TABLE.

No.	Initials of Subject.	Sex.	Age.	Gas or Vapour in which Lymph was Exposed.	Age of Lymph when Exposed.	Age of Lymph when Used.	No. of Points Vaccinated.	Result.	No. of Points Re-vaccinated.	Result.	REMARKS.
1	P. H.	M.	4 y.	Oxygen	Fresh	2 days	3	Failure	3	3 succeeded	
2	G. G.	M.	11 y.	Ditto	"	2 "	3	3 succeeded	—	—	
3	M. N.	F.	2 y. 3 m.	Ditto	"	7 "	3	Failure	3	3 succeeded	
4	J. M.	M.	"	Ditto	"	5 "	3	"	3	"	
5	M. M.	F.	7 m.	Ditto	"	5 "	3	"	3	Failure	
6	J. L.	M.	2 y.	Ditto	"	5 "	3	"	2	2 succeeded	
7	H. M.	M.	4 y.	Ditto	"	5 "	3	"	3	2 "	
8	M. M.	F.	7 y. 6 m.	Ditto	"	2 "	3	"	3	3 "	
9	T. B.	M.	5 m.	Ditto	"	2 "	3	"	3	3 "	
10	C. C.	M.	2 y.	Ditto	"	2 "	3	"	3	3 "	
11	F. W.	F.	1 y. 4 m.	Ditto	"	1 day	3	"	3	2 "	
12	T. L.	M.	3 m.	Ditto	"	1 "	3	"	3	Failure	
13	E. H.	F.	2 m.	Carbonic oxide	"	1 "	3	"	3	2 succeeded	
14	T. T.	M.	2½ m.	Ditto	"	1 "	3	"	3	2 "	
15	E. D.	F.	11 m.	Ditto	"	20 hours	3	3 succeeded	—	—	
16	T. D.	M.	7 y.	Ditto	"	20 "	3	2 "	—	—	
17	W. C.	M.	11 m.	Ditto	"	1 day	3	Failure	3	2 succeeded	
18	H. S.	M.	3 m.	Ditto	"	1 "	3	1 succeeded	—	—	
19	E. N.	F.	6 m.	Ditto	"	3 days	3	Failure	3	Failure	Revaccinated at 3 points, and 3 succeeded.
20	E. W.	F.	2 m.	Ditto	"	3 "	3	"	3	"	Revaccinated at 3 points, and 2 succeeded.
21	S. M.	F.	3 m.	Carbonic acid	"	3 hours	3	3 succeeded	—	—	
22	B. D.	F.	7 m.	Ditto	"	1 day	3	2 "	—	—	
23	G. M.	M.	5 y.	Ditto	"	2 days	3	3 "	—	—	
24	G. G.	M.	11 y.	Ditto	"	2 "	3	Failure	3	3 succeeded	
25	P. H.	M.	4 y.	Ditto	"	2 "	3	"	3	3 "	
26	L. R.	F.	2 y.	Hydrochloric acid	"	4 "	3	"	3	Failure	
27	J. C.	F.	5 m.	Ditto	"	4 "	3	"	3	2 succeeded	
28	A. B.	F.	3 m.	Ditto	"	2 "	3	"	3	3 "	
29	J. W.	M.	3 m.	Ditto	"	1 day	3	"	2	2 "	
30	A. D.	F.	2½ m.	Ditto	"	1 "	3	"	2	2 "	
31	E. T.	F.	3 m.	Ditto	"	1 "	3	"	3	3 "	
32	J. C.	M.	3 m.	Ditto	"	1 "	3	"	2	Failure	Revaccinated at 2 points, and 1 succeeded.
33	E. J.	F.	4 y.	Ditto	"	2 hours	3	"	3	3 succeeded	
34	L. D.	F.	15 y.	Camphor	"	50 "	3	"	—	—	
35	J. N.	M.	5 m.	Ditto	"	50 "	3	1 succeeded	—	—	
36	J. D.	M.	3 m.	Ditto	"	1 day	3	3 "	—	—	
37	F. D.	M.	3 m.	Ditto	"	2 days	3	3 "	—	—	
38	A. G.	M.	2½ m.	Ditto	"	2 "	3	3 "	—	—	
39	C. W.	F.	3 m.	Ditto	"	2 "	3	3 "	—	—	
40	J. M.	M.	5 m.	Ditto	"	7 "	3	Failure	3	1 succeeded	
41	S. B.	M.	2½ m.	Ditto	"	7 "	3	"	3	1 "	
42	H. N.	—	7 m.	Ditto	"	4 "	3	3 succeeded	—	—	
43	J. H.	—	3 m.	Ditto	"	5 "	3	1 "	—	—	
44	J. C.	F.	7 m.	Chloroform	"	4 "	3	Failure	—	—	
45	H. S.	M.	1 y. 1 m.	Ditto	"	1 day	3	"	3	—	
46	F. U.	F.	4 m.	Ditto	"	1 "	3	"	3	2 succeeded	Success of revaccination could not be ascertained.
47	T. S.	M.	3 m.	Ditto	"	6 hours	3	"	—	—	
48	L. K.	M.	3 m.	Ditto	"	3½ "	3	"	3	1 succeeded	
49	M. D.	M.	3 m.	Ether	—	2 days	3	"	3	1 "	
50	C. R.	F.	3 m.	Ditto	—	1 day	3	"	3	3 "	
51	J. D.	M.	3 m.	Ditto	—	1 "	3	"	3	3 "	
52	E. P.	F.	2 m.	Ditto	—	1 hour	3	"	3	3 "	
53	M. S.	F.	2½ m.	Ditto	—	1 "	3	"	3	3 "	

