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COURSE OF CLINICAL LECTURES, DELIVERED AT THE MIDDLESEX HOSPITAL. BY DR. WATSON.

Lecture II.—October 22, 1842.

When last I had the pleasure of addressing you, I mentioned that I would take the present opportunity of submitting some hints and suggestions respecting the mode of best ascertaining the true character of disease, when it presents itself for your investigation—the most judicious and satisfactory method of investigating and of recording its progress and results; and this shall be the last occasion on which I shall deviate from the exact plan I have laid down, of confining my observations strictly to a consideration of cases which occur in this hospital, and under your own eyes. I have said in my former lecture, and I now repeat, that it is of the very greatest importance that, in every instance, you should be quite sure of the seat and nature of the disease which presents itself for treatment. This most vitally important information we acquire through the symptoms, collected in part from our own observation, partly from what our patient tells us of his feelings and sufferings, and, in some instances, from the statements made to us by his relatives or friends. I need scarcely say, that of the information derived from those three different sources, that from our own observation is the most trustworthy and important. You should be aware that, as those personal observations are collected by our natural senses, the latter require to be educated, to be improved, quickened, and perfected by education. The touch of the experienced surgeon has been termed, and very appropriately termed, the *tactus eruditus*, or educated touch, which is, in delicacy of perception, far beyond the ordinary and natural power of that sense. The touch, the eye, the ear of the physician, should be an educated touch, an educated eye, an educated ear. From those senses, thus trained and accomplished, much power of observation is acquired, much is learned. I need not dwell on the importance of the touch, how accurately it reckons the beating of the pulse, how delicately it admeasures the size and form of affected parts. The ear should be quick and distinct, as well in catching the words in which the patient seeks to disclose his ailment, as in detecting the action of the lungs. A good deal also may be learned during the interrogation of the patient, as well as previously and subsequently to that interrogation, by close observation of the eye. When, even in the first instance, the disease is submitted to your inspection, when you enter the sick chamber, or the patient's entering room, you may gather much infor-

mation from your observation of his face, his figure, his attitude, and sometimes his mode of walking; if the face be flushed or pale, sunken or bloated, the features calm or distorted—if the figure be enlarged or attenuated, the attitude constrained, the gait unnatural and uneasy—from all or any of those appearances you may deduce much immediate information.

It is related of Pinel, that immediately on entering the sick chamber, and solely by looking on his patient's face, he could discover latent pneumonia and inflammation of the peritoneum. This I should consider doubtful, and the inferences so arrived at rather conjectural than certain. From the sense of smelling, too, something may be learned. Dr. Christison says that, by the smell alone, on entering the sick room, you may determine whether the urine be albuminous or not; and in very many cases I believe you may. There are many diseases in which appearances present almost unerring indications; a pale, flabby countenance indicates internal hæmorrhage; the blue lip reveals the existence of disease within the chest. In the same way, a sunken eye and hollowed cheek in cholera give plain intimation of the disease. Jaundice you recognise as soon as you see it. The same may be said of all eruptive diseases, particularly those of a febrile character, such as scarlatina, which impart their proper distinctive marks to the skin. In the same way you may judge by the strength or debility of the patient; sometimes even by his gait you may be led to a proper inference as to the seat of disease, and sometimes, as I have already observed, his attitude will help you to a conclusion. Thus, if you see, on entering the chamber, the object of your observation sitting up, bending forward, and supporting himself with his arms on the bed, you will most probably find that he labors under some affection of the thorax; if, on the other hand, you find him frequently lying on his back, having his knees gathered up, with a manifest unwillingness to change his posture, or if he lie on his side, having his flexed knees close up to his body, you will fairly infer that he labors under inflammation of the abdomen. Many similar appearances, with the inferences to be deduced from them, will suggest themselves to you while walking the wards.

