days before her death, the temperature rose, for the first time, one degree above normal; her pulse increased from about 95 to 120; and there was complete orthopnoea. During this time, the expectoration became of an olive-green colour; it was at all times devoid of odour. She died on December 26th, about seven months, according to her friends, after the first mention of the intrathoracic pains.

The *post mortem* examination, kindly made for me by Mr. Plaxton, House-Surgeon of the Hull Infirmary, gave the following results. The right pleura contained a considerable amount of fluid and many adhesions. The lung was puckered up and nodulated, and in the part exposed to view (we were only allowed to make the examination on the condition of not displacing any other organ) had been converted into a hardish white substance, rather creaky in parts when cut. The disease had invaded nearly the whole of the upper part of the lung, the base and posterior portion being free and containing air. There was a small quantity of serum in the pericardium, and the same growth made its appearance at the root of the heart in the form of a round nodule projecting between the right auricle and the aorta. The left lung was quite healthy, and so were the abdominal organs. Subsequent microscopic examination of a small portion of the growth showed it to be of the usual encephaloid character.

REMARKS.—The extreme rarity of such a case as the foregoing renders it worthy, I think, of record. Dr. Walshe, in his work on *Cancer*, says—"We have not materials for deciding the proportion borne by cases of cancer limited to the lungs to those in which the implication of the pulmonary substance is merely an element of the diathesis." In judging of the probable existence of malignant disease in internal organs, we are naturally, to a certain extent, guided by the appearance of the patient; but, in the case of the lungs, we can draw, it seems, no inference from it. Laennec remarked that, in all the cases seen by him, death took place before emaciation was apparent; and in the patient referred to there was, up to the last, little or no sign of it. The profuse night-sweats, said to be frequently an accompaniment of the disease, were absent. The nature of the case was at first, of course, doubtful; but the peculiar lancinating pains, the presence of hæmoptysis without pyrexia, and the existence of a family history of cancer, enabled me eventually to diagnose with tolerable certainty what the *post mortem* examination revealed. I have omitted to mention that hyperæsthesia of the integuments of the affected side, a symptom alluded to by Dr. Walshe, was present in a marked degree.

HOW TO ANALYSE AND HOW TO STATE THE MINERAL CONSTITUENTS OF NATURAL WATER.

By J. ALFRED WANKLYN, Esq.

IN giving the results of an analysis of a water-residue, it used to be the custom to state the different salts of which the water-residue was composed; but of late years a different fashion has grown up, and many chemists are now in the habit of stating the results in terms of the different metals, and in terms of the different acids or acid-radicals of which the water-residue is made up. The reason for this alteration was the perception of the fact that, when a solution contains various acids and various bases, the assignment of a particular base to a particular acid must be, to a certain extent, arbitrary; and that so it might come to pass that one and the same water could be made to appear different by mere tricks of statement, whilst waters which were dissimilar might be made to look tolerably similar by appropriate manipulation of the analytical results.

This objection is undoubtedly weighty; but, on the other hand, if we turn to prominent examples of the modern form of representation, we are not encouraged by them, and cannot fail to be struck by their singularly impracticable character, and by their want of perspicuity. In Watts's *Dictionary*, published in 1871, under the article "Water", will be found an admirable example of the modern mode of representation, where the water-residue is most strictly and rigidly broken up into its constituent metals, and constituent acid-radicals; and from this example we may judge how much is lost and how little is to be gained by the adoption of the modern form. For general purposes I am in favour of reverting to the older form, and, by the adoption of appropriate conventions, I would propose to get over any difficulties as they may arise.

The older form of representation fulfils one essential condition, which atones for all its faults. It exhibits certain waters as containing some one greatly predominating constituent, and other waters it exhibits as containing no greatly predominating constituent, whereas the new form of representation hides and buries these fundamental facts, as is most

strikingly exemplified by the tabular statement in Watts's *Dictionary* to which I have referred.

In sea-water, the predominating constituent of the water-residue is common salt, which forms about three-quarters of the water-residue. Sea-water is, therefore, a solution of common salt, containing certain other mineral matters in subordinate quantities. But, if we turn to the table in Watts's *Dictionary*, this fact is not apparent; and only by study do we find it out at all.

