate the return of the lymph. Tension within the area of lymphangitis, if very great, should be relieved by incision and drainage, without waiting for suppuration to take place. The whole affected area should be kept covered with compresses continually wet with some soothing, antiseptic solution, such as aluminum acetate, Thiersch's solution, creolin (one-half per cent.), bichloride (1 in 2,000), or a solution of lead and opium. These wet dressings should extend above and include the swollen lymphatic glands. Hot fomentations in some cases may be more grateful than the cooler solutions. As soon as pus forms or is suspected, the abscess should be freely incised, evacuated, and drained. In severe cases in which the process threatens to spread and is difficult to control, a very effectual means of combating this is found in the continuous immersion of the limb in an iced solution such as any one of those mentioned above.

Constitutional treatment consists in supporting and eliminating measures. The diet should be liberal and solid food should not be withheld unless a high degree of fever causes it to disagree. The bowels should be kept freely open. Quinine, and later iron in addition, are the most efficient medicines. Stimulants will be needed only in severe cases and should then be given in large doses (one to two ounces of whiskey every two hours). It seems remarkable (much discussion to the contrary notwithstanding) how favorably a free exhibition of alcohol in severe septic infections will affect the constitutional symptoms, as shown by a dry, brown tongue becoming cleaner and moister, by improvement in the appetite and in the cerebral symptoms, by strengthening and slowing of the heart, and by a diminution in the degree of the prostration. Persistent œdema and stiffness in muscles and tendons, after subsidence of the inflammation and healing of the wounds, are to be overcome by bandaging, hydrotherapy, electricity, and massage. It may be necessary to give analgesics and hypnotics, such as the bromides, codeine, and trional, during the acute stage. Opium should be used only as a last resort.

Chronic Lymphangitis.—This is seen in the course of certain diseases, such as elephantiasis (which see), bubonic plague, tuberculosis, syphilis, etc. Tuberculous lymphangitis occurs both in large and in small lymph vessels in whose walls miliary tubercles and diffuse tubercle tissue may grow, producing partial or complete obstruction. This may occur independently, but it is most frequently seen in connection with tuberculous inflammation of adjacent structures, particularly the lymph nodes. In the vicinity of tuberculous ulcers in the intestines, the subserous lymph vessels, which pass from the ulcers, are often distended with the products of tuberculous inflammation, which makes them look like dense white knobbed cords. Syphilitic inflammation of the lymph vessels not infrequently occurs in the vicinity of syphilitic ulcers in the primary stage. In later stages there may be thickening of the walls of the vessels and the development of gummy tumors in and about them.

Clarence Arthur McWilliams.

LYMPHATIC SYSTEM.—(Synonyms: Absorbent system; Latin, *Systema lymphaticum;* French, *Système lymphatique;* Italian, *Sistema linfatico;* German, *Lymphsystem oder Saugadersystem.*) The lymphatic or lymph vascular system consists of the vessels and spaces containing lymph or chyle (colorless or white blood), and of the lymphatic or conglobate glands situated in the course of the vessels, and through which the lymph must percolate in somewhat the same manner as water passes through a sponge. This system is an appendage of the blood-vascular system, its two terminal trunks, the thoracic duct and the right common lymphatic trunk, ending in the great veins at the base of the neck.

A tolerably correct pictorial idea of the entire vascular system may be formed by considering the blood-vascular part as made up of a great tree, the heart forming a short trunk and the arteries, veins, and capillaries, the branches; but there is present the untree-like character of the direct union of the terminal twigs of the arteries and veins, that is, the venous and arterial capillaries are continuous. The lymphatic system may then be represented by two vines of unequal size, but which together follow all the blood-vessels to their ultimate ramifications, and in many places even send minute twigs beyond them. The analogy with a vine is further borne out by the lymphatic vessels, as they remain of a more uniform diameter than the blood-vessels; and, finally, the terminal twigs, like those of a real vine, end freely or blindly, often in slight expansions like leaves, thus forming a marked contrast with the terminal twigs of arteries and veins, which cannot be properly said to terminate at all. In a word, the blood-vascular system forms a complete circle or circuit in itself, while the lymph-vascular system joins the blood-vascular system at its central or trunk end, but ends blindly at the periphery.

