In the second case of myxœdema recorded above it will be noted that for one week (September 20th to 27th) the patient got, instead of the albumoses, 0.05 g. of the non-proteid body twice daily. During this week he lost nearly 3 lbs. in weight, a much greater loss than had been brought about by a considerably larger quantity of the albumoses. Further than this the loss of weight continued for a week after the administration of the substance was stopped; in other words, it has that prolonged action which is characteristic of the colloid as a whole, which is absent in the case of the albumoses.

It would appear, therefore, that the colloid matter owes its activity chiefly to its non-proteid part—that is to say, to the part of it which is richest in iodine. The objection may be raised that the albumoses, as I have prepared them, owe their activity to the incomplete separation from them of the non-proteid body. Inasmuch, however, as I have submitted specimens of the albumoses to a three hours' boiling with 10 per cent. sulphuric acid, and subsequent extraction for three times with boiling alcohol, and have found them still to contain iodine, I hardly think that the objection is valid.

THE NUCLEO-ALBUMIN.

I have administered this substance in one case of exophthalmic goitre, which reacted markedly to ordinary thyroid treatment. The dose given was small but not disproportionate to the small amount of the substance present in the gland. Its administration was continued for a week but no evidence of activity was observed.

THE THERAPEUTIC ACTIVITY OF THE COLLOID MATTER.

From these observations it follows that the total therapeutic activity of the thyroid is to be attributed to the colloid matter. On consideration it will be found, I think, that all the preparations of the thyroid which have been found to be of therapeutic value contain the colloid. It goes into solution in all watery and glycerine extracts. Of dried preparations of the whole gland it is, of course, unnecessary to speak. One preparation deserves special mention—the thyroid powder prepared by White.⁵ This powder was prepared in the manner usually employed for the separation of ferments, and was successfully used in some of the earliest cases of myxœdema treated by the thyroid. As a result, the conclusion was arrived at by many that the thyroid owes its activity to the presence of a ferment. I have found, however, on preparing the powder according to the directions of White, that the colloid matter is thrown down along with the precipitate of calcium phosphate, and that the dried powder consists, in fact, of calcium phosphate and colloid matter. It is, therefore, not surprising that it should have been found to be active. Vermehren⁶ has described a case of cretinism cured by the administration of the precipitate produced by the addition of alcohol to a glycerine extract of the thyroid. Of course, such a precipitate would contain all the proteids of the gland, including the colloid matter.

THE THERAPEUTIC ADVANTAGES OF THE COLLOID MATTER.

Seeing, then, that all the preparations of proved activity contain the colloid matter, the time has come, I think, when we should reconsider our methods of thyroid administration, and give to patients the colloid matter separated from the inert parts of the organ in a state of purity. The advantages of such a mode of administration are obvious.

1. Constancy of dose is ensured. The quantity of colloid present in different glands varies considerably; hence the amount of active substance in dried preparations of the whole gland is really not constant. By isolating the active part and giving it alone the difficulty is removed.
2. The drug is quite pure. The pure colloid matter is entirely free from fat, which is always present in dried preparations of the whole gland and is apt to make such preparations disagree when given in large doses.
3. The pure colloid is entirely free from taste and odour, and keeps indefinitely. These advantages cannot be claimed for other thyroid preparations.
4. A very small dose is required. Thus it will be found that as much of the dried colloid as will lie upon a sixpence

is equivalent in activity to three of the tabloids in common use.

5. The colloid is absorbed with great ease and rapidity. This is a point on which I desire to lay special emphasis. Incredible though it may seem, I have seen its effects begin to be manifested in a thyroidectomised dog within five minutes of its administration by the mouth.

6. The administration of the colloid matter is really the most economical way of giving the thyroid. In giving the colloid, one is giving the active part of the glands, nothing more and nothing less. There is no waste of active material such as occurs in the preparation of thyroïdin.

THE SUBJECTIVE SYMPTOMS.