With respect to interrogating the patient, there is much perplexity in ascertaining the best mode of doing so, in order to elicit useful information. On this point a variety of directions has been given, and some of them by no means calculated to lead you aright. To be instructed how to examine by interrogatories in the first instance, is a matter of much importance. This sort of examination should be brief but comprehensive. It should not occupy much length, for it should be so conducted as to save your own time, which must frequently be of material

moment, and to avoid fatigue to the patient, which may be in many cases of the very first importance. There are many cases which must constantly recur in which it will be most desirable that the patient should not be subjected to a long course of questions, which may lead to unnecessary and injurious excitement and irritation. Let me instance pulmonary hæmorrhage, inflammation of the lungs, where slight exertion would be followed by great exhaustion; in those cases very serious injury may be produced by long talking. Again, in affections of the brain everything should be carefully avoided that would require exercise of that organ, and also in febrile inflammation, where any great demand, or continued demand, on the attention must conduce to increase of the symptoms. In such cases, therefore, your questions should be few as possible, not protracted so as to weary and excite the affected organ. There are several other reasons why your examination by questioning the patient should not be tedious or lengthy, but on those other reasons I do not so much insist; those which I have particularised seem the most cogent, and of themselves show to conviction the necessity of adopting a concise mode of oral investigation. It must be remembered that a good bold inquiry is most valuable, most essential. It gives the patient a confidence in you, and consequently a readiness to comply with your directions, an anxiety to second your efforts so far as he can, and a hopeful trust in your skill and attention, of the advantage of which I need not speak. Be assured that patients distinguish, promptly and keenly distinguish, between an examination conducted judiciously, boldly, directly, and, to use an expressive phrase, in a workmanlike manner, and one conducted tediously, confusedly, circuitously, in an unworkmanlike manner. Your examination by interrogatory should, therefore, be a short and conclusive one. You must not, however, mistake me, in thus enjoining a brief examination, as recommending a superficial one. Quite the contrary; I advise conciseness, as leading to clear answers—a brief, but a bold, direct examination, as being not only the most satisfactory to yourself and the patient, but as also the most efficient examination. In your first questioning of a patient, you may range over too great a space; you may search for information of trivial or of no importance. This I would have you avoid. Many books, purporting to advise you on this head, suggest a mode of inquiry most tiresome. They direct you to omit from your inquiries no circumstance at all bearing on the condition of the patient. Such a course would be, in my mind, frequently tedious and annoying. There are many questions suggested in those books which would be quite unimportant in some cases; and where questions are unimportant, to put them to your patient is not only useless, but unwise.

Rostan, who has written a work on clinical medicine, suggests that the best question to put a patient, on commencing your interrogatory examination, is, whereabouts the ailment lies, where the affliction is felt? I do not always commence my examination in this mode—as many of you may remember, I often have put the question, “What is the matter with you?” or “What ails you?” And you may have found that, when I asked this question the answer I obtained was vague, unsatisfactory, and conveying no information.

But if we ask the question “whereabout,” or where the patient feels affected, we generally obtain from the answer some definite information—we generally obtain some clue to the true seat and character of the disease. It must, however, be remarked, on this point of patients’ replies to professional inquiries, as is very truly observed by Rostan, that patients are very prone to miscall the several parts of their body, and that therefore you must not always be content with their verbal reply to your question “whereabout,” as in many cases your reliance on their answers may altogether mislead. Most patients call what is known to us as the epigastrium, their chest; all that portion of the body which lies between the pubes and the ribs is known to us as the abdomen—a term which is, of course, unfamiliar to the generality of patients; but they have a strong objection, particularly females, to call it by its ordinary familiar and proper name—the belly; they will uniformly miscall it the stomach.

A case suggests itself to my recollection, which shows how strangely erroneous notions are prevalent, particularly among the humbler classes, as regards the localities and proper names of several parts of the body. A boy, who was under treatment for mumps, complained to me that one of his kidneys was swelled. I was rather astonished, because there was no apparent cause for such a swelling, nor any other symptom indicative of the kidneys being disordered; neither could I suppose the boy to be acquainted with the interior of his own structure and the precise situation of his kidneys, or able to distinguish whether such a swelling existed or not. I therefore desired him to place his hand on the part affected, when he put his hand on one of his testicles. You will often find it advantageous, and indeed necessary, on receiving the patient’s reply, to adopt the additional precaution of making him put his hand on the part in which he complains of being affected or pained. The Irish, almost uniformly, if you ask them what ails them, or where they feel affected, will reply, that they have a pain in the heart; and this is the sure answer, no matter what may be their ailment or disease. Sometimes you will be told of an all-overness, or something equally vague and unsatisfactory. It is, therefore, a good rule to follow up in most cases your question of “What ails you?” and “Where do you feel affected?” by a careful inspection for yourself of the part indicated.