Historical.—It is not to be wondered at that the lymphatic system should not have been discovered and investigated before the circulation of the blood and the general relations of the blood-vascular system had been investigated and understood; and yet, from the prominence of the lymphatic glands, they were seen by Hippocrates; but, having no notion of their true relations, he classed them with the other glandular structures of the body; so, too, there is strong reason for believing that the lacteals were seen in animals by the two famous Alexandrian physicians, Erasistratus and Herophilus; but their significance was not comprehended. About the middle of the sixteenth century (1564), Eustachius found the thoracic duct in the horse, and traced it, both to its beginning in the abdomen, where he became bewildered, and to its termination in the great veins in the neck. He did not profess to understand the significance of this vessel, but named it, from its color and position, *vena alba thoracis.*

It was not until 1622, when Asellius saw the lacteals in a dog, that the real significance of these vessels was appreciated. The whole scientific world was about this time aroused by the epoch-making discussions and discoveries of Harvey on the circulation of the blood, and everything like a vessel was scrutinized with inquiring eyes. The story of Asellius in connection with the discovery and comprehension of the significance of the lacteals will never lose its interest as long as the human mind is striving to comprehend the universe, either in its details or in the *ensemble.* Having opened the abdomen of a living dog, to show to some friends the arrangement of the nerves and the working of the diaphragm, Asellius saw in the mesentery some white cords in addition to the nerves and vessels with which he was familiar, and upon cutting one of them and seeing a white liquid exude, he immediately recognized that they were a new kind of vessel. Most fortunately for him and for science, the dog, killed on the following day to find out still more about these curious white veins, showed none of them. Fortunately, because it led Asellius to consider the conditions under which they appeared in the first dog, and wherein the conditions differed in the second. With the sure comprehension of a scientific mind, he saw that the only essential difference lay in the presence of partly digested food in the first case, and in the absence of food in the second. When this condition was realized in a third dog, the lacteal vessels reappeared, and the relation between the products of digestion and these vessels was fully established for the dog.

Not content with the experiments on the dog, Asellius examined many other animals, showing in every case that there was a constant relation between digestion and the presence of the white fluid in the lacteal vessels. Owing to the powerful influence of the prevailing opinion that all matter must first go to the liver to be assimilated, Asellius supposed that the newly found lacteals extended to the liver. It is difficult to comprehend how a mere hypothesis could blind the eyes of so skilled an anatomist, but so it was, and the belief that the lacteals passed to the liver continued to prevail for nearly twenty-five years.

About 1650, the great facts concerning the lymphatic system, as they are understood at the present day, were discovered by four men in different quarters of Europe. In France, Pecquet showed that the *venæ aquosæ hepatis*, or lymphatic vessels connected with the liver, were not the continuation of the lacteals to the liver, but were vessels extending either to the lacteals, or with them into a common reservoir into which both opened, and that the reservoir was continued as a somewhat smaller vessel (the thoracic duct) through the thorax, to terminate in the great veins in the neck. The same facts were observed by Rudbeck, in Sweden, at about the same time, and completely overthrew the notion that all absorbed food must first pass to the liver for assimilation before entering the blood; for here was *apparently* the only path of the absorbed food, and it terminated directly in the great veins on their way to the heart.

At about this date, Bartholin in Denmark, Jolive in England, and Rudbeck in Sweden, discovered the general lymphatics of the body. They also showed that these lymphatics (*vasa lymphatica* of Bartholin, *vasa aquosa* of Rudbeck), or serous vessels, either united with the lacteals in the *chylocyst* or joined the thoracic duct, and consequently the lymph and chyle or lacteal fluid unite, and together flow into the great veins. In other words, they showed that the lacteals form only a special part of a great system distributed throughout the entire body. It may be said, in passing, that when the facts concerning these new vessels were presented to Harvey, he did not welcome the newly acquired knowledge. Doubtless the weight of years had quenched the enthusiasm of investigation, and he may have been troubled lest these newly discovered vessels might in some way prove a stumbling-block to his simple and easily comprehended explanation of the blood-vascular system.