THE ETIOLOGY OF ENDEMIC GOITRE.

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It is my lot to live in a locality where goitre is of common occurrence. I have lately taken notes of the cases I have seen; up to the present, the number is two hundred and sixty. This fact establishes the endemicity of the disease in the district. It was natural that I should turn to my books for information regarding the origin of this peculiar complaint. To my surprise, the more I looked into the literature of the subject, the more puzzling and perplexing did the matter become. My medical brethren, too, seemed to hold contradictory opinions. For this unsatisfactory state of the etiology of goitre, there must be a cause. A great philosopher once said that, if we wish to penetrate the mysteries of Nature, we must observe patiently, experiment cautiously, and generalise slowly. It appears to me that (1) medical men in goitrous districts have not observed patiently, if, indeed, they have troubled themselves to observe at all; on the other hand (2), writers on goitre have generalised far too quickly; and (3) experiments have not been attempted, except on a very small scale. The result is our present incomplete knowledge of the subject. No doubt there are great difficulties to overcome. The thyroid gland, even in health, presents a puzzle to the physiologist; its function is not yet clearly made out. It is possible that a study of its morbid conditions may throw some light on the question. To add to the general fund of knowledge should be the ambition, if not the positive duty,

of every practitioner who resides in a district where goitre is endemic. It is important that all his facts should be carefully observed and accurately recorded. It is only by the accumulation of these that, in the course of time, the true etiology will be built up. No single observer can hope by himself to solve the mystery. The rural practitioner especially, who has often the best opportunities for watching and noting obscure diseases, must be content to contribute the raw material, leaving the rest of the work to the skilled hand of the well-trained master. It is impossible for the general practitioner to find time for diving deeply into the sciences of geology and chemistry, without which the true origin of goitre cannot be traced to its source. The physician, the geologist, and the chemist must combine in the work. There is no lack of material; the difficulty is to find workers.

From inquiries I have made, I find that goitre is endemic in twenty-seven English counties; it is also found in various parts of Scotland and Ireland; in nearly every country in Europe it exists; it is common in many parts of Asia, Africa, and America—in hot and in cold countries, in moist and in dry climates, by the seashore and inland, by lakes and rivers, on plains, in valleys, and on high mountains. It has even been developed, so it is said, in a ship's crew in mid-ocean; it appears alike in the burning Sahara and in the frozen regions of the far North. With such an almost universal distribution, it is the more remarkable that there should still be this vagueness regarding its etiology. I have, during my recent studies, met with nearly fifty different theories of the origin of goitre.