Are the subjective symptoms such as headache and pains in the limbs which are so often complained of by patients who are being treated by large doses of ordinary thyroid preparations produced also when the pure colloid is given? In other words, are these symptoms a necessary result of giving large doses of the active principle of the thyroid, or are they merely by-effects due to the presence of impurities in the preparation employed? My own observations show quite clearly that such symptoms are unavoidable results of the physiological action of the gland whenever that action is pushed beyond a certain limit. These symptoms are produced whenever large doses are given, even if everything other than the active principle of the gland be excluded from the preparation. It cannot, therefore, be fairly claimed for the colloid or for any other thyroid preparation that it obviates the occurrence of such symptoms. At the same time, the advantages of giving the colloid matter isolated in a pure state are so obvious that I have asked Messrs. Oppenheimer and Co., wholesale chemists, to prepare it according to my directions. This they have done, and members of the profession can now obtain the substance in a convenient and reliable form for administration to patients.

REMARKS ON THE OPERATIVE TREATMENT OF

A CASE OF

DOUBLE FRONTAL SINUS EMPYEMA,

COMPLICATED BY

DOUBLE ANTRAL SUPPURATION.

By HERBERT TILLEY, M.D., B.S.(LOND.),
Assistant Surgeon, London Throat Hospital.

IF one was asked what kind of surgical diseases (except those of a malignant nature) are most intractable to treatment, and fraught with most anxiety to the surgeon as to the ultimate success of his intervention, it is probable that the correct answer would refer to certain cases of chronic suppuration of the various hard-walled, bony cavities of the body.

The following case may therefore be of interest both to the general surgeon as well as to those who give special attention to rhinology, and this not only because of the extent and duration of the disease, and the number of accessory cavities involved, but also because the treatment which has been practically successful embodies most of the suggestions for dealing with chronic suppuration of the frontal sinuses which have been made up to the present time:

Mr. S., aged 38, was sent to me, October 19th, by his medical attendant on account of a constant purulent discharge from the nose, which he found associated with polypi. The discharge had been continuous for eighteen years, except for slight remissions during sea voyages. When about 8 years of age he had a severe blow on the forehead, after which he had a discharge from the nose, but whether purulent or not he cannot remember. When 18 years old he was attacked with violent frontal headache and fever, and a large abscess formed over the lower part of the forehead, and the whole scalp became tender and swollen. The abscess was opened by a median vertical incision extending from the root of the nose about 2 inches upwards, and counter-openings were made at different parts of the scalp where drain tubes were inserted. He was confined to bed for some six weeks, and when sufficiently strong he left for South Africa, where for five years a

⁵ BRITISH MEDICAL JOURNAL 1892, vol. ii, p. 966, and *Pharm. Journ.*, September 2nd, 1893.

⁶ *De med. Woch.*, March 16th, 1893.

fistula at the lower part of the incision secreted pus constantly, so that he was never without a small bead of it on his forehead. This, however, finally closed, but the secretion of pus from the nose continued for twenty years, until recently, and but for the inconvenience of this his general health has been excellent.

On October 19th I saw him for the first time, and found both nasal cavities bathed with pus, while the middle meatuses and upper regions were filled with polypi and granulations. Having cleansed the mucous membranes they were cocaineised with a 10 per cent. solution of cocaine, when I had no difficulty in removing five polypi from the two sides, the largest being about the size of a broadbean; it was now easy to feel exposed bone with a blunt probe in each middle meatus, and on the right side I had no difficulty in passing a Hajik's probe into the frontal sinus, a proceeding which I was unable to carry out on the left side. It was also easy to pass a strabismus hook into each maxillary antrum, on removal of which there occurred a free flow of very offensive pus. The two bicuspids and first molar teeth were represented on each side by carious stumps only. On thoroughly cleansing the nasal cavities I noticed that pus soon made its appearance above the middle meatus, and flowed down the anterior part of the nose, so that I came to the conclusion that I had probably frontal sinus and certainly antral empyemata to deal with. I ordered him an antiseptic alkaline nasal wash, and on October 23rd I explored both antra with a Lichurtz trocar, perforating the inner wall below the inferior turbinate about an inch and a quarter from the columna. The operation is practically painless with cocaine. A quantity of extremely offensive dark green pus was evacuated from each cavity. The fluid returned from the left cavity with some difficulty, and whilst giving a little extra pressure to the syringe attached to the trocar the patient felt the fluid swirl round the forehead, so that I had no doubt that the frontal sinus and antrum on the left side were in free communication.

