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ART. XXIII.—*Pathological Histology, by* GOTTLIEB GLUGE, M.D.; *translated from the German by* JOSEPH LEIDY, M.D., *Philadelphia.*

INTRODUCTORY REMARKS.

PATHOLOGICAL Histology comprises the description of abnormal tissues, their individual elements,* and their development.

Tissues produced under the influence of disease are composed of physical elements, in which the inorganic or organic constituents predominate. The former consists of amorphous or granular matter, or crystals; the latter of fibrine and albumen, or fat.

As the first class of pathological deposits are mixed with inorganic elements, ordinarily with one, and frequently, also, in small quantity, these are necessarily combined with organic elements in various relations. Their existence appears essential, if the organic elements are to assume a definite form; and, if we knew exactly what quantity and quality of inorganic substance were requisite to the formation of each tissue, a new field would be open to therapeutics. Thus, upon the supposed necessity of phosphate of lime in the formation of cells, a therapeutic treatment has already been established.

* The elements of the tissues, are their, individual parts; thus the cells are the elements of the epidermal tissues, fibres of fibrous tissues, &c. The association of several tissues form an organ.

Among all organic substances, fibrine alone appears to me to be capable of immediate organization or conversion into tissues, and then only in combination with albumen and fat. Hence, it may be placed down as a principle, that organization never commences without the presence of fat, separated into the form of globules, which contributes with fibrine to the formation of the various tissues.

Albumen, to become organized, probably, must first be converted into fibrine. This view, however, although resting upon the fact of the transformation of the latter into tissues in pseudo-membranes, yet the mode is entirely unknown in which albumen becomes solid in the process of nutrition. Under these circumstances, I shall prefer employing the expression plastic or coagulable liquid, or proteine, in speaking of the formation of tissues, thus leaving the question open as to the participation of fibrine and albumen in the process. It is, nevertheless, remarkable, that in the strongly albuminous liquid of a blister, at first no molecules or nuclei are visible, nor when this liquid is removed do they form; but later, if the stasis continues, and fibrine exudes, they begin to appear.

In disease, as in the normal processes by nutrition, the coagulable or plastic liquid convertible into tissues, is mostly derived from the blood.

This development of tissues occurs most frequently in the proteine substance which has exosmosed from the blood-vessels, but it may also take place, though in a limited degree, in the entire mass of blood discharged when the latter are lacerated, or in the blood within the vessels themselves.

Chyle and lymph; the former the main source of the formation of the blood; the latter being the result of the imbibition of the effete elements of the tissues, are capable only of an inferior and rare metamorphosis into the elements of the tissues. The only instance which I, at present, can admit, is their conversion into nuclei or nucleus-like structures in the form of tubercle and pus, which have been observed within the lacteals and lymphatics. Probably, also, the nuclei of medullary carcinoma (medullary cancer globules), may be reckoned in this category.

Pathological formations are either perfect tissues homologous to those which are normal, or they are tissues arrested in some stage of their development. The former intimately associate themselves with the natural tissues and organs, determining hypertrophy, or they occur in these as isolated masses constituting tumors. These tissues undergo the same metamorphosis as in the normal development of the embryo.

The latter class of pathological formations are histological malformations, and resemble the malformations of organs, the history of which lost its marvelousness so soon as their normal course of development became known.

To decide how far these pathological productions exercise an injurious influence upon the organism, or how far they are compatible with life, is no more the business of histology than it is for the chemist to consider the influence of different substances upon the living body, when engaged in their classifications. If we were more intimately acquainted with the chemical and organic relations of pathological tissues, such an independent, scientific treatise would exert quite as great an influence upon pathology as does theoretical upon practical chemistry. Nevertheless, the practical utility of histology is sufficiently great at the present time, avoiding all disposition to over-estimate the subject, to command the close attention of the practical physician.

FIRST SECTION.

Development of the elements of tissues.

ELEMENTS OF TISSUES.

The pathological formations are as follow:—

1. Perfect physiological tissues (homologous formations).
2. Imperfect tissue elements or heterologous formations, to which belong—

(*a*). Granular or amorphous proteine substance, or cytoblastema.

(*b*). Fat globules.

(*c*). Nucleoli or elementary granules, consisting of fat or proteine, or a combination of both, or of pigment, isolated or in a mulberry form (inflammation-globules), and united into irregular groups.

(*d*). Nuclei.

(*e*). Cells.

(*f*). Fibres having a quadruple mode of origin, viz.: fibres more or less defined, formed by cleavage (cleavage fibres), as, for instance, such as occur in exuded coagulated fibrine;* fibres formed through coagulation (fibres of coagulation) in a gelatinoid blastema, as, for instance, sometimes occurs in colloid; fibres proceeding from cells (cell fibres); and

* Schwann has indicated examples of fibres which he could not trace as originating in cells, as in the cartilages of the ribs, in the last transformation of the chorda dorsalis, and in the formation of feathers. From a verbal communication, I am informed he does not view fibres as necessarily produced from cells, but may be formed by a cleavage of the substance in which they exist, constituting cleavage-fibres and cleavage-structures, in an analogous manner, as in inorganic nature, besides crystals, determinate forms occur, as, for instance, in the formation of the basaltic columns, evidently from a previously liquid mass, or in the cleavage of slates, or the formation of asbestos, &c. This admission, however, Schwann considers does not by any means affect the general laws of the development of tissues, which the organic cell remains the fundamental type.

fibres produced by the deposit of extended layers around nuclei, or by the prolongation of these (nuclear fibres).*

2. *Development of cells in the exuded plasma of capillary vessels.*

1ST. MODE OF CELL-FORMATION.

The coagulable liquid which exudes from the blood-vessels is called cytoblastema, and in it are formed the above mentioned elements of the tissues in the following manner: At first nuclei originate, which are spheroid, oval, or pointed at two extremities, sometimes clavate, from one of the latter being rounded. They are of very variable diameter, are soluble in caustic potassa, but ordinary not in acetic acid. The majority, but not all, contain several—usually two or four, rarely none—shining granules, resembling fat globules, from the $\frac{1}{800}$ to the $\frac{1}{500}$ of a millimetre in diameter. These latter are the nucleoli, and they probably precede the nuclei in their origin, for I have frequently observed them as the first visible form in exuded cytoblastema, but have not seen their relative course of origin directly.

In the formation of pus-corpuscles, the so-called nuclei of which I view as nucleoli, this appears most distinctly to be the case, for the latter appear in the plastic liquid shortly before the occurrence of the pus-corpuscles. A like instance is presented in the formation of epithelial-nuclei (mucus-corpuscles) in the mucus of catarrh. At a later period, the nucleoli become blended with the nucleus, and then are no longer visible; thus, this appears distinctly to be the case in formation of epithelial cells upon blistered surfaces.

At the next step of cell formation around the nucleus, a layer of matter accumulates, soluble in acetic acid, at least always in the beginning, the outer part of which is converted into a cell wall: while the inner portion constitutes the cell contents, inclosing the nucleus; the latter, not unfrequently several in number, generally lies eccentrically within the cell, but sometimes in the center.

Frequently, new nuclei form in cells, which previously have but one, and around them new cells. In many cases the cell-wall forms only a half circuit or partial layer, around the nucleus; or, as observed by Schleiden to be the case in plants, the cell-wall lies upon the nucleus in the relative position of a watch crystal to its dial.

Cells appear rarely to increase by division in the animal, as is so commonly the case in crytogamous plants; and an

* Frequently, the simple nuclear fibres become fused together at their extremities, and form in this manner longer and knotted fibres.

undoubted instance I have not observed, but have only sometimes seen the beginning of the process.*

The cells are spherical, ovoid, flattened, or polyhedral from mutual pressure, or sometimes have filiform prolongations, which are frequently split up into delicate filaments. The cell-wall closely surrounds the nucleus, or is separated from it by a layer of softer granular, or amorphous semi-liquid contents, which may be constantly increased by endosmosis. The latter is rendered evident when cells are treated with water, when they are observed to dilate and then burst.