Certain very common forms of land-water—the entire water-supply of London, for instance—yield water-residues in which carbonate of lime predominates. These waters are, in fact, very dilute solutions of carbonate of lime (held in solution by carbonic acid), all other constituents of the water-residue being collectively subordinate in quantity to the carbonate of lime; and this fundamental fact is not apparent in the table.

For general purposes, we must adopt a form of representation which gives prominence to important facts such as these. In dealing with the water-residue of potable waters, it will be convenient to treat the carbonate of lime as a constituent apart from all the rest, and, so to speak, to regard these waters as dilute solutions of carbonate of lime.

Water which drains from granite, and from the igneous rocks generally, as also from the older stratified rocks and from the millstone grit, contains very little mineral matter in solution. But if such water encounter limestone or chalk, its character changes at once; and, from containing less than five or six grains of solids per gallon, it at once comes to contain sixteen, twenty, or thirty grains—the gain in solid contents consisting mainly of carbonate of lime which has entered into solution.

Now, abstraction being made of the carbonate of lime, drinking-waters, as a rule, do not exhibit very great variation in the solids contained by them. For the determination of carbonate of lime in waters we are provided with a variety of methods, which may be made to control each other. There is the direct determination of the amount of lime in the water, which will be treated of at length by and bye; there is, likewise, the determination of hardness; and there is a third method, which is, I believe, new, but which is a very obvious one. The indications afforded by these three methods enable us to fix the proportion of carbonate of lime with considerable accuracy and certainty.

Here a sketch may be given of the third method, which consists in determining the soluble and insoluble constituents of the water-residue. This is a very simple operation: 700 c. c. of the water are evaporated to dryness at 100 deg. C. in a platinum dish, and the water-residue weighed. It is then treated with small successive portions of boiling distilled water, and the resulting solution is passed through a very small filter and evaporated to dryness. The washing must be managed neatly, so as to make a very little water accomplish it. The filtrate is then to be evaporated to dryness in platinum in the water-bath, dried at the temperature at which the total water-residue was dried, and weighed. In this way we get the amount of soluble and the amount of insoluble water-residue yielded by a water. The amount of wash-water to be employed should be 35 to 70 c. c.; and with neatness, and in the absence of more than traces of sulphate of lime, it will be found to be possible to obtain as high a soluble-residue using 35 as using 70 c. c.

The Water of the New River Company as supplied to London.—The total solids in this water appear to range from 13.6 grains per gallon to 21.0; the mean for the year 1865 being, according to Dr. Frankland, 17.7 grains per gallon. According to a recent determination in my own laboratory, the solids in this water on March 4th, 1874, amounted to 20.7 grains per gallon.

The first point of interest in relation to these solids is, that they consist mainly of carbonate of lime, and that the variation in the total solids in the water is mainly due to variation in the amount of carbonate of lime which it happens to have dissolved. The 20.7 grains of solids were submitted to the action of successive small quantities of boiling water, whereupon 5.5 grains dissolved out. Hence:

Soluble salts	5.5 grains per gallon.
Insoluble (mainly CaOCO_3)	15.2 " "
	20.7 " "

The hardness of the water was found to be 15 degrees, which, as will be explained in next chapter, signifies 14 grains of carbonate of lime, the one degree pertaining to the water itself. I made likewise very careful determinations of chlorine and of sulphuric acid, and obtained these results.

Chlorine, per gallon 1.10 grains.
Sulphuric acid (SO_3), per gallon 0.19 "
The amount of nitric acid in New River water has been estimated by Frankland and Armstrong on various occasions, and amounts to about 1.0 grain per gallon.

Further material for deducing the chemical history of New River water

is furnished by the loss on ignition, which was carefully determined by Frankland in 1865, and is, in mean, 0.7 grain per gallon. The loss on ignition consists mainly of exchange of 2 (NO³) for CO³; and, as will be perceived, on making the requisite calculation, one grain per gallon of nitric acid would require a loss on ignition of about 0.5 grain; wherefore the loss on ignition is an additional confirmation of the determination of nitric acid.