November 6th. Since the preceding date the patient has been in the hands of the dentist, who removed carious stumps and fitted him with vulcanite plugs which entered each antrum. By this means he was enabled to syringe out each cavity twice daily, and used for this purpose the antiseptic alkaline tabloids made for me by Burroughs and Wellcome. None of the carious teeth removed communicated with the antra. I now noticed that when the fluid returned clear from the antra that the passage of a probe up the fronto-nasal canal was followed by a free flow of pus, so that one's diagnosis was fairly clear, and I considered that the antra merely acted as reservoirs of pus coming down from the sinuses above, the communication between which had already been proved on the left side. After some delay he agreed to allow me to perform the following operation, in which Mr. Collier kindly assisted me.

November 30th. The patient being under ether, I made two nearly median and slightly curved vertical incisions from the root of the nose upwards for about 2 inches, and joining above and below, so as to include the old depressed scar, which I dissected out. In doing this I found its deeper portion firmly cicatrised to a small vertical slit in the frontal bone, and through which a probe passed easily into the left sinus.

Retracting the soft parts and periosteum over the lower median portion of the frontal bone, the pin of a $\frac{1}{4}$ inch trephine was applied to the bone (in the lower part of the space included between the median vertical line and a line drawn vertically upwards from the internal angular process), and a small disc of bone removed, when the unhealthy mucous membrane at once bulged into the aperture, resembling in appearance a rectal pile. A probe was now passed in to gauge the size of the sinus; it passed for 2 inches backwards and 3 inches outwards, the septum was complete, and everywhere the bony cavity seemed intact. A piece of sponge was secured by a ligature and passed down to the infundibulum, and the polypoid degenerated mucous membrane was gently scraped out, one or two apparently localised abscesses being opened during the process, if one may judge from the bright yellow pus which now and again made its appearance in the opening during the curetting. The hæmorrhage during this process was free, and the value of the plug in the infundibu-

lum evident. Having carefully scraped the whole internal surface, the latter was swabbed out with chloride of zinc grs. 40 ad $\frac{1}{2}$ j, and plugged with dry cyanide gauze.

The same procedure was adopted on the right side, but as it was a smaller sinus I did not plug the infundibulum, and during the curetting some blood entered the larynx, and towards the end of the operation caused us some anxiety by inducing respiratory difficulties. The upper end of the incision was now stitched together, the middle part being gently packed with gauze. I should say that previously to packing the sinuses I passed medium-size rubber catheters through the trephine openings and *via* the fronto-nasal passages out of the nares, and tied the ends together in order to prevent the latter passages occluding by blood clot.

December 1st. The sinus were repacked after removing the previous day's dressing, and the surfaces lightly touched with chloride of zinc gr. xxx ad $\frac{1}{2}$ j.

December 2nd and 3rd. Sinuses similarly dressed.

December 4th. A brief gas and ether anæsthesia was induced, the previous day's dressing removed, and a thorough swabbing out of the sinuses was made with chloride of zinc grs. xl. to $\frac{1}{2}$ j. The catheters were removed. I now passed from above downwards into the left sinus, through the fronto-nasal canal and out at the left nostril, a rubber catheter 6 inches long, with a funnel-shaped upper end $\frac{1}{4}$ inch in diameter; by drawing on the lower end the funnel was made to occupy the left infundibulum. The edges of the external wound were freshened, and with the periosteum, which was carefully drawn over the trephine apertures, sutured in the middle line.

December 4th. There is no collection of pus in either antrum, and I have syringed out the left frontal sinus with lukewarm mercuric chloride lotion, 1 in 3,000.

December 7th. Sinuses and antra daily syringed out with antiseptic lotion, and left sinus injected with zinc chloride, gr. x ad $\frac{1}{2}$ j. Only a slight collection of muco-pus in right antrum. Removed funnel tube from left frontal sinus.