Before contributing the facts I have collected, it may not be out of place, with a view to the better understanding of the subject, to refer briefly to some of the principal theories found in text-books and elsewhere. Some have expressed surprise at the idea of goitre being pre-

valent in England; they had always imagined it to be endemic only in such places as the valleys of the Alps or Pyrenees. Some well-known works on medicine make no mention at all of endemic goitre. There has been from a very early date a popular idea that goitre arose in some way from the drinking-water. Hippocrates, Aristotle, Galen, and Celsus blamed coldness of the water. Agricola and others thought that metalliferous waters were the cause. Snow-water, muddy water, water deficient in carbonic acid, oxygen, or iodine, have all been blamed. The favourite theory has been hardness of the potable water. In our day, Dr. Aitken (*Science and Practice of Medicine*) and Dr. F. T. Roberts (*Theory and Practice of Medicine*) maintain that the weight of evidence is in favour of the supposition that water impregnated with salts of lime and magnesia is the cause of enlarged thyroid. I cannot pause here to discuss this theory; but I may say I have before me analyses of two samples of water (known to cause goitre) which contain only 4.75 and 7.0 grains of total solids per gallon respectively. On the other hand, many hard waters, notably so hard as to cause purging, are never known to give rise to goitre. Dr. McLelland, whose observations (*Some Inquiries in the Province of Kemaon relative to Geology, including an Inquiry into Causes of Goitre*, Calcutta, 1833) are a model of painstaking and laborious research, believes that water from certain defined geological strata, and contaminated with certain earthy salts, is the real cause of bronchocele. Dr. Inglis (*Treatise on English Bronchocele*) says that it is always found wherever the magnesian limestone formation prevails. M. Grange (*Sur les Eaux de la Vallée de l'Isère*) says the causes of this affection depend exclusively on the nature of the soil and of the water. Dr. St. Lager (*Études sur les Causes du Crétinisme et du Goître Endémique*), whose work I strongly recommend to all who wish for information on goitre, argues that the poison is some form of iron, probably in combination with sulphur as a bisulphide. He states, with some reason, that goitre is found on all those geological formations which contain iron pyrites. He asserts that he has produced enlargement of the thyroid in mice by adding sulphide of iron to their food for some months. Sir Thomas Watson (*Principles and Practice of Medicine*) says that the deleterious agent has been traced with tolerable certainty to water, and he looks to the chemist to solve the question. Dr. Bristowe (*Theory and Practice of Medicine*), with his usual candour, confesses that the causes of goitre are not yet clearly understood; but he inclines, apparently, to the theory of the impregnation of water by earthy salts. Mr. Erichsen (*Science and Art of Surgery*) says that air and locality have more to do with it than water, and that it is nearly always associated with a peculiar form of anæmia. The Sardinian Commission (*Rapport de la Commission Sarde*), charged with the settlement of this question, came to the conclusion that the causes were multiple, and included insalubrity of locality, humidity, absence of sun's rays, want of ventilation, poverty, and insufficient nourishment. There is good reason to believe, apart from other refutation, that these conclusions were for the most part purely theoretical, and unsupported by any series of accurate observations. Some have blamed want of phosphates in the system, owing to malassimilation from improper diet. Many believe that goitre only occurs in deep narrow valleys. Humboldt refuted this theory; but the latest contradiction which it has received is to be found in a recent book on African exploration (Thompson's *Central African Lakes*), where the writer observed goitre among the Marungu, a warlike tribe inhabiting the lofty peaks, 7,000 feet high, on the mountains which skirt the western bank of Lake Tanganyika. Livingstone, too, that keen observer, mentions in his *Last Journal* that goitre and hydrocele are frequent in the Lopere and Kabuiré districts in Central Africa, at a height of 3,350 feet. Shakespeare seems to have connected the disease in some way or other with mountains; for the following passage occurs in the *Tempest*, Act iii, Scene 3.

"Who would believe that there were mountaineers
Dew-lapped like bulls, whose throats had hanging at them
Wallets of flesh?"

There are those who believe that carrying heavy loads on the head or shoulders is the cause of goitre; others accuse the violent efforts of parturition. In certain country districts in England, it is attributed to the muscular efforts made in milking cows, the head being firmly pressed against the animal's side whilst the hands are employed. Ackerman and others have confounded goitre with scrofula and rickets.

