produced an extensive bed sore over the sacrum, and small sores of similar character formed on the upper surfaces of several toes and one knee. During the last three days of his life, there was a total cessation of his habits of restlessness, this disappearance of perverted motor-power being entirely due to the extremity of the paralysis. Under these circumstances, it was deemed safe again to put him to sleep in an ordinary bedstead and common bedroom. His restlessness did not return, and he gradually sank, and died exhausted on November 13.

The case afforded, in many respects, quite a typical illustration of general paralysis, although it differed from all other cases known to my experience in its terrible rapidity of progress towards fatuity, helplessness, and death. It might be added that, just before his removal to the padded room, the patient had an attack of severe epileptiform convulsions, attended with perilous prostration, from which, however, he at once rallied. Sanction having been given by the relatives to my performing a *post mortem* examination, I commenced this thirty-two hours after death, on November 14. On denuding the chest, however, I discovered a transverse fracture of the manubrium of the sternum, and at once abstained from proceeding with the necropsy until I had communicated with the coroner, and received his instructions as to what steps further should be taken in the presence of such an important injury. It was arranged that, as an independent medical witness, Dr. Boulton, senior, of Beverley, should be present with me at the *post mortem* examination, and should also give evidence at the inquest which the coroner decided to hold. We accordingly made the examination in concert; and the following were the various appearances noted in course of it.

Head.—There was an inconsiderable degree of adhesion between the skull-cap and dura mater. Effusion of serum in the membranes existed to the amount of probably half-a-pint. The arachnoid was in many places, but especially at the base of the brain, opaque and of a pearly whiteness. The grey substance of the convolutions was not obviously affected. On making the usual sections of the brain, there was noticed, when the centrum ovale minus was exposed, a remarkable difference in the vascularity of the two hemispheres, the left being much congested, and its cut surface presenting multitudes of dark bloody points, while the right was tolerably healthy. This difference was perceptible throughout the entire area of the section, but nothing further was observed until, on displaying the centrum ovale majus, the posterior lobe on the right side was found to be extensively affected by softening, portions of the diffident mass having clung to the blade of the knife whilst finishing the section. The greater portion of the posterior lobe was the seat of this morbid change, and it reached to close upon the upper surface of the cerebellum. The brain-substance was transformed into a reddish, pulpy, semifluid mass, having no resemblance to the original brain, and in some parts of it supuration had evidently made progress. The posterior cornu of the corresponding lateral ventricle was invaded by the diseased action, and the ventricle itself was distended with a sero-purulent fluid, which had passed in great abundance into the opposite ventricle, through the broken down and disorganised layers of the septum lucidum.

Chest.—The fracture of the manubrium sterni first and principally claimed attention. This portion of the bone was broken straight across at about the middle part of its length. The fractured ends were bathed in a small quantity of fluid, which had a grumous oleaginous appearance, only remotely partaking of the physical character of non-laudable pus. There was no attempt at reparation; and, although a few weeks was suspected to be the age of the injury, yet this could not be alleged very positively. (I need scarcely say that at no time during his residence here, had there been any external bruise on this part of the man's chest.) The cancellous texture of the bone was far gone in disorganisation and disease, its colour being deep red, and much resembling that of a muscle. It was soft and boggy, and a knife could with perfect ease be made to sink into and scoop out a portion of it. Experimentally, in course of the further dissection of the chest, the sixth rib on the right side was removed from the body, and its degree of fragility tested. Outwardly it had the character of a well-developed bone, but, on the application of very gentle violence, it snapped in two, revealing a brittle exterior periosteal shell, and, internally, the same dark-red spongy material which had been seen in the broken sternum. A slight quantity of oleosanguineous fluid exuded from its fractured ends. With the exception of the cranium, the examination of the bones was not further pursued. In opening the head, the easy and pleasant manner in which the saw did its work, excited the astonishment of the attendant who did this duty; and, when removed, there was no difficulty in cutting the skull-cap with a knife. The heart and lungs were perfectly normal, and so likewise, although the patient had been much addicted to habits of intemperance, were the viscera of the abdomen. All the structures in the neighbourhood of the fractured sternum were quite uninjured, there being indeed

no displacement calculated to do any damage to adjoining organs. The original certificate of death was not therefore impugned; it stated that deceased died from "disease of the brain and general paralysis," and Dr. Boulton agreed with me, that the injury found upon the body had not in the slightest degree accelerated the man's death.