A further point to be determined is the following. Is the "soluble part" of the total solids alkaline, and to what extent? We are now in possession of materials for arriving at a tolerably certain knowledge of the mineral constituents of the New River water. The 15.2 grains of insoluble portion contains 14 grains of carbonate of lime, the difference being made up of a little silica (according to some published analyses this amounts to 0.5 grain per gallon) and to a trace of iron, and possibly of alumina and phosphoric acid, and to a trace of organic matter retained by the carbonate of lime. Magnesia is all but absent. The 5.5 grains of soluble salts contain no lime, and consist entirely of salts of the alkalis. They contain:

Chlorine	1.1 grains.
Nitric acid (NO ³).	1.0 "
Sulphuric acid (SO ³)	0.19 "

The Thames Water, supplied by the London Water Companies.—The highest amount of total solids found by Frankland in the water of the Thames companies during the year 1865 was 22.8 grains per gallon, and the lowest 13.2 grains, the mean being 18.7 grains per gallon. In an experiment in my own laboratory, I found, on March 2nd, 1874, 22.9 grains of solids per gallon; and on the 27th of March of the same year I found 21.7 grains per gallon: as in the case of the New River, these solids consist chiefly of carbonate of lime. The 22.9 grains of solids was treated with a little boiling water, and yielded up 7.8 grains. The 21.7 grains also yielded up to boiling water 7.42 grains. And here the remark may be made, that in the latter case double as much water was employed as in the former, showing the efficiency of this process. We have, therefore:

	2nd March.	27th March.
Soluble.	7.8	7.4 grains per gallon.
Insoluble	15.1	14.3 "
	22.9	21.7 "

The hardness taken on March 27th was found to be 16.5 degrees, signifying 15.5 grains of carbonate of lime per gallon. I have no determination of the hardness of the water-supply on March 2nd, and so we must confine our attention to March 27th. On this day, at any rate, the carbonate of lime, as measured by the soap-test, was larger than the insoluble residue. The meaning of this circumstance is, that the soluble portion of the solid residue contains lime-salts. We have, therefore:

Soluble salts (including lime-salts equivalent to about 1.2 grains of CaOCO ²) . . .	7.4 grains per gallon.
Insoluble salts (mainly CaOCO ²) . . .	14.3 "
	21.7 "

And here attention may be called to the confirmation which is afforded by the "permanent hardness". In 1865, Frankland found the permanent hardness of Thames water always sensibly greater than that of New River; the mean "permanent hardness" of Thames water being 4.3 degrees, that of New River was found to be 3.6 degrees. The explanation why waters sometimes exhibit a degree of hardness in advance of that which can be due to the solubility of carbonate of lime in boiled water, is that such waters contain more permanent acid than is enough to saturate the alkalis proper (*i.e.*, more hydrochloric, nitric, or sulphuric acid than will saturate the potash, soda, etc., in the water). Further determination in Thames water shows 1.2 grains of chlorine and about one grain of nitric acid per gallon. A recent determination of sulphuric acid showed 1.6 grains (SO²) per gallon.

Guildford New Water-Supply.—According to an analysis of my own in 1871, this water contains 19.7 grains per gallon of solids, whereof 14.7 grains are carbonate of lime, and magnesia is almost entirely absent. In this water, therefore, there are four or five grains of salts of the alkalis per gallon.

Determination of Lime in Drinking-Water.—The usual manner in which the lime in drinking-water is determined is faulty in detail, and is not calculated to yield the most accurate results. The manner of proceeding, as is well known, is as follows. A considerable volume of the water, having been measured or weighed out, is evaporated to dryness in a platinum dish, a little hydrochloric acid having been added, so as to impart a distinctly acid reaction. The residue is then moistened with a few drops of acid, treated with distilled water, and passed through a filter. To the filtrate excess of ammonia is added, and then the liquid is boiled and passed through a second filter. In this way silica, alumina,

oxide of iron, and phosphoric acid, are got rid of as precipitates, and the filtrate is next mixed with oxalate of ammonia, which throws down the oxalate of lime; this is then washed, etc.