The formation of a nucleus is not an essential condition to the production of cells, for there are instances in which the latter occur without having been preceded by a nucleus. All non-nucleated cells, however, do not belong to this category, for frequently a nucleus originally exists, but afterwards becomes indistinct, or disappears entirely, by solution in the cell contents. Cells may form even after the exuded plasma is separated from the body. This may be observed with certainty in the fluid of a blister. There is, however, nothing very remarkable in the fact, for we observe, under the influence of the warmth of incubation, entire organs formed from the organizable liquid of the germinal vesicle in the egg of birds.

2ND. MODE OF CELL-FORMATION.

Small bodies appear, ordinarily, spherical and resembling fat granules, to which, in fact, they often correspond in their relation, but also frequently may consist of proteine, or sometimes of pigment. These average in size from the $\frac{1}{300}$ to the $\frac{1}{400}$ of a millimetre in diameter, and become associated, in groups of from ten to forty or more, by means of a coagulated albuminous matter soluble in acetic acid The groups of granules are mulberry-like globules, measuring on the average the $\frac{1}{30}$ of a millimetre, and in this condition are frequently observed. Only at a later period does a cell-membrane rise upon these globules, occurring by the separation of an exterior soft layer resembling coagulated albumen, and, in the mean time, the granules within gradually disappear by liquefaction. This, however, only occurs when the contents consist of proteine or fat, and then, ordinarily, a nucleus, rarely more, becomes visible, which appears as if it had been previously formed. This is a peculiar mode of cell-formation, in which nucleoli are formed in large quantity (the first layer), from which a

* That cells do increase by division in the animal body, appears evident in the dev[illegible] of groups of cells in articular cartilage.—*Trans.*

simple or compound nucleus is produced. So long as this structure remains without a cell-membrane, I have given it the name of inflammation-corpuscle, which should be retained, because other adopted names—granular cells (originating in a false hypothesis), or granulated bodies—are inadequate; whereas the former appears most expressive, as the inflammation-corpuscle is the first characteristic form produced wherever blood stagnates and becomes organized, after or withou exudation, or in other words, wherever inflammation occurs. It has been very learnedly shown that similar bodies appear in the colostrum and in the egg; but I have in no case asserted that they are found only in inflammation; and, on the contrary, I have ever tried to harmonize the pathological alterations of organs as much as possible with physiological development, for I have always viewed disease as nothing more than a physiological process modified by accidental causes.

3. *Parallelism existing between the pathological and physiological development of cells by the first mode.*

If we examine the development of physiological tissues, we find, according to Schwann, they originated from cells, in the following manner:—

In the beginning, in an amorphous or finely granular cytoblastema, there originate non-nucleated cells or nuclei, or the commencement of these, around which, at a later period, the cell is formed. Non-nucleated cells occur in low plants, but, according to Schwann, rarely in animals. The young cells of the chorda dorsalis, of the yolk of the egg of the bird, of the mucous layer of the germinal membrane, and some of those of the crystalline lens, belong to this category.—(Schwann, p. 204.)

Non-nucleated cells, also, are rare, as we have seen above, in pathological tissues.

Most of the tissues of the body of mammalia originate in nucleated cells, and the nucleus is either solid or hollow. Such is also the case in pathological tissues.

The nucleus generally contains one or two small dark nucleoli, more rarely three or four. The same is the case in pathological nuclei, in which the nucleoli are also occasionally absent.

Most nuclei are not disscIved by acetic acid, at least not rapidly—(Schwann, p. 206). This is found likewise to be the relation of pathological nuclei. Pus-corpuscles, however, which I view as nuclei, quickly dissolve in acetic acid, leaving behind the nucleolus; but many other nuclei do not dissolve at all, or do so only very slowly, as the so-called mucous-corpuscles, or nuclei of epithelial cells.

The nuclei of animal tissues appear to be developed from nucleoli, as, according to Schleiden, is the case in plants. I have not been able directly to observe such a development of pathological nuclei, but it often appears to be the most probable mode.

Cells exhibit a variable constitution. Thus, according to Schleiden, the cell-membrane of the youngest cells of plants dissolves in water, but not at a later period. The cell-membrane of cartilage-cells is soluble in acetic acid, that of the blood-corpuscles is not; the young epithelial cell-wall is also soluble in the latter liquid, but no longer after it has become corneous, &c. Whilst the wall of most cells is dissolved by a solution of caustic potassa, epidermal cells only become clearer, and swell out. Similar phenomena are presented by the cells of pathological structures. Ordinarily, these cells, at the commencement of their development, dissolve in acetic acid, but at a later period do so no longer, as in the case of abnormal epithelial cells.

Cells grow by endosmosis, and through deposition upon the inner surface of their membrane. In plants the deposits frequently occur in layers. Pathological cells also grow by endosmosis, and deposit upon their inner surface. Concentric deposits rarely take place in the latter, so that the layers remain distinct (as in cancer), and occasionally these deposits occur externally, and afterwards become transformed into fibres. Similar results of physiological development I have observed in the skin.

In some cases a fusion takes place between the cell-wall and an intercellular substance, or of the walls of neighbouring cells, as, for instance, in certain cartilages—(Schwann, p. 217). A similar occurrence I have observed, though rarely, in the epidermal formations of meliceris in which the walls of the sac and the cavity become indistinct; and only the outlines of the contained cells remained visible, in the form of a shaded network.

The endogenous reproduction of cells occurs rarely in animals, as in cartilage, and in the thyroid gland, but is common in plants, and is frequent in pathological products, as in cancer, and not rarely in abnormal epithelial formation (catarrh of the bladder). An extraordinary enlargement of parent and secondary cells is presented in the endogenous formation of cysts. It is a repetition of the process of endogenous cell-production on a grand scale. In these cases there is at first formed a scarcely visible semi-solid, rounded, gelatinoid mass, the nucleus, and around this a layer becomes separated, which is the cell-membrane. The new cell grows by endosmosis, and finally is supplied by blood-vessels, and through these material for a repetition of the same process. New cells produced within the former, originally are eccentric and attached to the wall of the parent cell, but afterwards separate and pass towards the centre of the latter, so as to give place to new formations In this manner several generations of cysts, that is to say, cells within the parent cyst (cell) may be produced. The origin of cysts in organs, in which they do not exist normally, without doubt frequently occurs through the enlargement of an ordinary cell.

Cells produced in diseases exhibit throughout a like relation to those, the result of physiological development. As we have seen, they grow by imbibition and deposit upon the inner surface of their membrane, and exchange or convert chemically their contents. The latter fact is particularly striking in the case of adipose cells of many fatty tumors, which, after having existed some time, are found to contain albumen or fibrine; also in the cells, inclosing blood corpuscles, which afterwards become coverted into pigment; and again, in the calcification of cells. On the other hand, cells containing albumen often become filled with fat globules, or with pigment.