Another question which will be generally useful is, how long the patient has been ill; the answer to that question will tell you whether the disease is acute or chronic. Here again, however, the answers of patients are apt to mislead; for they usually date their illness from the time when they have been actually laid up, or when they have been compelled to cease from usual employment or labor. If, then, you find their reply means only that they have been stayed from work, or have kept their bed for a certain time, you must inquire, and endeavour to ascertain how long before that period of so being constrained to abandon their work, or of having taken to their bed, they had felt any pain, inconvenience, or unusual sensation or affection. Your other questions will follow in order, as the particular circumstances of each case will require. As to the mode of examining the several parts of the body, I must reserve my observations and directions

for other occasions when you have the patients before you, and my words can be accompanied by demonstration. Any suggestions I could make here on this head would be necessarily lengthy, and, after all, calculated but little to impart accurate instruction.

With respect to the mode of recording cases coming under your notice, I have promised a few hints as to the method which will be, in my opinion, the best to be observed. Most persons have methods peculiar to themselves of making memoranda and taking notes of such matters as seem deserving particular attention. You probably have, each of you, a method peculiar to yourselves, and which may in most cases fully answer your purposes, if you intend them only for your own recollection and information. But if the record of cases be, as in your subsequent practice it must often be, required for the information of others, as in the case of a consultation with professional brethren, or of a judicial inquiry, you will find the utility, nay the necessity, of having some certain, general, uniform plan of recording your observations, so as to make them properly and instantly available on reference. I have found most serviceable a plan laid down by Dr. Andrew Duncan, when I was attending lectures in Edinburgh and seeking knowledge under his valuable instruction. He advised us to have our memorandum or case-book divided into four heads, applicable to every case, and to arrange our observations under each of these four heads in this manner:—The first division related the actual condition and circumstances of the patient when first examined; the second division recorded the symptoms; the third the progress and history of the disease; the fourth the causes. This plan I can recommend for your adoption, as having myself experienced the convenience and other advantages of it. Under the first head—that of the condition and circumstances—you place the actual condition and circumstances of the patient at the time of your first professional examination—that is to say, the age, the sex, and, if a female, the state of the uterine functions, whether married or not, if pregnant or not, if she be a mother, or a nurse, then the station in life, the trade or occupation, which you are all well aware has great influence in either engendering disease, or in creating and fostering a tendency to it. In some cases, too, it will be of importance to note the dwelling-place, as it may be that the patient's abode was exposed to malaria from its situation, or to the influence of contagious diseases from its density of population and other causes. Under this same head you will also note, as accurately as you can ascertain, the previous habits, of the influence of which in originating or nourishing disease you are fully aware. These are the chief things to be noted under your first division—to repeat them again, the actual circumstances, age, sex, uterine functions, station in life, trade, or occupation, habits, and place of abode.

Under the second head—that of the symptoms—you should note the most important symptoms that present themselves. And here you must remember that you should not under this head enter into a historical relation of the disease and its successive symptoms, but state the actual condition at the time that you first examine the patient, all that you learn from the information given by others, all that you see, or

feel, or hear yourself, what the patient tells you of his own feelings; it is to be observed, however, that the patient's account is generally exaggerated or ill-expressed; besides these you will also note all the principal functions—that is, their actual condition at the time. You may then go back into the historical inquiry, and under your third head endeavour to note accurately the progress of the disease from its commencement, the time of its first appearance, and its manner of appearing. Then you should extend your inquiries into the causes, and note under your fourth head such circumstances as you may consider the immediate or predisposing causes of the present disease. It will not be always enough to trace back only to the first manifest assault of the disease under consideration; you should go further back, and inquire whether the parents or other relatives were subject to any hereditary disease, or whether the patient himself had at any time previous, and at what time previous, to the present disease having made its appearance, labored under any other disease, and what that disease was. To mention one instance of the propriety of this inquiry, you must have frequently seen how important it is in diseases of the heart to ascertain whether the patient had been previously attacked by rheumatic fever. The analogy extends to very many other complaints. You must also take note of the effects of such remedies as may have been previously employed.