Not much was added to the knowledge of the lymphatic system for nearly one hundred years after the main facts were established, and naturally, in those early times, with both undeveloped methods and superstition as impediments, knowledge was only general and obtained principally by investigating the lower animals. And yet, in 1628, a criminal was properly fed before execution, and the lacteals demonstrated in the mesentery after death, thus showing conclusively that the absorbed food in man takes the same course as in animals.

Between 1760 and 1787 there was a renewed activity in investigating the lymphatic system. In England the Hunters, Hewson, and Cruikshank, not only investigated the human lymphatics, but pushed their investigations to all forms of vertebrates, and they were found abundantly in all forms. The Munros, in Scotland, were also very active. In Italy the great anatomist, Mascagni, was preparing his magnificent work on the human lymphatics, a work which remains a standard to the present day; and reduced copies of his splendid folio plates are still to be found in every extensive account of this system.

As in all departments of human activity, the crowning discoveries in the lymphatic system are due to the work of an almost untold number of men; and yet a few present the principal and salient features so unencumbered with useless, distracting, or foreign details that they are, for the majority of minds, the true discoverers. They make the special knowledge a part of the knowledge of the race. So in the above historical sketch many names have been omitted, and undue prominence may have been given to others; barring these defects, it is hoped that it represents fairly well the progress from vague and uncertain to certain knowledge of this system.

Since the work named above, something noteworthy has appeared almost every decade, but it has been usually toward the elucidation of special details of function, origin, distribution, or structure, rather than an investigation of the whole field. The work of Sappey[1] forms an

exception to this general statement. His investigations have extended over more than forty years, and with a rare skill and all the refinement of modern anatomy, he has not only done much on the general subject both in human and comparative anatomy, but some of the difficult points have been elucidated by him. His atlas is probably, without qualification, the most important monograph that has appeared since Mascagni's.[13]

General Structure in Man and Animals.—Considered as a whole, the lymphatic system consists of minute and larger spaces, of definitely walled capillaries and larger trunks. Lymphoid or adenoid tissue seems also to be an integral part, and in man and the higher forms this adenoid tissue is, in part, aggregated into special masses, the lymphatic glands or nodes, situated in the course of the vessels and forming a sort of sponge-work through which the lymph must percolate on its course to join the blood-vessels.

Like the blood-vessels, the lymphatics may be divided into groups according to their position, as *ectal*—subcutaneous, subserous, or superficial, and *ental*,—subaponeurotic, submucous, or deep, and also as *visceral*—those belonging to the heart, lungs, urinary and generative organs, and the alimentary canal. Part of these, *i.e.*, those from the small intestine, are called lacteals or chyle vessels. All of the larger vessels possess more numerous valves than do the veins.

In distribution, the lymphatics follow mostly the course of the blood-vessels, but this does not apply to the subcutaneous lymphatics, as will be seen by comparing Figs. 3267, 3268, and 3269, with figures showing subcutaneous veins. Furthermore, in many situations lymph vessels, or lymph canals and spaces, extend beyond the blood-vessels and more intimately envelop the tissue elements.

In general, however, it may be stated that the ectal or superficial lymphatic trunks follow the veins, and the deep or ental lymphatic trunks follow the arteries. This anatomical relation was shown in 1836 by Breschet for the adult, and in 1902 by Dr. Florence Sabine[19] for the embryo.

The lymphatic capillary network, although agreeing in general appearance with a blood capillary network, is composed of larger vessels and its mesh is coarser. With the larger vessels the anastomoses are more frequent, but differ in character from the anastomoses of blood-vessels inasmuch as the parallel vessels divide equally or unequally, and unite at a very acute angle, making a long, narrow-meshed network (Fig. 3268); and nowhere is found such great disparity in the size of the vessels as is found with the great arterial and venous trunks. Even the terminal lymphatic trunks are minute as compared with the veins into which they empty. The entire lymphatic system is supposed to have a capacity one-half as great as the arteries, and perhaps more, but no very close approximation can be made on account of the structural peculiarities of the lymphatics, and the immense number of valves. In man and the higher forms, all lymph traverses one or more lymphatic glands before joining the common lymphatic trunks. The exceptions to this rule which have been reported from time to time have not been verified.