Besides the faculty of imbibition and growth possessed by cells, which, according to the ingenious comparison of Schwann, might be considered as crystals formed of organic materials endowed with the capacity of imbibition, they have no other vital property. Movement or contraction in cells is observed quite as little in those produced pathologically, as in such as are physiological. On the contrary, nuclei, as well as cells, have a marked degree of influence upon the production of new cells in the plastic liquid which contains them, as in the case of pus-corpuscles and the cells in cancer.*

4. *Artificial formation of Cells.*

The artificial production of cells from the contact of oil with albumen, as discovered by Ascherson, has often been compared with that which takes place in the living body. Such cells, however, although composed upon the principles

* Unfortunately the conditions of this influence are unknown, but they appear to depend upon accidental causes, and the nature of the cystoblastema. Thus, fermentation is induced in a solution of sugar, by the addition of yeast, but the ferment corpuscles disappear. If, however, the yeast be mingled with a vegetable juice containing gluten, the former reproduces itself from the latter Again, the products of fermentation differ when yeast or when rennet is added to a solution of sugar These observations have no other object than to show that what exercises an influence upon the production of the various forms of tissues, are causes certainly accessible to the naturalist, and not hypothetical vital powers.

of formation by layers (a layer of albumen surrounding a globule of fat), are as different from those produced through the vital agency as a corpse is from a living body. This difference is strikingly observed in cases in which such a mode of cell-formation as the former occurs in the living body. In the tubuli urineferi, for instance, precipitates are sometimes produced consisting of fat globules surrounded by albumen. These artificial cells are non-nucleated, and undergo no kind of transformation.

A not uninteresting modification of the fact, discovered by Ascherson, I have observed when nitric acid is added to bile containing albumen. A precipitate of resinous molecules takes place, around which a layer of albumen is deposited. This phenomenon I have noticed most satisfactorily in the albuminous bile of cholera cases.

5. *Parallelism existing between the Physiological and Pathological development of cells by the second mode.*

Inflammation-corpuscles belong to the second mode of cell-development; and, however frequently they are asserted to result from the transformation of cells, the contents of which at first were not granular, are to be viewed as the remains of cells,* no unbiased observer will deny they find their analogy in the originally noncellular development of the cleaving globules of the fecundated ovum, or even in the development of the egg itself, which is at first observed in the ovary of the bird as a mulberry-formed agglomeration of globules, in which, only at a later period, a central spot and hollow nucleus, or the future germinal vesicle, becomes visible. Even in the fully developed germinal vesicle, as in that of the frog, masses of globules, resembling inflammation-corpuscles are observed, which, only at a later moment become enveloped by a cell-membrane (compare the observations of Nageli, Kolliker, and Vogt, and those in opposition by Reichert).

6. *Development of Fibres.*

In the enumeration of the tissue elements, the different forms of fibres which occur in morbid tissues have already been mentioned. Nuclear fibres originate by the elongation of nuclei at one or both ends, and the deposit of layers upon these, so that the nucleus is the central point around which, to the greatest extent in the direction of the long axis, a new layer, the fibre, is deposited. Cell fibres, in the same

* How can such structures be regarded as the disintegrating remains of cells when it is observed they appear in the most healthful animals within the veins of the lungs in the course of twenty-four hours, when quicksilver is injected.

manner, originate from cells. Whether fibres ever form by the conjunction with one another of nuclei, I have never distinctly observed; and such a mode of origin is in my mind doubtful. By far the greatest part of fibres in pathological structures originate from cleavage of a coagulated plasma, as is frequently the case in pseudo-membrane and fibrous polypi of the uterus, or through coagulation in a liquid plasma. Generally in these cases, and always in young fibres, minute fat-molecules are observed upon their surface. Many fibres of pathological formations remain in the embryonic condition, with further development, they continue as cell, nucleus, or cleavage-fibres, without ever constructing a regular tissue.

7. *Conclusion.*

If we adhere to the general conception of the cell theory, and particularly the beautiful parallel drawn by Schwann between crystallization and the formation of fibres—the similarities and dissimilarities of which he has explained—and remember the opinion frequently expressed by him that the formation by layers, ordinarily of two different substances, is the most important character. it must be acknowledged that the physiological formation of cells by the first mode, as conceived by Schwann,* is the same as that which is pathological. It is, however, to be regretted that Schwann, perhaps for the purpose of drawing the parallel between vegetable and animal tissues, was sometimes obliged to employ the term cell for structures which are not such; for a solid body, or one having no cavity, is no cell.†

As regards pathological tissues not consisting of cells, their immediate development from the latter, as we have

* "The whole process of the construction of a cell, therefore, consists in the primary origin of a minute corpuscle, the nucleolus, around which is deposited a layer constituting the nucleus; and then, later, a second layer, the cell-substance or contents. The different layers grow by the reception of new molecules among those already existing by intussusception, and a law determines the deposition more strongly in the external than the internal part of each layer, and more so in the most exterior layer than in those within. Under the operation of this law, frequently only the external portion of each layer becomes condensed to a membrane (the membrane of the nucleus and that of the cell), and the exterior layer is more perfectly developed than that of the nucleus."—Schwann, p. 213. Hence, the formation of the cell is a repetition of the production of the nucleus.

† By the irrational application of the discovery of Schwann, the view has been for some time entertained to reduce physiology entirely to a cell theory, and to consider almost all tissues which have heretofore been recognized as peculiar to be composed of cells. Thus we have pus-cells, blood-cells, ganglion-cells and even muscle-cells, &c., and he who cannot everywhere distinguish cells is in danger of being considered unskilled in microscopic examinations. It is almost overlooked that tissues preceded in their development by cells, when fully formed, possess quite different propensities from the latter. When a chemist has learned the properties of sulphuric acid, and later finds it to be composed of sulphur and oxygen, he does not think of applying the qualities of one of these to the former. An application of this kind, however, certainly has been made in physiology. A nerve-tubule, or a muscular fibre, is no longer a cell, nor does it possess the properties, re-act, or grow like the latter, from which it was developed. From the false view which has been here opposed, our best works on general anatomy are frequently only histologies, and not general anatomy, as originally conceived by the genius of Bichat.

seen in the case of solid fibres, is still more to be restricted than has been done by Schwann (page 22). So far as my observations extend, and they are numerous in the development of abnormal tissues, I am not prepared to assert, with Schwann, that, to form a muscular fibre, a nerve-tubule, or a blood-corpuscle, cells must first originate, out of which they are immediately developed. Several tissues in pathological structure, such as the striated muscular fibres, or even the nerve-fibres, are observed with very great difficulty in their course of development; but others, as bloodvessels and the haversian canals of the bone, I am satisfied are not necessarily and in all cases developed from cells.

Cells appear to assume the part of a chemical apparatus, in which the materials of the tissues are prepared; and they either become immediately converted into the latter, as cartilage cells into bone-corpuscles and bone-laminæ, or fibres, epidermal cells into corneous structures, &c.; or, when their function is to be a permanent one, remain in their original condition, as in glandular structures.

As the result of the above remarks, the following law of the development of morbid tissues may be proposed. Many pathological structures originate through previous cell-formation in a double form. The production of the cells, in such cases, occurs according to the first mode, as discovered by Schwann. All tissues, however, cannot be proved to originate necessarily and immediately from cells, and several, we know, certainly are not formed from them.

(*To be continued.*)

ART. XXXIV.—*The Hip-joint—Considerations on its injuries and diseases, deduced from the Anatomy, by* S. J. STRATFORD, M.R.C.S., Eng., Toronto, *continued from the "March" number of the Journal.*

TREATMENT OF INFLAMMATION OF THE SYNOVIAL MEMBRANE.

(*Continued.*)

In discussing the treatment of synovial inflammation of the hip-joint, we have endeavoured to point out the methods most appropriate to each stage of the disease and variety of the complaint; we have especially advocated the section of the neck of the femur at that stage of the disease when the formation of pus has been clearly indicated, and we have had full proofs that the consequences of this state of things —ulceration and removal of the textures of the joint, and the amount of constitutional irritation—clearly demonstrates that the presence of the disease will continue until a separation of the articular extremities of the joint has been accomplished. Following up the subject, we presume to offer the method by which this operation, in our opinion, can be most effectually and readily accomplished.