These are the chief hints I purposed submitting to you, regarding the mode of investigation and of recording the result of your inquiry and observation. You will extend and perfect them by your own practical experience. I now proceed to the ordinary and regular business of this course, and shall say a few words upon two cases which have presented themselves latterly in this hospital to your notice. In my former lecture I said, that I would generally bring forward those cases in which death had occurred. One such case has occurred since last we met here, and on that case I shall make a remark or two. It is not a very uncommon or very instructive case, but there are some points in it to which I think it desirable to draw your attention. It is that of Mary Andrews, a young woman, aged 23, unmarried. She entered the hospital on the 30th of August in the present year. She was anasarcaous, having swelled legs and thighs, and some enlargement of the abdomen; she had been so affected for nine weeks previously; during that period the catamenia had been suspended; she suffered from a slight cough, had a tendency to faint often, and vomited all food, either sooner or later after eating. We examined her urine to ascertain whether it was albuminous or not, and found it did not contain any albumen whatever. I found that her complaint was disease of the liver. The liver could plainly be felt, hard and firm, particularly towards the right hypochondrium. I made inquiries into her previous habits of health, and learned that twelve years before her feeling the present attack she had had an attack of jaundice, and five years before the same period an attack of acute rheumatism. After the last-named attack she had felt frequently palpitation of the heart, with shortness of breath. In almost every report made of her case in the book I find, from first to last, that she vomited all food. Over this no

medicine that I could think of, no treatment that I could direct, exercised any control, and on the 17th of this month she died. On post-mortem examination the kidneys, as I anticipated, were sound—there was no disease of the lungs—no organic disease of the heart; but the cause of her death was evidently disease of the liver, which was exceedingly large. Here are two portions of the liver; you perceive it is of a pale yellowish color, presenting a waxy appearance to the eye. It is a remarkable specimen of what is called cirrhosis or fatty liver, which is itself a very curious disease, and one of which we do not as yet know much. This liver is full of fat, or grease; a small portion being cut off fed a lamp, and burned itself after the wick was exhausted. Another portion cut out, floated upon water, whereas healthy liver, as you know, sinks in water. It is inordinately large, of a smooth, uniform color and appearance, not speckled, as if the blood had deposited any colored particles in its course. In general the fat of this kind of diseased liver is much softer than the fat of a healthy liver. In the healthy liver, Mr. Bowman has ascertained, by microscopic examination, that in each of the globules of which the whole mass consists there are found a few minute granules of fat. The disease of fatty liver arises from a great increase of those granules in both number and size.

This disease is a very common accompaniment of phthisis. Louis relates that of every three cases of death from consumption, one has been found attended with fatty liver. Of 49 cases of cirrhosis which he had recorded, he states that 47 were cases of death from consumption, and 223 other cases supplied the other 2 instances. In the case now before us, all sustenance was rejected by the constant vomiting, and this vomiting I take to have been caused by the pressure of the enlarged liver on the stomach; there was no other apparent explanation. The cause of this disease in the human subject is unknown. I do not know whether this enlargement of the human liver is similar to that diseased enlargement caused, by a very cruel practice, in the livers of geese, which are confined within a very narrow space and in darkness, and there supplied with large quantities of rich food, until the liver becomes diseased, greatly enlarged, and possessed of that particular flavor for which it is by epicures prized. I know not whether the diseases are in any degree similar; but certainly this female was not subjected to any such mode of treatment.

The other case, on which I would address a few words, is that of another patient in the hospital, who is afflicted with a very interesting disease, diabetes. I allude to the case of Thomas Rawson, who was admitted on the 19th of last July; at that time he used to pass an immense quantity of urine, and this was strongly impregnated with sugar. He stated that he was in the habit of passing six quarts of urine in the twenty-four hours, and in the hospital he has frequently passed, within that period, a good deal more. In this case it was highly important, if possible, to ascertain the date of the commencement of the disease, which is usually very difficult. He stated, in reply to my questions, that he began to be dreadfully thirsty about four months before, and that before and after his urine had been very copious. Dr. Crouch has suggested a mode of approximating to the time