Bramley (*Some Account of the Bronchocele of Nepal*, Calcutta, 1833) says, that a want of tone in the living fibre, and some defect in the lymphatic system connected with the stumous habit, is the cause of bronchocele. Some have blamed consanguinity and intermarriage. Among agriculturists, the goitre, which sometimes appears in cattle of very "pure-blood" stock, is attributed to close breeding—i.e., a breeding "in and in", to keep the stock unmixed. It is looked upon by breeders of cattle as a "scrofula". Heredity has been blamed; and

some have sought to prove that the morbid condition of the thyroid is handed down from generation to generation. An interesting fact, in support of this view, is mentioned by Inglis, who relates that goitre had become endemic in a locality where a detachment of French prisoners had been stationed; these men formed *liaisons* with the women of the district, and the female portion of the progeny were said to have been goitrous. At the time of Inglis's visit, almost all the girls bore marks of their descent, in their physical formation and features, exceeding in elegance any similar number of Scotch or English girls of the same class. The men were presumably from a goitrous district in France (in which country, it is calculated, there are at least 450,000 goitrous persons at present). Drunkenness of one or both parents, at the time of conception, is said by some to be the cause. There is a remarkable relation between pregnancy and goitre. Many enlargements of the thyroid begin with the first pregnancy—some, indeed, with the first menstruation. It has been said that uterine disease caused goitre. Dr. Edward W. Jenks (*New York Medical Record*) has maintained this theory; and says that goitre has a close relation with diseases of the female generative organs, the disease being oftener functional than structural. Excessive indulgence in sexual intercourse is blamed by some. In a book of travels (Spix and Martius' *Travels in Brazil*, 1820), referring to the prevalence of goitre at Jacarehy, near St. Paul's, the following passage occurs: "Excessive sexual enjoyments may be considered as one cause of goitre, as it is at Rio de sarcoele and hydrocele." Bramley, in speaking of this so-called pelvic sympathy, relates a case of the sudden disappearance of a gonorrhœa, synchronously with the development of a goitre. Dr. Reid has often noticed the connection between obstructed catamenia and goitre. He also states that the custom among the ancients, of measuring the bride's neck the day after marriage, is still followed in some parts of Germany. Enlargement of the neck was formerly considered one of the signs of rape (Laycock's *Nervous Diseases of Women*). Various conditions of the atmosphere have been stated to originate goitre. Iphofen says that want of electricity in the air of infected districts determines the endemicity of the disease. Many meteorological conditions have, in turn, been blamed—even hailstones have been pressed into the service. Some have attributed to a cryptogam, or microzoon, the origin of goitre. Dr. F. N. Macnamara (*Climate and Topography of Himalayan and Sub-Himalayan Districts of British India*, with reasons for assigning a malarious origin to goitre and some other diseases) has recently attempted to prove that the malady is due to a poison of a fungoid character. Billroth and others believe goitre to be a chronic miasmatic affection; and attribute the recent increase of goitre in Vienna to the introduction of the new water-supply, six or seven years ago; this water is brought from the Kaiserbrunn, in Styria, a district well-known to be affected by endemic goitre. Dr. Woakes ("On the Pathogeny and Treatment of Bronchocele or Goitre, *Lancet*, March 19th, 1881) has asserted that it is due to a "paresis of the vaso-motor nerves, which mediate the vessel area constituted by the thyroid gland"; but he does not tell us how or why this paresis is produced. He also denies the endemicity of the disease, and says that it is more common in all localities than is generally supposed. From what has been written, it must be evident that a great diversity of opinion exists among the profession as to the origin of goitre; and that any local inquiry, which will be of any use, must carefully cover a large amount of ground, and supply details of the locality; its configuration; its geology; the various sources and qualities of the drinking-water, with minute analyses; the habits and customs of the people; their sanitary surroundings, dietary, and other items of a similar nature.