The removal of the diseased head of the femur may be accomplished in the following manner:—A circular incision must be made over the hip-joint, with its convexity looking downwards, and passing at least two inches above the trochanter major, the flap must be raised by careful dissection, and any vessels that may be cut, tied as we proceed, until we expose the capsular ligament; if this appears strong and not greatly diseased, by rotating the thigh outward and abducting it from the body we shall expose the weakest point in the capsular ligament, and having made a considerable opening into it, we may pass the finger down into the joint. Having fully explored the amount of disease, and become quite convinced from the amount of ulcerative absorption that the disease must progress, we may introduce a small saw, and cut through the neck of the bone within the capsular ligaments. The diseased bone is now easily removed from the cotyloid cavity, the proportions between the parts being now greatly changed—the head and neck of the femur being diminished by ulceration, and the cotyloid cavity enlarged by the distention of the contained matter—the bone easily escapes from its cavity, and, after cutting the ligamentum teres, is removed with facility from the joint. The round ligament is most commonly implicated in the ulcerative action that affects the hip-joint, so that the diseased bone may most commonly be removed without any impediment from the already divided ligaments. Were the capsular ligaments already destroyed, and the neighbouring areola tissue not largely implicated in the disease, the operation might evidently be considerable facilitated, although the positive result might not be so satisfactory. After the removal of the head of the bone, the parts are to be brought together and supported with three or four sutures, aided by sticking plaster and bandage. The limb must now be placed upon a well padded splint, so as to preserve the limb perfectly free from any movement, and keep it extended in its proper position.

After the head of the thigh-bone has been removed from the cotyloid cavity, the constitutional irritation generally subsides, the ulcerative action is arrested, the purulent discharge by degrees ceases, and a new and healthy action pervades the diseased parts; the disease of the hip-joint terminates in the formation of a new joint, or a complete anchylosis of the parts which remain of the old one. Our hopes of the formation of a new joint must rest upon the presumed powers of the patient's constitution, if it is strong and healthy, and has not been undermined by the long continuance, or the excessive irritation of the disease. If things progress favorably, after ten days, or a fortnight, we may carefully try passive motion, and if this can be continued during the remaining progress of the cure, we may have hopes of success; but if pain and irritation are excited upon the least movement, we must not persevere in our irritating attempts, but rest contented to save the patient's life with a stiff and anchylosed joint.

Before having recourse to this operation, we should endeavour accurately to define the nature of the disease which has attacked the hip-joint. If from its history and symptoms we are convinced that it has originated in inflammation of the synovial membrane, or is the sequence of disease, commencing in the cartilage, or in the cancellated structure of the bone; we shall have far greater hopes of ultimate success than when we suspect the disease of the joint to be dependent upon tubercular deposit. In all such cases we cannot venture to define the limits of the strumous deposit; nor can we reasonably hope that a disease dependent upon such deposit, in the cotyloid cavity, can be arrested by removing the head of the thigh-bone. If tubercular deposit is present in this structure, the natural changes consequent upon the disease will still progress, and we cannot expect to cure the disease unless we can remove all the deposit, which, in certain cases, must be next to impossible; so that, when the disease of the hip-joint is caused by tuberculosis, we should hesitate to perform the operation, fearing that the simple separation of the bones would not be sufficient to arrest the disease; or even, if it was so inclined, that from the condition of the constitution might we not have a further disposition of tubercular matter, which occurring, must render all our endeavours to obtain a cure abortive. This want of due discrimination is the cause of the bad success in many of our operations in this disease, and I think it readily explains the variable opinions of Surgeons in respect to the advantages of this operation; which, if based upon the principles which I have laid down, will, I think, be more reasonably expected to succeed.

The disease of the synovial membrane of the hip-joint having advanced to suppuration, the pus having by ulceration of the capsular ligament effected its escape into the surrounding areola tissue, it has burrowed down among the muscles, may appear as a large fluctuating swelling pervading the upper parts of the thigh, advancing to the surface the abscess may point in the groin, at the back of the hip, or descend far down into the thigh. The discharge of matter may be great and persistent, while it may escape from many sinuses at the same time ; it may be so profuse as vastly to debilitate the patient, that death itself is not unfrequently the result. Should the patient's constitution be able to withstand the stock of the formation of matter, by degrees ulceration of the capsular and round ligaments of the articular cartilages of the head and neck of the femur, and even of the bony margins of the cotyloid cavity, take place to a considerable extent; so that the bone becomes loosened in its socket, and, after a time, what remains of the head and neck of the femur will be easily removed from the cotyloid cavity, and will be retracted upwards by glutei muscles, and fairly lodged upon the dorsum of the ilium. This position of the head of the bone upon the dorsum of the ilium is not its invariable position, although by far the most frequent, in consecutive dislocation of the hip-joint. The bone may be placed in the thyroid hole, or in the sciatic notch, where it may become anchylosed, or we may have a new joint formed in either of these situations with considerable latitude of motion. The reason of these differences in the position of the bone seems to depend upon the posture of the patient at the moment of dislocation—if he has reclined upon his back in the bed with his knee bent at this time, the action of the glutei muscles will have a powerful effect upon the shaft of the bone and draw it upwards ; but if the patient has laid upon his side, with the limb greatly flexed upon the pelvis abducated from the central line, say by the patient rolling somewhat upon his back, the pectinalis and obturator externus muscles will in all probability assist to locate the head of the bone in the thyroid hole. If, upon the recovery of the patient, we find that the dislocation has been upwards and backwards, the limb will be found to be considerably shortened and slightly flexed ; he will have a limping gait, touching the ground only with the toe of the diseased leg ; but if the bone has been placed in the thyroid hole, the patient will have a stradling unwieldy mode of progression ; the limb standing out from the body and rotated outwards, greatly abducted from the central line, and moving in a circle in advance of the body.

Soon after the completion of the dislocation, and the perfect separation of the diseased parts, if the patient has strength of constitution sufficient, the parts will take on a more healthy action, the ulcerative action will cease, the discharge by degrees subside, and the disease is cured by the formation of a new joint, or the complete anchylosis of the bones in their new position.

In cases of this disease of the hip-joint in which this favourable stage has been shown to have been already accomplished, excession of the head of the bone has been recommended and practised; but under such circumstances, we think, it can seldom or never be required. Although we would advise the removal of the head of the femur at an early stage in this complaint, before luxation of the head of the bone had been accomplished, it by no means follows that we should think it advisable, nay even unwarrantable, after that change had taken place. Nature has already done all that we could accomplish by the operation; she has separated the diseased parts, that kept up a continual irritation the one upon the other; and now, if the constitution has strength, in all probability nature will finish the cure she has already commenced.—Why now add the forminable pain and increased injury of an operation to the diseased structures, by making a large wound, and otherwise injuring the parts? A section of the neck of the thighbone will not cure a disease of the acetabulum, if it still persists after a separation of the parts. The same healthy action that shall fill up and obliterate the colyloid cavity will cure the diseased process going on in the thigh-bone; therefore the removal of the head of the thigh-bone at this period of the disease must obviously be unnecessary, unsurgical, and injurious; by the operation we can only add fuel to fire, and completely destroy the feeble powers of the constitution, and thereby prevent the very object we have in view,—a healthy action in the diseased structures.

Inflammation of the Ligaments of the Hip-joint.

The powerful ligaments of the hip-joint are liable to inflammatory action, which may either commence in the fibrous structure, or spread to it from the neighboring textures of the joint. So close is the connection between the capsular ligaments and the serous membrane which lines it; so completely surrounded is the round ligament by this synovial membrane, that inflammatory action occurring in one or other of these tissues, will most commonly, and, in the generality of cases, quickly spread to the other, soon become confounded with it in symptoms and in results; nevertheless there are to be found clear indications derived from the nature of the structure affected, and the character of the disease, which, in the earliest stages of the complaint, will afford us pretty clear diagnostic marks of inflammation of this fibrous tissue.