when the presence of sugar in the urine commenced, by endeavouring to trace back to the time when it plainly contained nitric acid, contending that if you ascertained that time, you may be assured that then there was no sugar in solution in the urine. The patient answered, to questions put to him with this view, that two years before his urine had been scanty and contained small gravel, by which description I understood him to mean nitric acid. The disease had probably, therefore, been making way since that period. He continued, after admission, to suffer from extreme thirst; he had a good appetite and no symptom of diseased kidney. It was quite plain that his disease was diabetes—a strange and intractable disease. In fact it was quite plain that sugar was held in solution in the urine. Its taste was sweetish, it left discolored spots on his trowsers, and he stated that he had had three or four pairs of trowsers destroyed, having been saturated with a liquor, in appearance like chalk and water, which was undoubtedly caused by the involuntary trickling of his urine, the sugar of which crystallised spontaneously. On examining, as you perceive by this instrument, the urine is found to exceed considerably ordinary urine in specific gravity. Here are two specimens of sugar obtained from his urine by evaporation, both fair specimens, but one much finer than the other. You perceive the crystals are more like the sugar of grapes than that produced from the sugar cane. Here is a bottle of alcohol obtained by distillation from the urine, not of this patient, but of another, a female who was similarly affected. But I have no doubt alcohol could in like manner be obtained from the sugar of this man's urine. It is, as you see, much lighter in color than that of other and healthy persons; it is manifestly sweet, as you may readily ascertain if you choose to taste for yourselves, and its specific gravity is much greater than that of ordinary urine. I have found, also, a faint, sickly, sweetish smell from his breath, and this is one of those instances in which the presence of disease can be distinctly ascertained by the sense of smell. About two years ago I was asked by a professional acquaintance to visit a gentleman by whose case he was somewhat puzzled. Immediately on entering the gentleman's chamber I perceived the sweet sick smell, which instantly informed me that sugar was present in his urine, and, though the physician certainly was not at all previously aware of it, it was clearly a case of diabetes, and the patient died very shortly after. The urine of a diabetic patient is supposed to be deficient in urea; but I rather am of opinion that urea is not absent, but that the sugar obscures the urea, which is abundantly held in solution. I think it also certain that sugar is contained in the blood of diabetic patients, although it is not easy to detect it there, because the system is anxious to throw it off, and this anxiety explains the inordinate quantity of water discharged. The quantity discharged by this patient is considerable. A healthy person passes from one to four pints in the twenty-four hours; this man has, since his admission, passed more than double that daily; the largest quantity evacuated in any twenty-four hours has been so much as seventeen pints; the least, within the same period, nine pints. The specific gravity of his urine, taking that of water at 0, has varied from 30 to 48; or taking

that of water at 1,000, his may be set down at from 1,030 to 1048. The specific gravity of common urine is 23 or 24, taking that of water at 0; or 1,023 or 1,024, taking that of water at 1,000; that is, when the urine is not of a very low specific gravity, as in diuresis. The average specific gravity of this man's urine we may put down at 1,040. Dr. Henry has published at the commencement of his well-known work, tables showing the quantity of solid matter contained in urine of various degrees of specific gravity. Taking the specific gravity of Rawson's urine at 1,036, which is the average, and the daily quantity at fourteen pints, which is also the average discharge, we find, by Dr. Henry's table, that he has been passing away in urine one pound and a quarter of solids every day. When we consider this we can easily account for the loss of strength in diabetic patients, and even for the loss of virility which is generally the consequence. This is one important point for our notice, for it shows why this disease is so often accompanied by phthisis. You will find that phthisis is very generally an attendant on diabetes, though this is not necessarily the case; and I have examined four or five bodies of diabetic patients who had no symptoms of phthisis. I much fear, however, that in the case to which I have been referring, this too general accompaniment is about to manifest itself. Within the last three or four days I find that the patient has begun to be distressed by a short choking cough, and that his breathing has become very suspicious. I have learned, too, that last night he showed a tendency to spit blood, and altogether I fear that the common result is approaching, and that he must shortly sink beneath constant exhaustion.