December 8th, 9th, and 10th. Patient now syringes out his antra twice daily. There is scarcely any discharge from them. No sign of pus coming from the sinuses.

December 16th. Patient has returned from seaside. External wound quite healed. On syringing the antra a small amount of muco-pus still appears every other day from the antra.

December 30th. No discharge from the sinuses, and a very small amount from either antrum.

There are several points of interest in this case:

1. The length of time that the disease has been present, and yet the patient has been in good health all the time. It is difficult to understand how such a collection of indescribably foul discharge can be located in the skull for years without even producing headache, especially when one remembers the distress produced by an ordinary catarrh of the sinuses, as experienced during an acute nasal catarrh.

2. The large sinuses; the left almost reaching into the temporal fossa.

3. The nature of the degeneration (myxomatous) of the mucous membrane, and the value of plugging the infundibulum before commencing the removal of the disease.

4. The method of draining the sinus by inserting a self-retaining tube. Had the sinuses been smaller I should have inserted these tubes on both sides, and closed the external wound at once, but the free hæmorrhage necessitated packing in the case recorded here.

5. The sinuses, in spite of the long-standing disease, did not communicate, as the septum was complete.

6. The enormous number of these polypoid granulations, the localised collections of purulent matter referred to, and the size of the sinuses would have afforded an excellent demonstration of the futility of treating these bony empyemata by syringing lotions up the nose through the fronto-nasal canal, and still more so of endeavouring to force a passage from the nasal cavity into the frontal sinus when a natural one does not exist, or, if existing, cannot be found. As regards the use of syringing, I would point out that the fronto-nasal passage is often difficult to find, and, when found, may be unnavigable with a probe on account of its curves or narrow calibre, to say nothing of the danger of using force in this neighbourhood. Nothing could be easier than to make a false passage into the eye socket, into healthy ethmoidal cells, or

even into the brain, as has recently been done by a very careful and skilled worker, who learnt by means of a *post-mortem* examination how easy it is to go wrong, and how absolutely impossible to know the extent of the sinuses, the thickness of their walls, or, indeed, if they exist at all, without an external operation which is practically devoid of danger and has everything in its favour.

In these days, when enthusiasm runs high and the nasal cavities share with other regions its successful as well as unsuccessful results, I am sure I do right in adding a word of warning with regard to careless probing in the higher nasal regions, and I refer especially to the opening of the frontal sinus from the nose, in order to drain, irrigate, or insufflate. From investigations I have recently made, I am correct in saying that it is a proceeding which bristles with danger both to neighbouring healthy structures and to life. Even supposing it was devoid of danger, surely it must more often than not be absolutely useless—for example, in the case recorded, I would ask, What benefit can possibly result from syringing, or insufflating, or draining such large cavities lined by unhealthy degenerated mucous membrane of eighteen years' standing?

One must bear in mind that in dealing with the frontal sinuses we are dealing with a bony cavity, and that diseases of all bony cavities are very intractable to any treatment which is not thorough, that its relations are as various and intricate as its size, that its walls are often thin, and that no treatment which does not actually allow one to see and feel one's way with certainty and safety can be considered scientific or accompanied with reasonable prospects of success.

REFERENCE.

¹ For further information as to size of sinuses and their variations, see An Analysis of the Frontal Sinuses in 120 Skulls from a Surgical Aspect, with Cases illustrating Methods of Treatment, *Lancet*, September 18th, 1896.

THE INFLUENCE ON THE ACTION OF THE AURICLE OF VARIATIONS IN ITS CAPACITY.

By D. W. SAMWAYS, M.A., M.D., B.C.CAMB., M.D. PARIS,
D.Sc.LOND., M.R.C.S., L.R.C.P.,
Formerly Fellow of St. John's College, Cambridge.
Menton, France.

"NOTHING appears to us more inadmissible than the existence of a current going from the auricle to the ventricle during the systole of the latter. In presence of a physical impossibility....." In these words Professor Marey has expressed the view which has hitherto been held without question in France and England, but which the following experiments seem to throw some doubt upon.