The capsular ligament of the hip-joint, which is peculiarly thick and strong, consists of white fibrous tissue, this is formed into a net-work of minute bands and fibres; these freely interlace with each other, and appear to have a continuity of substance: the amount and character of these fibres evidently vary at different points; in some parts they take a wavy direction, while in other places small bands evidently predominate. This fibrous structure has but little power of extension—seems to possess a very low degree of vitality, and needs but little interstitial change to maintain it in a normal condition. In a state of health it has a white glistening appearance, and is apparently destitute of blood-vessels; under disease, however, it assumes an intensely pink colour, showing that the red corpuscles of the blood now traverse the fibrous element and are seen through the semi-transparent structure. It has been shewn by Arnold that minute transparent vessels permeate between these fibrous elements, which, in a healthy condition of the part, carry but a thin serous fluid, some of which exuding from the coats of these vessels, serves to maintain in the fibrous elements a degree of moisture that supports their elasticity and preserves their normal tone. Nerves doubtless traverse this fibrous tissue to arrive at their points of destination, but are not directly supplied to the structure There is no doubt but that the fibrous elements are originally produced from the consolidation of a plastic fluid that has been elaborative by cells; for on the application of acetic acid, under the microscope, there appears more or less numerous groups of oval, or sometimes pointed, oat-shaped nuclei, presenting occasionally a curved appearance. May not the nuclei which are so liberally supplied to the fibrous elements by consolidation and arrangements produce the transparent blood-vessels above mentioned? At all events, it is clear that the fibrous element has little sensibility, and its low vascular condition distinctly marks the cause of the tardy progress of its inflammatory action; why in some cases days elapse before that condition of deranged nutrition is fully developed, after the application of any exciting cause; and why at first almost perfect insensibility of the texture is followed by a dull wearying sense of distention in the part often most sickening and painful to bear.

The capsular ligament of the hip-joint is, on its outer surface, liberally supplied with vessels carrying red-blood; these take their course through the areola tissue, which surrounds the joint and is intimately connected with the fibrous structures; these afford fluid to the transparent vessels of the part, occasionally after minute injection we may observe a vessel carrying red blood to permeate the fibrous texture; but this, in a state of health, is rare, while in injection after disease the very colour of the ligament is changed, plainly showing its vascular condition—a point of vast importance in the consideration of the changes which happen during the progress of inflammatory action. On its inner surface the ligament is intimately connected with the synovial membrane. By means of subserous tissue, the blood-vessels of this structure also assist to supply fluid for the transparent vessels of the ligaments.

From this description of the anatomical structure of the ligaments of the hip-joint we may deduce the different symptoms which indicate the disease of this structure, and shall be able to comprehend the changes which occur as the result of inflammatory action. It has been shown that a transparent fluid circulates in and permeates the delicate vessels of the fibrous tissue; but that, when irritative action is set up in the parts, these vessels carry the red corpuscles of the blood. As a necessary consequence of this increased supply of blood, the whole texture of the ligament is greatly swollen, and the whole structure now puts on a pink colour, from the amount of the red globules now passing into it; a change precisely similar to that which is plainly seen when the fibrous structure of the sclerotic coat of the eye is under disease. From the character of the vessels of the fibrous tissue, we apprehend that but comparatively few red globules get admission into them, and that none of the white corpuscles of the blood circulate in the inflamed part; although the consistency of the now circulating fluid may be more dense than natural, carrying considerable fibrine, we seldom or never find a deposition of this substance, as plasma, or a formation of pus, resulting in this texture from the inflammatory process; we believe it is a law that seems particularly to mark the presence of this disease, in fibrous textures, dependent upon their unyielding character, and which we do not remember to have seen noticed by authors. We may boldly assert that pus never forms within the texture of ligament; it may be seen upon its surface, but it is formed from plasma, deposited not by its own vessels, but from those of some neighbouring structure. The patient now complains of a dull heavy pain in the hip-joint, a sensation and stiffness is present in the part, which is generally most extreme about midnight, while sometimes a remission is experienced in the morning—the patient often complaining of a sense of weariness and distress down the whole thigh, in probability consequent upon the participation in the disease of some of the nerves which take their course through the neighbouring areola tissue. The dull heavy pain complained of by the patient is doubtlessly dependent upon the distention, which the fibrous tissue experiences from the increased supply of fluid, it serves to irritate the fibrillæ of nerves supplied to the synovial membrane; hence, too, we mark the difference in the character of the pain, now dull and wearying, and, when the synovial membrane is primarily affected, or even after the inflammatory affection of the ligament has extended to that structure, we find it is acute, and often severely lancinating. If, upon manual examination of the joint we find the pain somewhat increased by pressure behind the trochanter major; or, should the pain be also increased, if the patient, resting upon one leg, allows the limb to swing relaxed from the body; now the chief strain and weight of the limb coming upon the capsular ligament, so that the increased amount of pain will make the disease of the ligament sufficiently manifest; sometimes by pressing upon the trochanter major the sensation of pain is apparently relieved rather than increased, because we relax the same structure; this may thereby be a means of deception to the unweary. In acute disease of the ligaments the inflammation soon extends to the vascular structure of the synovial membrane, when a speedy effusion of serum into the cavity of the joint is the result, and a complication of the symptoms, which quickly obscures the distinctive marks of ligamentous inflammation.

(*To be continued.*)

ART. XXXV.—*Puncture of the Bladder above the Pubes, for obstruction of urine, and Cure. By* JOHN WANLESS, ESQR., *of London, C. W., formerly House Surgeon to the Dundee Royal Infirmary, N. B.*

LONDON, C. W., October 3, 1853.

SIR,

If you consider the following case of puncture of the bladder, with a successful issue, worthy of a place in your valuable Journal, it is at your service.

On the 22nd of August last I was called upon to visit James Aird, ætat 33 years, in the Township of Westminster. He had been employed in a brick-yard to dig under an embankment of clay, while doing so the embankment gave signs of falling, and he ran to save himself, but unfortunately fell on his abdomen, over an old heap of rough boulders of clay, with his right thigh extremely flexed upon his body, and his perineum upwardly exposed. The embankment of clay fell upon him in this position; covered him to about four feet in depth; and when taken out of this perilous entombment by his fellow labourers he was apparently dead; but on exposure to the atmospheric "pia mater" he soon showed signs of life. An hour after the accident he complained to me of a severe pain across his pelvis and pelvic joints, and along the course of the urethra. His pulse was weak, and beating 100 per minute; he was breathing laboriously, with a sense of stricture of the intercostal muscles on both sides; skin rather cold and clammy; countenance pale and anxious. The scrotum and perineum very extensively ecchymosed. The lower extremities nòrmal, as to length and position, but completely powerless. A dose of castor oil was administered, and fomentations applied to the bruised parts and chest. On the 23rd, the bowels were opened freely by the oil. Skin warmer, tongue moist and clean; pulse 98, fuller ànd soft; voided no urine; complained very much of pain over the region of bladder. That viscus could be distinctly defined, but considerably distended. He stated that he had been affected occasionally with difficulty of passing his urine, from enlarged prostate. I endeavoured to pass the catheter as gently as possible without effect; called on my esteemed friend Dr. McNogie, who likewise endeavoured to pass the catheter without beneficial results; and after being both foiled in our attempts at relief in this way, we gave it up as impracticable, and left him with warm fomentations applied over the hypogastric region.