The district from which I have collected my cases is situated on the edge of the eastern moorlands of Yorkshire. It is not easy, without a map, to convey distinctly a correct idea of the position and configuration of the locality. My readers must imagine an inland lake, or estuary of the sea, from which the water has been drained off, leaving a flat fertile plain or "strath", bounded north and south by two parallel ranges of hills, which run at a distance varying from five to ten miles apart. These two ranges rise on the coast—the one near Scarborough, and the other near Filey—and extend for nearly thirty-six miles, where they converge. Near this point of convergence, or, in other words, at the head of this antediluvian lake or estuary, is the district from which I have taken the cases. From the northern shores of this ancient lake rise the eastern moorlands of Yorkshire, a breezy expanse of moor and mountain, having, with many town physicians, a high reputation for salubrity. Patients are sent hither to inhale the health-giving atmosphere, and to enjoy the bracing breezes which blow over this wide extent of rock and heather. Here, indeed, is no insalubrity of locality, no absence of sun's rays, nor want of free movement of air. The bed of the lake is now a well-cultivated plain, and presents a marked contrast to the wild and barren moors. The hills, which form the boundary of the "strath", are intersected in many places by valleys and well-

wooded ravines, which impart a picturesque beauty to the scene. The highest point in the district is nearly 1300 feet above the sea-level; and here, in a hamlet close by, I have found cases of goitre. The villages are met with in three situations: (1) on the mountainous moorland; (2) in the wooded valleys; and (3) on the fertile plain—in all, goitre is to be found. The district may be said, geologically, to stand on the middle and upper oolitic formations. The plain consists of alluvium, upon Kimmeridge clay, in which iron pyrites is found. The hills are mostly tabular, and consist of Kellaways rock, Oxford clay, and calc grit. In one valley alone, at the extreme western boundary of my district, is the lias formation met with. The remaining geological details (for which I am indebted to Mr. C. Fox Strangways, F.G.S., of Her Majesty's Geological Survey) are given shortly in the following statement (from *Memoirs of the Geological Survey*, 96, S.E.).

The following are the geological formations which occur in the district:—*Recent and Post Glacial*: Alluvium; warp and lacustrine clay; sand and gravel.—*Glacial*: Boulder clay and gravel.—*Upper Oolites*: Kimmeridge clay.—*Middle Oolite*: Upper calcareous grit; coral rag and upper limestone; middle calcareous grit; lower limestone; passage beds; lower calcareous grit; Oxford clay; Kellaway's rock.—*Lower Oolites*.—*Lias*.

Those geologists who have studied the distribution of goitre have remarked its entire absence on the oolitic formations. Mr. Lebour (*On the Geological Distribution of Endemic Goitre in England*, by G. A. Lebour, M.A., F.G.S., Professor of Geology, University of Durham College of Science, Newcastle-on-Tyne) has, among other interesting details, drawn attention to the absence of goitre on the oolites. It is said that the Yorkshire oolites differ in composition from, although they are geologically the same as, the oolites of the South of England. Dr. St. Lager, in his work already referred to, speaks also of the absence of goitre on the oolitic formations in France. Goitre is said to be of rare occurrence on the lias; but in the valley I have just spoken of it is quite common. In justice to Dr. St. Lager's theory, I may say that iron is found in many parts of the district; and at one place there are two iron and two sulphur springs rising together within a few yards of each other. These springs are of great depth, and do not represent the drinking-water of the locality, but are used by invalids for medicinal purposes.

[To be continued.]

NEW CONVERTIBLE STETHOSCOPE.