I chose two rubber balloons such as are commonly sold to children, the one, *v*, being large and thick walled, the other, *A*, being small and thin. The larger, *v*, when filled with air, but not distended, was about the size of the closed fist, and its walls were about equal in thickness to a sixpenny piece. The smaller, *A*, when similarly full of air, but undistended, was rather smaller than a hen's egg, and its walls were about equal in thickness to a piece of goldbeater's skin. A short tube was inserted into the mouth of the balloon, and tied there. The free end of each of these tubes was connected by a short rubber tube with a T tube, as shown in the figure.

EXPERIMENT I.—Air was blown in by the free tube of the T-piece, and was at liberty to pass into either or both of the balloons. It was found that, although the walls of the smaller balloon, *A*, were many times thinner than those of the larger balloon, *v*, yet the former supported better the pressure and the latter alone was distended.

EXPERIMENT II.—Both the balloons, *v* and *A*, were separately inflated to twice or three times their original diameters. They were then put in communication by opening the clamps placed on the tubes between them. Instead of the large thick-walled balloon, *v*, sending air into the small thin-walled balloon, *A*, the air took the reverse course, and *A* emptied itself into *v* and still further dilated it.

EXPERIMENT III.—Air was allowed to escape from *v*, so that the balloon *v* was diminished in size; *A* was distended as in the last experiment. *v* and *A* were then put in communication. In this case the air was expelled from *v* into *A*, and the connecting tube had to be closed to prevent *A* being burst.

EXPERIMENT IV.—The balloon *A* was inflated and then put in communication with *v*, which was empty and collapsed. In this case the air escaped from *A* into *v* at such a rate that a rubber band which was stretched across the end of the tube inserted into *A* was made to vibrate

sufficiently to produce a loud musical note. This note had not been heard in Experiment II, when the air passed from *A* into *v* more slowly.

It follows from Experiment I that a weak, thin-walled, but small balloon can sustain a greater pressure than a strong, thick-walled, but large balloon; and it follows from Experiments II and III that, if both these balloons be inflated and then put in communication, the direction of the current of air will depend quite as much on their relative sizes at the time as on their initial strengths. The same conclusions may be arrived at mathematically; the internal pressure which a hollow sphere can support, or, if contracting, exert on its contents, being easily proved to vary inversely with the diameter of the sphere.

Now, exactly the same mechanical principle applies to the heart and to the two chambers, the auricle and ventricle. These on contracting assume a form sufficiently spherical for the purpose of the analogy—and the error would be comparatively small if they did not—and as they contract they exert a pressure on their contents which increases in proportion as their diameters diminish. Supposing that the auricle and ventricle should at any time be contracting simultaneously, is it, as Professor Marey states, "une impossibilité physique" that the auricle should succeed in sending its contents into the ventricle?

If the auricular cavity happen at the time to be small, the auricle having nearly finished expelling its contents, and the ventricular cavity happen at the time to be large, the ventricle having just commenced its contraction, then Experiment II suggests the possibility of the auricle being master of the situation, and sending the remnant of its contents into the ventricle, in spite of the latter being already in contraction.

Professor Potain² has shown in France, and Professors Roy and Adams³ in England, that the auricular systole lasts till the opening of the aortic valves. If so, the auricular systole must overlap any portion of the ventricular systole which precedes such opening. During this, the first phase of the ventricular contraction, the ventricle is large and full of blood; the auricle, on the other hand, is small and nearly empty of blood, it having already sent most of its contents into the ventricle. The auricle, in fact, is just in the position in which it has every advantage from relative size, and the mechanical advantage thus gained probably more than compensates it for its relative muscular deficiency, and leaves it at this stage of its contraction more than a match for the ventricle resisting it.

It has been pointed out that the auricle is not more than one-tenth the thickness of the ventricle, and therefore could not exert more than one-tenth as great a pressure on its contents. Since, however, the auricular walls thicken as they draw together during contraction, it is not necessary to suppose that the diameter of the auricular cavity must be re-