In the higher mammals the general arrangement and distribution of the lymphatics is as in man. So far as has been investigated, however, the lymphatic vessels are fewer in number; this is markedly the case with the cutaneous and subcutaneous vessels. The lymphatic glands, although abundant in the horse and ox, are less numerous in most other forms. Groups of glands in man are often represented by a single one or are wholly absent. Although this is the case, a vessel never joins the main trunk without first traversing one or more glands (Figs. 2281, 3284, and 3286). In the lowest mammals there is a strong tendency to symmetry in the lymphatic system, the right and left terminal trunks being more nearly equal in size, and in area from which the vessels come. This tendency is also marked in the horse, and especially so in the rabbit; it is frequently observed in the cat, and occasionally in man. The crossing of considerable trunks from one side to the other is more marked in the lower mammals than in the higher, but even in man considerable trunks not infrequently cross from one side to the other (Figs. 3264, also 3281, 3286); and in all the forms there is the closest possible relation between the two sides through the lymphatic plexuses, that is, networks formed by groups of lymphatic glands and their connecting lymphatic vessels. While it is not uncommon to speak of a network of lymphatic vessels as a plexus, the term is coming to be restricted rather to a lymphatic network in which the glands form the nodal points of the mesh (see Fig. 3263).

Of the animals below the mammalia, the birds possess few lymphatic glands, and these are mostly restricted to the neck. A cutaneous and subcutaneous lymph network has not been demonstrated in the birds. Those that have been shown, it is supposed, correspond with the ental and visceral lymphatics of mammals. The two trunks opening into the veins of the neck are symmetrical, that is, equal right and left trunks. There are also two openings for the lymphatics in the pelvic veins, and lymph hearts are found in this region, but they have muscular walls in only few adult forms (ostrich, cassowary, stork, and sea-gull), although they are contractile in the embryos of birds so far as investigated. Contractile lymph hearts are never present in man and the other mammals (but see below under Development). In addition to the birds mentioned, they are found in reptiles, amphibia, and some fishes. They are mostly situated in the pelvic region, and possess striated muscle which is paralyzed by curare like the skeletal muscles (Kölliker and Ranvier). In the tailless amphibia (Ranidæ) there is a pair of lymph hearts on the thoracic ducts as well as in the pelvic region; and with some elongated amphibia, *Salamandra maculosa* and *Siredon pisciformis*, eight to twelve lymph hearts exist along the sides of the body and tail, at the junction of the dorsal and ventral body muscles. Finally, in some elasmobranch fishes the number of lymph hearts is very great (Sappey).

Below the birds the lymphatic glands are absent, their place being supplied by lymphoid tissue and by special fine vascular rete or networks into which the vessels break up in their course (Owen has described mesenteric glands in the crocodile). Perfect valves like those present in mammals are found in birds, less perfect ones in reptiles and amphibia, and finally in the fish-like forms none at all are found, so that the system may be injected toward the periphery like the arteries.

Topographical Anatomy of the Lymphatics.—While it would seem more philosophical to treat the various parts of the lymphatic system in their entirety throughout the whole body—viz., the ectal, superficial, or subcutaneous; the ental, subaponeurotic or deep, and the visceral lymphatics with the corresponding glands and lymphoid tissue—it is better practically, both for the purposes of demonstration and study, to consider all the lymphatic structures belonging to a given region at one time. This method is also really in accord with nature, because all the lymphatic structures in any moderately well-defined region of the body are, sooner or later, intimately associated and really form one whole for the given region.

Following the plan ordinarily pursued, the lymphatic vessels will be considered as extending in the direction in which their contents flow as with the veins, and also in order in which they must be demonstrated by injections. This will require the investigation to commence at the periphery and extend toward the centre. In the descriptions here given, usually only the trunks containing valves will be considered. The origin of the vessels in the tissues and the valveless networks will be considered below, under the origin and relations of the lymphatics. When the term plexus is used in this article it will be restricted to a lymphatic plexus composed of lymphatic glands with their connecting lymphatic vessels, and will not apply to a network of vessels without glands. After the vessels of a region have been described, there will be given a list of the groups of the lymphatic glands and the plexuses belonging to the region, together with the source and destination of the afferent and efferent vessels. This will serve both to give the proper information concerning the number and position of the glands, and also to form a condensed summary of the lymphatic system in the region.