Now, the two precipitations to remove traces, before the precipitation of the main ingredient of the water-residue, are very objectionable, and involve a sacrifice of accuracy in more ways than one. The plan which I recommend is this: I take 700 c. c. of the water, and, having ascertained that it is quite bright, I add about half a *gramme* of crystals of oxalic acid, and some two or three c. c. of strong ammonia, taking care to have excess of both reagents. Then I stir up and filter through a small filter, and when the filtrate has run through, I wash with a very little distilled water. The filtrate is meanwhile set to evaporate down in a large platinum dish, and is evaporated to 10 c. c. in bulk. If necessary, a drop or two of hydrochloric acid is added, and the liquid is put into a small beaker and mixed with a little ammonia, which will throw down a fresh quantity of oxalate of lime, which is put on a very little filter and washed, and the filtrate and wash-water sent through this filter should not much exceed 30 c. c. altogether.

By this manner of operation we gain several advantages. We precipitate most of the oxalate of lime in very dilute solution, and ensure the completest washing. At the same time, by making the second minute precipitation, we avoid the great disadvantage of complete washing—*viz.*, loss of some of the precipitate in virtue of its solubility. Inasmuch as the second precipitate is very small in quantity, and in very little bulk of liquid, we can make a very minute filter serve to retain it, and can make a very little wash-water serve to wash it several times.

The question of the carrying down of silica, etc., along with the oxalate of lime, is best reserved; and after the oxalate has been converted into carbonate of lime, or into sulphate of lime, and weighed, a correction may be made, if necessary, for traces of these substances.

Magnesia.—There can be little doubt that the magnesia in drinking-water is, as a rule, very badly determined. The second precipitate of oxalate of lime is, in the ordinary way of analysis, very apt to be confounded with the magnesia. The only special directions which I have to give are, that, having separated the second precipitate of oxalate of lime, the filtrate, which is small in volume, is to be mixed with a slight excess of phosphate of soda and a considerable quantity of strong liquor ammoniac, left to stand, and the resulting ammonia-phosphate washed, dried, ignited, and weighed.

Alkalies.—Evaporate a considerable bulk of water down to dryness in platinum in the water-bath; treat the residue with a little boiling water, filter and wash; treat the filtrate with a slight excess of baryta-water (to precipitate magnesia), filter, concentrate in platinum, and then precipitate with a little carbonate of ammonia (to remove baryta and lime), filter and evaporate the filtrate to dryness, ignite gently, and weigh. Notice whether the weighed residue is sensibly alkaline, and if it be so, acidify with a drop of hydrochloric acid and water, dry down in the water-bath, heat to low redness, and weigh. The alkalis will be in a state of chlorides, and may be further investigated in various obvious ways.

NOTE ON HÆMATOMA OF THE EXTERNAL EAR.

By WILLIAM P. PHILLIMORE, M.B.,

Superintendent of County and Borough Asylum, Snettont, Nottingham.

SINCE the name of this disease, hæmatoma auris, with its synonyms, has been placed second on the list of diseases of ear in the official nomenclature now in use, the attention of the profession has been more prominently directed to it. Hitherto the notices and descriptions of the affection have more frequently emanated from medical men engaged in the treatment of the insane than others, but its study is of equal importance and interest to those employed amongst the general public. The papers upon this subject, published in the BRITISH MEDICAL JOURNAL, are calculated to revive inquiry, which is the more needed from the circumstance that, while some pathologists hold that it is a morbid condition observed as an intercurrent phenomenon of cerebral disorders, others contend that its presence is due to physical injury, and as such preventable.

Mr. Cobbold, in his concise account of a dissection, published in the BRITISH MEDICAL JOURNAL, 18th October, 1873, says, "I do not find in the essay by Dr. Stiff any account of the *post mortem* examination of hæmatomatous ears". He refers to an article published by myself in the *British and Foreign Medico-Chirurgical Review* for January, 1858, p. 223, which was illustrated by engravings of the several stages of the lesion in living subjects, and he has doubtless overlooked a second and supplementary essay of mine in the BRITISH MEDICAL JOURNAL of August 1st, 1863. In this number the *post mortem* results are given,