On the 25th his bowels were again opened; pulse 110, soft and full; violent pain in the hypogastric region; had voided no urine; bladder very much distended; hiccup; countenance haggard and anxious. He thought that it was impossible for him to live, but wished relief from pain. Again uselessly tried the catheter; proposed puncturing the bladder. He was anxious that it should be done, although he knew of its danger. The perineum being so much bruised, precluded its adoption as a site for puncture. The want of a curved trocar prevented the adoption of the rectum method. The only other method was above the pubes. I made an incision about an inch and a half long, from the symphysis upwards, exactly in the mesial line, and then separated the edges of the pyramidal muscles and pushed the trocar into the distended bladder, which could be now distinctly felt, withdrew the trocar, introduced an elastic gum catheter through the canula into the bladder (the urine flowing through both); I then removed the canula, leaving the catheter in the bladder, and tied it, to prevent escape, by tapes passed round the hips and thighs. On the 2nd of September he made urine by the natural channel, mixed with pus, and continued to do so more and more freely until the 10th Sept., when the catheter was removed. On the 11th Sept. he passed a small piece of bone per urethra about half an inch long, and a quarter of an inch broad, and a sixteenth thick, encrusted on the one side with calcareous deposit, which I here enclose for your inspection; and I have been much puzzled as to its source. Although I strongly suspected fracture of the pelvis across the ramus of the ischium, I cannot fancy how a broken portion of that bone would find its passage into the urethra, in order to obstruct it in the above manner, from the nature of the injury he received.

However, he has continued to do well; is in good spirits, and gradually regains strength.

EDITORIAL DEPARTMENT.

TORONTO GENERAL HOSPITAL.

In one of the previous numbers of the *Upper Canada Medical Journal*, we promised to return to the consideration of the Toronto General Hospital; and we now propose to pass in review the recent movements of the newly appointed Hospital Trustees; to consider their effects upon the Institution, and their influence upon the medical profession generally.

In the first place, we have been informed that several plans and specifications have been laid before the Board of Trustees, and that the plan drawn by Mr. Hay, Architect, of Church street, has been selected, and will be acted upon as soon as proper arrangements can be made. If we can rely on the taste and opinion of our informant, there is every reason to believe that the new Toronto General Hospital to be erected in this city, will be a noble edifice, and not unworthy of the Queen City of the West.

The land on King street, where the old Hospital Buildings now stand, has been laid out in lots, to be leased for building purposes. A few days since the leases were offered for public competition, when the whole of the property was readily taken up, and it is said that the rents to be derived from it will amount to upwards of eight hundred pounds per annum.

In the second place, with regard to the intended site of the new hospital, the Trustees have declared that it will be located at the eastern part of the city near the River Don. Now, we conscientiously believe that there are cogent reasons against this situation being selected; one, and the most strenuous, is its disadvantages to the public. If the hospital is placed at the eastern extremity of the city, only picture to yourself the necessity of conveying in the middle of winter, perhaps upon a shutter, any poor man who may chance to meet with a serious accident at the western end, a distance of four or five miles, before he could be received into hospital; the state of depression which always attends the more severe kinds of accidents, and which demand immediate attention, with rest, warmth, and cordials—these could not obviously be used in many cases, until all hopes of saving life were at an end. Again, there is an objection with regard to the situation. It is said that the situation is comparatively a high one, and that the building will be considerably elevated in itself, and being thoroughly ventilated, and properly heated, there is no fear of the baneful influences of malaria. That the proper heating and effectual ventilation of the new building will doubtless go very far to obviate the engendering of the poisonous miasm, which is the curse of the present hospital, we are ready to hope; but that the intended site of the new hospital is completely removed from all the influences of marsh miasmata, engendered by the alluvium drifted down the River Don, and located at the eastern part of the harbour, we are not so perfectly sure. When we consider that during the past summer ague has prevailed very extensively throughout the east part of the city, so that scarcely a house has been free from its visitation, how shall we expect the new General Hospital to escape its influence? certainly the only chance for it to escape is to select the most elevated situation, and to raise the hospital building as high as possible. The known laws of marsh miasma, in this temperate region of ours, leads us to believe that as the atmosphere which holds the poison, as it were, in solution is submitted to the influence of the sun's rays, it becomes specifically lighter and more attenuated, and by a natural law ascends far above us; at this time we take into the lungs, during the act of breathing, a less dose of the poison, not sufficient to contaminate the blood, or to produce any very marked effects upon the constitution. When the sun is high and its influence greatest, then does the decomposition of the dead animal and vegetable matter located in the marsh proceed with the greatest rapidity, then is the poison rapidly generated and as quickly elevated into the upper regions of the air; but as soon as night returns, the cold consequent upon the cessation of the influence of the heating rays of the sun causes the heavier matter of the atmosphere to descend, and vastly augments the quantity of poison in the air we breathe, and will be sure to produce its effects, be they ague or be they remittent fever, according to the amount of the poison received, and the state of the constitution. Doubtless, a situation immediately on a level with the marsh would experience the most intense influence of the poison, and that a more elevated and distant position would not be so likely to suffer; but it must be remembered, that the atmosphere which contains the poison is submitted to the action of the wind, and whenever a moderate south wind should blow, at particular seasons of the year, it would convey, especially during the night season, a very powerful dose of malaria to locations placed within its range; and that the selected site of the new hospital is one of them, we believe. These reasons, we are inclined to think, should form an objection to the Toronto General Hospital being located at the eastern extremity of the city. It must be confessed that, in all probability, the influence of this malaria would be confined particularly to the season of autumn; but, however slight or temporary this morbid influence may be, it is certain that the patients in hospital should not be submitted to it, if it could by any possibility be avoided; it is certain that there are plenty of places in the city of Toronto that are not subject to this influence.

Lastly, and not least in importance, the location of the Toronto General Hospital in the extreme eastern portion of the city will be a great inconvenience to the medical students, who are obliged to resort to it in search of practical knowledge. It would uselessly occupy a great portion of their valuable time in walking from one place to another; and to the students of the Medical School of Trinity College, it would be a great injustice and almost prevent the possibility of the pupil attending the medical classes and the Hospital at the same time,—the distance between the one and the other would not be far short of four miles, and in our opinion will be almost sufficient to break up the school. For these reasons, we would certainly suggest that it would be well for the *Board* of Trustees of the Toronto General Hospital to reconsider their resolution, and, if it be possible, to locate the building in a more central and fitting situation.

It has been used as an argument against the retaining of the Hospital in its present situation, that it would be an obstruction to any improvement in its immediate neighbourhood: nothing could be more erroneous in idea, with regard to a properly built and well-regulated Hospital, such as the necessities of the city of Toronto demand at the present time. Let any person only view the beautiful and elaborate plans submitted to the Hospital Trustees, and we are convinced that he will be easily satisfied that the magnificent building about to be erected will be an ornament and improvement to any neighbourhood in which it may be located. The fears expressed against a well-regulated Hospital of which we speak, are as absurd as they are unfounded. Only look at the city of London, for example; some of its most noble edifices are dedicated to the cure of disease. Strangers would take the hospitals to be palaces, in that city of magnificent and lordly buildings; then, again, their vast extent, for they contain beds and conveniences for the treatment of 100,000 patients. The magnificence of their exterior is not considered derogatory to the palaces which surround them—take, for example, St. George's Hospital, which is located in immediate proximity to Apsley House, the palace or town-house of the late Duke of Wellington. Again, the Borough and St. Bartholemew's Hospitals are situated in the most densely populated and most business parts of the city of London—and at once stand out in bold relief as the most magnificent buildings in their immediate neighbourhood. If we view the interior of these buildings, we shall find them roomy and well ventilated, and of the most scrupulous cleanliness, furnished with all the appliances of comfort and convenience compatible with the purposes for which they are intended

These magnificent piles of buildings have been for the most part erected as the result of public charity, having been built by subscription and private endowment. We hope to see the Toronto General Hospital about to be built bear, at least, a humble comparison with those noble edifices, and trust it will be located in a conspicuous and healthy situation,—then shall we feel an honest pride, that in our day and generation we have at least done one good thing; and by fearlessly expressing our opinion with regard to the disadvantages and abominations of the present hospital building, we have been indirectly the means of erecting the new one.