Neither our observations on this case, nor any published cases, afford much instruction in showing where the disease resides. It is not disease of the kidneys—this has been, I think, satisfactorily ascertained. I have had in my professional career frequent opportunities of seeing diabetes, and have examined a good many bodies of diabetic patients, and never have found the structure of the kidneys diseased. They have been enlarged, presenting the appearance of having been overworked, but not of any organic ailment. The presence of sugar in the blood leads to the inference that it is to be found in the digestive organs, and this inference has been corroborated by experiment. Mr. M'Gregor, of Glasgow, relates that he had a diabetic patient who submitted himself to the following trial:—Mr. M'Gregor administered, three hours after each had had a full meal, to his patient and to another person, an emetic; it took effect on each, and he placed the matters vomited up in separate vessels, with a quantity of yeast; both fermented, but the matter vomited by the diabetic man much more so than that of the other person. This was not very conclusive, so he varied the experiment. He kept both individuals for three days wholly on roast beef and water, substances which do not contain sugar; no saccharine matter, therefore, was introduced into their stomachs. As before, at the end of the three days, three hours after their meal of roast beef and water, he administered emetics, and again subjected the matter vomited by each to the trial by yeast, when he found that the matter vomited by the healthy or non-diabetic man did not ferment, while

that rejected by the diabetic patient did, as he terms it, ferment very briskly, showing that, as sugar was not introduced, it must have been present in the digestive organs. He found also that the fæces of his diabetic patient fermented in a similar manner, and that when analysed they contained crystals of sugar—another proof of the presence of sugar in the digestive organs.

As I have said, the causes of this very extraordinary disease are extremely obscure. It is sometimes hereditary in certain families. In my private practice I have had in one family, until recently three, at present two, children patients, for one has died, all the three of whom have passed sugar in their urine.

As to the treatment to be pursued to effect a cure, I fear I have nothing very valuable to communicate. Your first object must be to correct, if possible, that tendency or condition of the digestive organs, by which so much of the food taken is converted into sugar; your next—to prevent as much as possible the introduction into the stomach of anything containing sugar, for if you can succeed in having a certain portion of the food taken converted to its proper destination, you may keep your patient for a length of time free from much inconvenience. It will be most important to keep your patient as much as possible on animal food, which contains no sugar, and, thereby, you will diminish the means and the tendency to the creation of sugar in the system. It is certainly very difficult to confine patients to animal food; they become tired of it, and will too often break through your restrictions. The child to whom I have just now alluded was the best patient I ever had; she liked animal food, was confined almost exclusively to it, and consumed an incredible quantity of it. It agreed well with her; occasionally she took creosote; she grew, became fat and stout, when suddenly she sunk under an obscure affection of the chest. Opium too, is, in this disease, a valuable medicine, when judiciously administered; it calms and appeases the irritation of the affected parts, and has a very sensible effect in diminishing the quantity of urine and of sugar held in it. Carbonate of ammonia is also recommended; I have never tried it. Acetate of lead is another medicine used. The warm bath will often be found very advantageous. By making your patient perspire freely you greatly relieve the organs affected. However, your chief reliance must be on the supply of proper diet; you must limit your patients in quantity of drink, though you will find them absolutely tormented with thirst. I need scarcely say that all drinks containing sugar in any degree should be prohibited; warm animal broths will be the best drink. Steel will, from its fine tonic properties, be found very serviceable in restoring the dilapidated system and strengthening the blood. You must, of course, vary those remedies as circumstances may require. Blood-letting is sometimes efficacious, and Dr. Satterly and Dr. Watt recommend it in every instance. I am persuaded that too much importance has been attached to blood-letting in this disease, though I think it may be found useful at the very commencement; and at other periods of the disease it may sometimes be used to relieve uneasiness of the epigastrium, or pains of the loins. More valuable instruction I fear I

have not to impart on this extraordinary and fatal disease. Fatal I much fear it will speedily prove in the case of the poor man now in hospital, on which I have addressed to you those few remarks.

COURSE
OF
LECTURES ON ORGANIC CHEMISTRY,
AS APPLIED TO
MANUFACTURES AND AGRICULTURE.

By M. PAYEN, Member of the Institute.

LECTURE III.

PRESERVATION OF TIMBER.—MANURE.

Cost of the Various Articles employed in the Preservation of Timber—Pyroligneous Acid and its Compounds—Sulphates, &c.

Nutrition of Vegetables—Assimilation of Carbon, Hydrogen, and Nitrogen—Humus—Theory of Manuring—Physical and Chemical Properties of Soils—Lime—Pyrites—Dried Blood.