Lymphatic Vessels of the Head, Face, and Neck.—The ectal or subcutaneous lymphatic vessels of the head and face are very abundant and follow, in general, the course of the occipital, temporal, and facial blood-vessels, converging somewhat toward the great vessels of the neck; they traverse one or more of the lymphatic glands which form an irregular zone nearly around the base of the head (Fig. 3263), and finally enter the internal jugular plexus, and terminate in the thoracic duct on the left, or the common lymphatic trunk on the right (Fig. 3279). In addition to the general description just given, the lymphatics of the eyelids, nose, and ear require special mention.

The lymphatics of the eyelids and palpebral conjunctiva form a very abundant network, although it is somewhat difficult to demonstrate. Those from the conjunctiva wind round the edges of the lids and mingle with those of the integument, which are especially abundant at the edges of the lids. The branches unite into two great groups at the canthi of the lids, those at the lateral canthus extending to the parotid lymphatic glands, while those at the nasal canthus join those from the middle of the forehead and the nose, and extend to the submaxillary lymphatic glands (Fig. 3263).

The skin of the nose, especially the thicker part around the tip, where the large sebaceous glands are so abundant, is possessed of a very dense network of lymph capillaries and minute trunks. These trunks are joined by the abundant lymphatics from the vestibule, which in turn are continuous with the lymphatics of the nasal mucosa. Finally, the collecting trunks from the vestibule and the nasal integument extend obliquely across the face to the submaxillary lymphatic glands.

The lymphatics of the external ear and meatus form three principal groups: 1. Those of the helix, antihelix, and convex (posterior) surface. Those of the helix and antihelix wind round the free border of the ear to the convex surface, where they join the trunks of that surface, and uniting into several (four to five) considerable vessels, they extend to the mastoid lymphatic glands. 2. The lymphatics of the external auditory meatus, also the membrana tympani (see below), the concha and tragus, terminate by two or three trunks in the parotid lymphatic glands. 3. The lymphatics of the lobule unite into seven or eight considerable trunks which extend to the caudal or lower of the mastoid lymphatic glands.

Ental Lymphatics of the Face and Head.—These are exceedingly abundant, and extend mostly to the deep cervical glands, but the relations of the vessels and the terminal glands are so various that a special description is required for each of the principal organs. Nasal cavities and sinuses opening into them: The existence of lymphatic vessels in the nasal mucosa was not demonstrated until 1859, when E. Simon showed by successful puncture injections that they were numerous. He also showed their relation with the network of the naso-pharynx. The existence of these vessels has been verified by Sappey in man and numerous animals. According to Sappey, the demonstration is comparatively easy wherever the mucosa is of considerable thickness. Schwalbe, and later Key and Retzius, showed that the nasal lymphatics could be injected from the subdural space; Key and Retzius[2] further showed that the injection was equally successful from the subarachnoid space of the brain, the subarachnoid and subdural spaces of the myel (spinal cord). They also found that while in most cases the perineural sheaths of the olfactory nerves were injected at the same time, yet true lymphatic vessels did not communicate with these, but had special passages through the lamina cribrosa, and were often injected when the perineural sheaths were not injected; and sometimes the perineural sheaths were injected without the injection of the lymphatics. They were not successful in injecting the nasal lymphatics of man from the cranial lymph spaces, although the perineural sheaths of the olfactory nerves were in some cases filled. The freshly sacrificed dog and rabbit furnished the most successful preparations. The lack of success in man was attributed to the inability to obtain sufficiently fresh material; it was also suggested that in man the lymph from the cranial lymph spaces might have a sufficient number of other outlets.