Then, again, these immense medical establishments in London have the advantage of one of the most enlightened and scientific corps of medical officers in the world, some 8,000 of whom give gratuitously their services to the poor. In many cases the honour and privilege of officiating as house-surgeon only, and that but for a limited period, has to be purchased by heavy fees, and requires immense interest to obtain the appointment; when successful, it gives the fortunate applicant a standing and position in the medical profession, that serves him during after life. What a noble field for observation in medical and surgical science do such institutions present, and what safe and comfortable refuge for the poor during sickness and disease? Such establishments at once place the poor during sickness on a level with the rich; for here the poor have granted to them, without money and without price, the aid and assistance of the most exalted medical talent, the most scientific surgical skill, the world can produce—services which are not yielded to the rich without the payment of the most magnificent fees: here exists a kind of compact between poverty and science, that beneficially aids and assists one another. Here, the truly industrious medical officer has a field in which to improve his mind, to augment his knowledge and test his observation, in a manner incompatible with private practice. The book of nature is fairly laid open before him; his observations and deductions are submitted to the severest tests; his practical skill, at the same time that it is fostered and encouraged, is placed under the severest trials of public observation and approval. Under such training, a medical man's progress must be onward; if he will fill the office, he must unhesitatingly do its duties or be exposed to the ridicule and animadversion of his compeers. Here, there is no monopoly, no skulking; the medical officer must do his duties with regularity and effect, or he justly receives the denunciations of the medical press; if he is shown to be unworthy of the confidence reposed in him, he has to resign his office, and to make way for a better and more industrious individual —a wholesome state of affairs, conducive to the public good and the advancement of science.

These institutions also present a noble school for the teaching and training of youth in the practice of the medical profession — for, after all, a practical knowledge of our profession is only to be obtained at the bedside of the patients — it is the only basis on which to rest our hopes of successful practice during after life. Without such a foundation, a school of medicine is comparatively valueless; it certainly affords an opportunity to teach the principles and lay the ground-works of science, all very necessary in their way; theory alone is apt to be vague and indefinite, but with nature before us, the natural aberrations of mental conclusions are counteracted, and the truth more powerfully and permanently fixed in our minds. It is a certain fact, now a-days, that no school of medicine can prosper, can be really beneficial to, or do its duty effectually to the medical student, unless it has an hospital for its basis. Look at the celebrated schools of Mr. Carpew, of Sir Joshua Brooks, of Sir Charles Bell; these, for example, with such splendid talent, such world-wide fame, especially that of the Windmill-street School— yes, and with all the fame of the Hunters to back it — have died and passed away before the utilitarian spirit of the age. These schools could not stand, because they were not immediately connected with some great hospital — they had no basis on which to rest for practical knowledge; and such must be the fate of every medical school that is not attached to a public hospital. That such a school of medicine must ultimately be attached to the new Toronto Hospital we have reason for believing, and that at no distant time it will absorb the present schools. We candidly believe that if such a union could amicably be accomplished, it would be for the public good. In saying thus much, we disclaim any desire to injure any of the present medical schools, such would obviously be contrary to our individual interest; but as impartial journalists, we despise the idea that selfish views should constrain our efforts for the public good. There are reasons, to us apparently of paramount importance to the medical profession generally, that would lead us to these conclusions; it is an amelioration of that dreadfully antagonistic and violently selfish feeling that appears so rampant at the present moment; which is a sure means of preventing the improvement of the profession, and a chief cause of its degradation, which must continue to retrogade and sink in public estimation, unless some means be found to obviate or lessen it. A proper incorporation of the profession would doubtless be a means of accomplishing this desideratum to a considerable extent; but unless we can have more unity of action, and better agreement among the members of the profession here, that cannot be accomplished. In these political and private squabbles, science is entirely disregarded, and the mind languishes under its withering influence; and was it not for assistance which it receives from other sources, would speedily evaporate from among us. Let it be remembered that union is strength, and that at the present moment some mighty effort is necessary to place the medical profession on some better basis, and in a fairer light before the public. It may be said that as a Churchman, we are, by a recommendation of a union of all the medical schools in Toronto, and their incorporation with the hospital, likely to injure Trinity College. We are convinced that, from the reasons we have shown above, such union is necessary to the profession generally and also to the well-being of the hospital itself. If the medical school of Trinity College is continued independent of such union, it must either absolutely absorb the hospital as the school to teach the practical departments of a professional education, or Churchmen will have to build an hospital in connection with that institution. Already have the professors of Trinity College absorbed the sole attendance upon the Poor House and the Toronto Dispensary, and if the spirit of illiberality and exclusiveness lately witnessed at the former of these institutions, with respect to the poor man Kane, is to be an example, the profession will have everything to fear when they get full possession of the hospital. Already the elements of antagonism and strife are rife in the hospital; how, in the name of common sense, could it be otherwise, with such various interests continually operating — some medical practitioners being anxious to absorb the others' patients and as many of the medical students as chance may throw in his way? Such a state of affairs, we fear, will lead to lamentable results, will have the effect of degrading the profession still deeper, and will end in the greatest tyrant driving out of the hospital all practitioners but his own favourites; such will certainly destroy all hopes that science shall be advanced or the interest of the poor attended to. Take away these elements of strife; unite their interests, by incorporatingt he medical school with the hospital; and we may hope that, after a time, this miserable state of affairs may somewhat subside, and the interests of science receive a due attention and grant a fair reward. As a Churchman, we conscientiously believe that science is comparatively valueless, without the previous direction and teaching of the truths of Holy Writ, and hail the advent and fervently pray for the success of the Theological department of Trinity College; doubtless, the truths of religion should *guide* and *direct* the professors of medicine, but its ministers should not *command* it. Religion and medicine should twine around each other, and should support one another — they were both ordained for a holy mission upon earth, for the good of man — the one to relieve the body, the other to save the soul; both have independent duties to perform, and must stand free and unshackled, or their influence will be cramped and their energies paralyzed. We trust that we have given many and powerful proofs of our attachment to the Church of our Fathers; and what is more, we are neither afraid nor ashamed in these days of expediency and deceit, openly to declare our readiness to spend and be spent in her cause. Still, as public journalists, we owe a duty to the medical profession, which compels us to recommend the union as the only means of advancing the good of the public, and the advantages of the medical profession generally. If the medical profession sink, the public must suffer, and the science of medicine be degraded. It shall be our endeavor to use our humble efforts to establish a more desirable state of things.

A point which we must not forget to notice in connection with the Toronto General Hospital, and which we have observed with great satisfaction, is, that the Trustees have revised the hospital rules, and while they have required the daily attendance to be most strictly enforced, for the benefit of the medical students and the hospital patients, they have most liberally thrown open the attendance upon the hospital free, to all the licentiates of the Province who may choose to accept it.

TO THE READERS OF THE MEDICAL JOURNAL

Our readers may observe that we have presumed to offer to them, as an original article, Dr. Gluge's celebrated work on Pathological Histology, translated from the German by Dr. Leidy, of Philadelphia. We thereby hope, as far as in us lies, to spread the fame of the author, and to make our readers acquainted with his opinions on the most important branch of our science.