GENTLEMEN,—Having, in my last lecture, explained to you the various methods employed for the preservation of timber, I shall now make you acquainted with the relative cost of the different materials so employed. The following numbers express the quantities of substances required to penetrate a beam (of oak, poplar, &c.) 18 to 21 feet long, and 11½ inches in diameter.* The pyrolignites are preferable to every other kind of salt, on account of their cheapness, and because they invariably contain an excess of creasote. The pyrolignite of iron obtained in forests is cheaper than the pyrolignite manufactured at a distance from growing timber; but as the former contains less creasote, the value of both is nearly the same. For example, the pyrolignite of iron manufactured by MM. Bobee and Lemire, at Choisy-le-Roi, marks 15° with the areometer, while that of forests generally marks 5°. Hence, 200 pounds of the forest pyrolignite at 5°, and costing 1s. 3d., will furnish the same results as 66 pounds of manufactured pyrolignite, which marks 15°, and costs about 2s. 8d. The price of the pyrolignite of lead found in commerce is much higher than that of the material just mentioned; 10 pounds are dissolved in 200 quarts of water, and the cost of the preservative solution amounts to 3s. 1d.

Pyroligneous acid, marking 7° with the areometer, has also been employed in the preservation of timber; 80 pounds are required, at a cost of 3s. 2½d.

Tar water, or, what is still better, the ammoniacal fluid resulting from the distillation of coal, and which is abundantly obtained in gas manufactories, may be employed in the proportion of 50 pounds; this gives a cost of 3s. 1d. for the preservative fluid. The bichloride of mercury is too costly a material, as I have already remarked, to be extensively used. Its action is very powerful; the quantity required is 0.8 of a pound, but this gives a cost of 8s.

To saturate a beam of timber, of the dimensions already given, with a solution of sea salt, would, likewise, cost about 8s., 50 pounds being the quantity requisite.

* The experiments which form the base of these calculations were made on 120 to 130 feet of timber; the mean results alone are given. Fresh timber absorbs 0.25 to 0.60 of its weight of fluid by forced imbibition.

Sulphate of zinc, the price of which is very valuable, has been employed in the proportion of 10 pounds. The sulphate of iron may also be employed in the same quantity; but when the timber has been saturated with the latter, it must afterwards be submitted to the action of oil, to prevent the decomposition of the sulphate into sulphuric acid and oxide of iron. The cost of the material is 8½d.

Many other substances are employed for the purpose of staining timber of different colors. Thus we obtain an ebony colored wood by first treating the timber with a solution of pyrolignite of lead, and then with a solution of the sulphate of sodium. The quantities are—

Acetate of lead	643 quarts.
	2037 quarts. 10 pounds.
Sulphate of sodium	201 quarts.
	290 quarts. 2½ pounds.

The above numbers signify that to make 2037 quarts of the solution of acetate of lead, we must employ 10 pounds of that salt; and 2½ pounds of sulphate of sodium for 491 quarts of its solution; that 643 quarts of the lead solution should be combined with 201 quarts of the solution of the sulphate, or 1394 quarts of the former with 290 of the latter. When a solution of the prussiate of potass has been introduced into timber and a solution of the sulphate of iron, we obtain a most beautiful Prussian blue color, which may be rendered still more brilliant by the addition of a small quantity of chlorine. The proportions are—

Ferro-cyanate of potass	666 quarts.
	1632 quarts. 10½ pounds.
Sulphate of iron . . .	840 quarts.
	675 quarts. 6½ pounds.

In like manner, if a solution of sulphate of copper is passed into the timber, and then a solution of ammonia, we obtain a very fine sky blue color; this mixture penetrates wood very readily. A solution of arsenious acid with a solution of acetate of copper gives a fine green tint, which becomes deeper on the addition of a small quantity of caustic potass. By varying these processes we can give wood a great variety of colors; but it is unnecessary for me to dwell any longer on this subject.

I shall now, Gentlemen, turn to the important question of the influence of manures on vegetation; but first allow me to say a few words on the nutrition of plants. Physiology, assisted by organic chemistry, teaches us the difference which exists between the mode of nutrition of plants and animals, and also points out the origin of carbon in plants, and the manner in which carbon, hydrogen, nitrogen, &c., are assimilated by them.

Vegetable growth takes place through the assimilation, by roots and leaves, of certain principles already prepared for plants by the hand of nature; while in animals different organs are required to operate certain changes in alimentary substances, and convert them into principles adapted for their nu-