I will take leave to say that the importance of the facts above recorded can hardly be over-estimated. Fracture of the sternum is a form of injury very rarely witnessed by the busy general practitioner, and, when it is seen, I think I am correct in saying, that it usually springs from the application of some strong mechanical violence, such as a cart-wheel passing over the chest. It is also a very grave accident, occasioning much anxiety in its treatment. When I communicated my discovery of the injury in J. H.'s case to Dr. Boulton, who is well known as a practitioner of great experience, he was greatly surprised and at once expressed an opinion that some cruel act of violence must be accountable for it. When, however, he came to the *post mortem* examination, and inspected the fracture, his suspicions of ill-treatment immediately vanished, and he gave it as his decided opinion before the jury that, with such a friable condition of the bones as existed in this man, some very trifling cause, as for instance a fall on the floor, which the patient was known to have sustained, and which would not have hurt a healthy person, would be quite sufficient for the production of the fracture. If this patient, instead of having been no earlier than was necessary put into the padded room, had received only such care as would be implied in allowing him, restless and helpless as he was, to knock and tumble about an ordinary bedstead, the discovery of many additional fractures of the chest, with their common attendants of penetrated pleura, pleuro-pneumonia, and empyema, would have been a more than probable event. As a principle of practice, then, the case illustrates how indispensable are good padded rooms in sufficient number for the proper equipment of an asylum. And it also teaches us to be careful when we find important and, it may be, mortal injuries after death, how we impute these to the violence of attendants, without the most convincing proofs of guilt, as it can no longer be regarded as a matter of doubt, the intemperate rhapsodies of that non-professional author who has produced "Shilly-shally" notwithstanding, that, let our nurses be ever so gentle and humane, the victims of certain kinds of mental disease may at times succumb in our asylums to accidentally contracted bodily injuries.

PRIMARY CANCER OF THE LUNG.

By GEORGE F. ELLIOTT, M.D., B.A.,
Physician to the Hull Infirmary.

MRS. H., aged 28, first consulted me on November 18th last year, and gave the following history. About four months previously to that date, she began to suffer from darting pains in the chest, described as shooting from the lower part of the sternum backwards, at times to the right shoulder, at other times up into the throat. Two months after the commencement of these pains, she noticed a feeling of fulness in the throat and a sensation of "fluttering" in the cardiac region. When first seen, she presented the following symptoms. The face was congested, and the neck enlarged from fulness of the thyroid body; the jugular veins were prominent. Percussion showed normal resonance in the whole of the left lung, and complete dulness in the right lung anteriorly; posteriorly it was tolerably clear, but less so than the left. Vocal fremitus was very marked in the upper and anterior portion of the right lung. Stethoscopic examination showed the respiration puerile over the left lung; in the right, the respiratory murmur was absent, even on forced inspiration, in front; behind, it was tolerably natural at base and apex, but at one point between the spine and lower angle of the scapula it was decidedly bronchial. She complained of dyspnoea, greatly increased on exertion, of violent paroxysms of coughing, and slight frothy expectoration. The heart-sounds were normal.

On December 4th she sent for me, saying she had spat up some clotted blood and "matter" after a more than usually violent fit of coughing. I could find no trace of what she called matter; the blood consisted of two or three small dark clots, and was along with clear and viscid-looking mucus. She remained in much the same condition, occasionally expectorating a little blood, until the 13th of the same month, when she complained of an intolerable aching in the throat. Shortly after my visit on that day, I was again summoned with an intimation that she was dying. I found, so far as I could gather from the attendants, that she had had an epileptic seizure. This was repeated on the two following days, when bromide of potassium was given and the fits ceased. Continued cough and sleeplessness became now very distressing; and from these chloral, hydrocyanic acid, etc., gave but little relief. Three

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