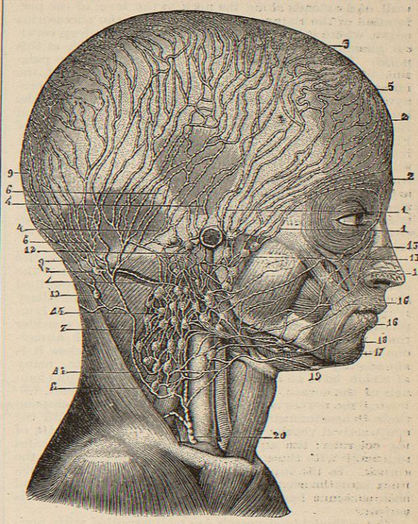

Fig. 3263.—Ectal Lymphatics of the Head and Face, the Ental Lymphatics of the Neck, and the Right Common Lymphatic Trunk. (Sappey[1].) 1, Lymphatics from the frontal region going to the parotid lymphatic glands; 2, 2, vessels arising near the middle of the forehead, the upper ones going to the parotid, the lower ones to the submaxillary lymphatic glands; 4, 4, vessels from the parietal and temporal region extending to the mastoid lymphatic glands; 6, 6, vessels from the parietal and occipital region joining the occipital plexus; 7, trunk from occipital plexus to the supraclavicular glands; 8, trunk from the occipital to the cephalic ental (superior deep) cervical glands; 10, 10, occipital lymphatic glands; 11, cephalic ental (superior deep) cervical glands and plexus; 12, mastoid glands; 13, parotid lymphatic glands; 14, part of supraclavicular glands; 15, 15, lymph vessels from the nose to the submaxillary glands; 16, 16, lymphatics from the lips to the same glands; 17, submaxillary glands; 18, vessel from the lip to 19, the supra-hyoid gland; 20, right common lymphatic trunk opening into the veins at the angle formed by the junction of the subclavian and internal jugular veins.

The lymphatic network covers the entire nasal mucosa, both on the olfactory and the respiratory part, and that lining the septum. In man this network is directly continuous with that of the vestibule of the nose, but the collecting trunks extend toward the pharynx. The network is also continued into the frontal, and presumably the other, sinuses opening into the nasal fossæ. As they approach the pharynx, the collecting trunks of the nasal mucosa are continuous with those of the dorsal surface of the soft palate and of the pharynx, especially the dense network around the Eustachian orifice. From

these situations the collecting trunks accompany those of the soft palate and the pharynx, sending one trunk through the wall of the pharynx to the large lymphatic gland ventrad of the atlas. This gland, according to Sappey, is the most cephalic (superior) of any in the body, and becomes involved in diseases of both the nose and the pharynx. The other trunk traverses the pharyngeal wall, and extends along the neck to the level of the perforation of the sterno-mastoid muscle by the accessorius nerve, where it bifurcates and enters the two deep cervical glands, covered by the sterno-mastoid muscle at this point. No doubt, also, minute branches join the palatine trunks which follow the posterior pillars of the fauces, and enter the deep cervical glands near the thyro-hyoid ligament (Plate XLII., 13). In the dog all the lymphatics from the nasal mucosa are shown by Key and Retzius as entering the deep cervical glands (3, 3, of Fig. 3285). Sappey figures and describes the exceedingly abundant lymphatics of the nasal mucosa in the horse and ox. In both these animals, but especially in the horse, the lymphatics of the mucosa lining the nasal septum are very abundant, and in both animals, besides the trunks extending toward the pharynx, there are large trunks extending toward the prenares, where they become subcutaneous, and extend with the ectal facial vessels to the submaxillary lymphatic glands.

Lymphatics of the Eye and the Orbit.—The lymphatics of the palpebral conjunctiva wind round the edge of the eyelid, and join those of the integument as described above, and finally reach the parotid and submaxillary lymphatic glands. Sappey denies the presence of lymphatics in the eyeball itself, but most anatomists consider that, while the eye may not be supplied with numerous independently walled lymphatics, nevertheless it is abundantly supplied with lymph passages, etc., many of which have an endothelial lining. The lymph channels of the cornea, which are exceedingly abundant, following the nerves as well as the corneal corpuscles and their co-anastomosing processes, communicate with the conjunctival vessels, and also with the lymph clefts of the sclerotic; the aqueous chamber also communicates indirectly with the conjunctival lymphatics through the cornea. In the suprachoroidea have been described distinct anastomosing lymphatic vessels by Altmann, and their presence has been lately confirmed by one of his pupils.[3]