By JOHN WARD COUSINS, M.D.Lond., F.R.C.S.,

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THE new stethoscope, which I beg to introduce to the notice of the profession, is a very simple contrivance, possessing the advantage of the double and single instruments in combination. The single stethoscope is now made in many forms, and with a variety of materials; still there exists a general preference in favour of the old-fashioned wooden instrument. At the present time, it is almost universally used by practitioners; and, no doubt, it serves, in a vast majority of cases, every purpose for correct diagnosis. But the practical question arises: Why is the single instrument so generally employed, instead of the double stethoscope? The preference, however, appears to me capable of very ready explanation. The double stethoscope, in the form in which it has hitherto been presented to the profession, since its introduction by the late Dr. Leared, is a somewhat costly instrument, and certainly less portable than the ordinary wooden tube. Few medical men are inclined to carry two forms of the same instrument, especially when one has been used habitually and successfully for many years. Moreover, the introduction of the ear plugs of the binaural stethoscope into the auditory canal sometimes causes uneasiness and discomfort, and this is frequently observed when they are supported in position by an elastic band. The external meatus is of very variable capacity in different individuals, and this important fact is often overlooked. It is essential that the plugs be perfectly adapted to the size of the canal: for, when they are too large, they cannot be retained; and, when too small, they occasion unpleasant sensations and friction-sounds in the ears. These inconveniences, however, are only temporary, and can be readily overcome by frequent practice with a well selected instrument.

The double stethoscope presents many special advantages in the physical examination of the chest. Two ears are certainly better than one for discriminating sounds, just as two eyes are better than one for purposes of vision. It is often important, for the sake of accurate diagnosis, to hear sounds emanating from a region of the chest with two ears simultaneously; and the value of the binaural stethoscope is very

evident in distinguishing obscure and feeble sounds, and also in defining the precise seat of their greatest intensity. The double stethoscope is certainly the best instrument for the student. It is a good plan to commence the study of auscultation with both ears, for this renders a practical acquaintance with the details more easy. The auditory power is very variable among different individuals, especially an acuteness of hearing for recognising low and feeble sounds; and experience proves that this power of ready discrimination is far more effectively cultivated with two ears than with one. By the same means, too, the faculty can always be improved and sharpened; and, with those who have long confined themselves to the use of the single instrument, and who have hitherto had no confidence in the binaural, it will be a great help to conduct an examination by the aid of both instruments alternately. A comparison between the auditory impressions can be thus readily obtained, the old prejudice will soon be dissipated, and the great advantage of using both ears fully recognised. I have often heard my friends remark, that "they do not like the double stethoscope"; but this dislike has been generally associated with no real effort to learn its great practical value. It is admitted by all accomplished auscultators to possess many advantages; and I am bold enough to express the opinion that it will, before long, take the place now occupied by the old-fashioned tube.

The "convertible stethoscope" is a very simple arrangement for promoting the practical study of auscultation with both the single and the double instrument. It consists of a flat ear-piece; a shaft, nine inches in length, separable into two parts; and a flexible tube, with perforated wooden ear-plugs. These separate parts are all adapted to each other by the same simple joint; so that, by fitting them together in different combinations, four stethoscopes are produced.

1. An ordinary short stethoscope (Fig. 2), which is especially serviceable for the dorsal examination of patients confined to bed.

2. A long single stethoscope, adapted for subclavicular auscultation (Fig. 1). This form of instrument is often very useful in practice; for, by its length, the head is kept away from the face of the patient, and it also prevents uncomfortable stooping over the bed.

3. A double stethoscope (Fig. 3). The shaft of the short single tube completes the instrument. The ear-plugs are retained in position, without pressure, by adapting them to the size of the external auditory canal, and not by fixing them in the ears, as in the ordinary binaural, by means of an elastic band attached to the ear-tubes. This method removes at once some of the most common objections raised against the instrument. It prevents the uneasy sensation of pressure in the meatus, and also the friction-sounds which are often so perplexing to the student. The ear-plugs, moreover, are made in several sizes, to suit the varying capacity of the canal; and this is a little practical matter very necessary to remember in selecting an instrument. This will be found a very handy form of stethoscope. The chest-sounds can be examined with both ears, and then again with either ear alternately, by simply compressing the elastic tubes between the finger and thumb; in this way, the single and double auditory impressions may be conveniently compared and studied.

4. A double stethoscope, with an auxiliary cranial conductor. The conductor is formed by placing the end of the long shaft between the teeth, or on the forehead. In the latter method, the ear-piece is fixed on the shaft, for the purpose of increasing the area of the conducting surface. (Figs. 4, 5.)

The value of this additional channel for the purposes of auscultation can be very readily estimated by experiment. I have employed it for many months; and, it is my opinion, that the sonorous continuity of the cranial bones and auditory nerves may be utilised, as an auxiliary channel, during many kinds of physical examination. It gives a re-