The retinal blood-vessels are well supplied with perivascular lymph spaces like those of the central nervous system, and may be injected from the lymph spaces of the optic nerve. Both chambers of the eye and the perichoroidal, and the space enclosed by the capsule of Tenon, and the lymph spaces of the optic nerve, all communicate; and as shown above, the corneal spaces, and the aqueous chamber through the cornea, communicate on the one hand with the conjunctival lymphatics, and on the other with the lymph clefts in the sclerotic. In accordance with this complicated relation of the lymph paths of the eye, the lymph streams have been likewise found of equal complexity—passing from the vitreous to the papilla optici, and along the central canal of the optic nerve with the blood-vessels, and ultimately reaching the cranial cavity. This has been shown to be the direction in the cat, dog, rabbit, and guinea-pig, and is supposed to be also the case in man. There is also a stream flowing from the subarachnoid and subdural spaces in the cranium, which follows the prolongations of those spaces around the optic nerve; these finally reach the eye and communicate with its various lymph spaces, and through the perichoroid space with the lymph space in the capsule of Tenon, and presumably through this with the lymphatic vessels in the orbit. That is, there is a lymph stream flowing from the eye to the cranial cavity, and another from the cranial cavity back to the eye through a different channel.[4] If the assumption is correct, that the lymphatics of the eyeball communicate through the capsule of Tenon with the lymphatics of the structures in the orbit, their destination is to the lymphatic glands of the ental cervical group in the sphenomaxillary fossa. Through the cranial cavity the lymph from the eye might also extend with the lymph of the subarachnoid and subdural spaces to any point with which these spaces communicate. (See lymphatics of the central nervous system, below.)

Lymphatics of the Ear.—The lymphatics of the membrana tympani are like the blood-vessels in three layers, corresponding to the cutis, the mucosa, and the intermediate fibrous framework. They extend to the external auditory meatus and, joining these, finally enter the parotid lymphatic glands, as described above for the exterior ear. Those of the tympanum or middle ear are numerous, but apparently confined mostly to the submucosa. They are directly continuous with the lymphatics of the Eustachian tube, and extend with them to the abundant network in the pharynx around the Eustachian orifice, and finally extend to the ental cervical lymphatic glands. The lymphatics of the internal ear consist mostly of spaces which are in communication with the subarachnoid and subdural spaces through the perineural spaces of the auditory nerve, thus agreeing with the eye and nose.

Lymphatics of the Mouth, Pharynx, and Larynx.—The immense richness of the lymphatic network in these regions, their connection with the nose, and through the

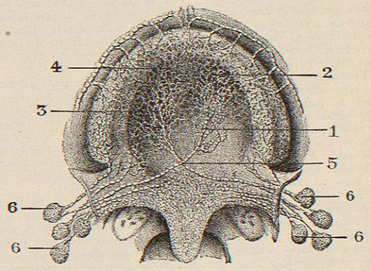

FIG. 3264.—Lymphatics of the Roof of the Mouth and the Gums in a Child at Birth. (Sappey, Atlas.) 1, The lymphatics injected by one puncture at 2; the trunk formed on the right crosses to the left, and those from the left to the right. Crossings of the lymphatics in man are most frequent in this situation, according to Sappey. In the lower animals such intercrossing is not infrequent; 2 and 4 point where the cannula was inserted to make the injections; 3, lymphatics of the gums, connected on one side with those of the palate and on the other with those of the cheeks, the trunks usually extend with those of the cheeks to the submaxillary lymphatic glands, those nearest the parotid lymphatic glands frequently enter them instead of going to the submaxillaries; 5, crossing point of the trunks from the roof of the mouth; 6, 6, group of ental cervical glands near the bifurcation of the common carotid.

nose with the cranial lymph spaces, with the middle ear, œsophagus, and trachea, and the varied termination of the collecting trunks, give the lymphatics of this group an especial anatomical interest. They are not less important pathologically from their involvement in the grave disorders of the mouth, nose, and throat.

The lymphatic network of the buccal mucosa, gums, roof, and floor of the mouth, palate, and pharynx, may be said to be continuous, but the collecting trunks in different regions have quite different destinations. At the lips the network is also continuous with that of the integument, but the course of the lymph stream is away from the lips. For the gums of the maxilla or upper jaw, the lymphatics extend between the teeth and join those of the mucosa of the cheek; these follow in general the contour of the jaw and penetrate the cheek at various points, extend in part to the parotid lymphatic glands, but mostly to the submaxillary glands. Nearer the pharynx they join the palatine lymphatics (Fig. 3264). A large number of those from the gums of the

EXPLANATION OF PLATE XLII.