We have to acknowledge the return of the *Medical Journal* from certain medical professors of Trinity College. We confess we feel ourselves humbled and abased, that an upright and independent course should call down the undisguised opposition of such liberal and enlightened personages. When the *Journal* was the organ of Trinity

College, it was freely supported and largely extolled by them; but as soon as it has ceased to be under the control of the professors of the medical department of that institution, it is discarded and opposed. We doubt not but this opposition proceeds from the same spirit of "envy, hatred, and all uncharitableness" that caused the attack upon Drs. King, Herrick, and Beaumont, before the Board of Hospital Trustees during the past year, and will meet with similar public reprobation. While such selfish and illiberal feelings guide any part of the medical profession in Toronto, how is it to be expected that a union of parties, so necessary to the well-being and advancement of the medical profession, can possibly take place? We flatter ourselves that the bare expression of so illiberal a spirit from these gentlemen will raise the *Journal* in the estimation of all who can fairly estimate such conduct. We have independently expressed our mind on all subjects connected with the well-being of the profession, and are resolved to continue to do so, let the consequences be what they may. Notwithstanding the spirit of opposition we have evoked from the parties above alluded to, in this city, we are truly happy to find that the country generally appreciate our endeavors, and that the *Medical Journal* is likely to meet with cordial encouragement and a very extended circulation.

To the Editor of the "Medical Journal."

DEAR SIR,

It is a mere matter of fact that the expenses of living in Toronto have increased most enormously within a few years, and the remuneration of almost every description of labour, whether mental or bodily, has increased also. The practitioners of our profession, however, are among the exceptions to this last improvement; and, although their expenses are increased at least from twenty-five to thirty-three per cent. over what they were eight or ten years ago, their fees remain the same. What is of more consequence is, that while there are the most decided reasons to expect a further *rapid* and *great* rise in rents and prices, there is not the slightest probability of their fall at any future period. Thus the medical practitioner is being reduced, in fact, to a lower state in society. Very few of us expect to earn more than a moderate and decent subsistence by our profession; and while we all know that more is not to be made by it, we also know that even that moderate expectation is only to be attained by constant and wearing hard work both of body and mind. Mechanics can afford to waste whole days on "excursions," or to remain idle for days together if a particular "boss" does not please them—they are, as a body, thriving, making and accumulating land and property. None can wish to interfere with their honest gains; but, Sir, should not that class on whom so much depends—whose usefulness depends so much on their education, and whose education is not only expensive but unfits them for manual labour—be permitted to share in the general prosperity?

Our fees are too low. Compare them with Montreal and New York, and with the actual state of society here, and you will admit that they ought to be augmented in proportion to the remuneration of other classes. If we will steadily unite, we may do much ourselves; and I am very certain we shall be supported by a large portion of those classes of society who consider that a medical gentleman should be not only in education but also in outward appearance above the ordinary workman.

I remain, Sir,

Your obedient servant,

A PRACTITIONER.

There is much truth in the statements of our Correspondent with regard to the depressed state of the medical profession in Canada West; we however fear, with the present feeling of the profession in Toronto, we cannot hope for sufficient unanimity to make any effective move in the matter. Perhaps it would be well to call a public meeting of the medical profession, and to take their sentiments upon the subject. If *A Practitioner* would make a movement in that direction, we should be ready to give it every publicity in our power.

Since the above was in print, a public meeting of the medical profession of Toronto has been held at the Toronto General Hospital, when Dr. Widmer was called to the chair. Speeches were made by several gentlemen, and a resolution was passed appointing a committee to prepare the draft of a tariff of fees. It was argued by some of the gentlemen present that a scale of fees was necessary to enable the judge to form a proper opinion in cases in which a medical man's fees were disputed; while by others a tariff was ridiculed as worse than useless, as it was a standard that all could not possibly maintain. The worst point, however, that strikes us in this matter, arising from the promulgation of a high tariff is, that persons able and inclined to pay a moderate charge will make it an excuse for not paying anything at all, unless they shall be obliged to do so by law. This is a proceeding that always places a medical man in a most unpleasant position, and is certainly derogatory to the honor and character of the profession. With regard to the tariff to be adopted by the profession in Toronto, do the gentlemen who advocate it mean it shall be a law or regulation for the profession generally? If they expect that the country practitioner is to be bound by it, why should he not be consulted? It surely cannot be just to make laws or regulations that shall have a partial effect. If a tariff is desirable, let the Parliament fix just and liberal charges. We are convinced that such a step would do more to restore the confidence of the public in the medical profession than any party movement that can be made. The patient would know what he has to pay, and the practitioner what he has a right to expect; besides, this would remove all objections to the incorporation of the profession, permit the adoption of the penal clause, and be advantageous to the profession and the public.

SELECTED MATTER.

A COURSE OF LECTURES ON ORGANIC CHEMISTRY.

Delivered in the Laboratory of the Royal Institution of Great Britain, by Dr A. W. Hofmann, F. R. S., Professor at the Royal College of Chemistry.

Lecture II.

Gentlemen:

If we glance at the vast number of compounds which the element carbon forms with hydrogen or with hydrogen and oxygen, or with the latter two elements and nitrogen—a number which has been rapidly multiplied during the last twenty years by the united efforts of so many cultivators of this branch of science—if we consider, moreover, that, so far as we can foresee, this number is capable of being increased—I might almost say *ad infinitum* —the mind seeks anxiously for some thread which may serve as a guide through the intricacies of this labyrinth. The first thing that strikes us is the necessity of a simple classification of these numerous compounds.

When we treat of inorganic chemistry, divisions and subdivisions of the subject present themselves very naturally in the diversity of the components of the ordinary mineral compounds. This mode of classification is, however, inapplicable in organic chemistry, (I may henceforth be allowed to use the term "organic" for representing that class of compounds which I have endeavoured to delineate in my last lecture.) inasmuch as in the composition of organic substances but a very limited number of elements is involved. Several attempts have been made to classify organic substances according to other principles, varying with the position of this science at different periods. At one time chemists were satisfied to group the substances according to their origin, and hence the subdivision, very frequently adopted even at present, of organic chemistry into vegetable and animal chemistry. You observe that this classification rests upon the arrangement of natural history. The compounds derived from the vegetable or animal kingdom were again roughly grouped according to their most salient chemical characters: for example, as acids, bases, and indifferent substances. This mode of classification possessed undoubted advantages at the time it was proposed: it formed a necessary step in the upward progress of chemical science; but it became more and more inadmissible in proportion to the increase of the sources of organic compounds and to the number of substances derivable alike from the animal and vegetable kingdoms. Moreover, in the same measure as organic compounds increased, acids, indifferent substances, and bases began to graduate so imperceptibly into each other, that in a great many cases it became doubtful under which of these three heads a given compound ought to be placed.

All attempts at classification which are at present being made (I say attempts, because the time for a definite and lasting system has scarcely come) are based upon another principle, which again serves to contradistinguish organic from inorganic compounds. While in inorganic chemistry it is, as was stated, the *quality* of the elements which assists us in synoptically arranging the mineral substances belonging to this department of the science, it is in organic chemistry the *quantity* of the few elements producing so vast a number of compounds which forms the basis of classification. It is not my intention to enter more fully into the subject of classification at present; in order to do this successfully, it is necessary that a certain amount of material should be at our disposal, that we should be already acquainted with a certain number of organic compounds. The object of these brief remarks is to direct your attention, even at this early period, to the interest belonging to the quantitative relations of organic bodies and to the importance of the methods of ascertaining these relations with facility and precision.

In this and in the next lecture I intend to describe to you briefly the methods which are at present used for determining the composition of organic substances. It is by no means my intention to instruct you in organic analysis,—to accomplish this, laboratory practice is indispensable;—my object is to put you in possession of principles. I will therefore avoid entering into details as far as possible, confining myself to an account of the more important processes which are actually in use. Enabled as I am to illustrate these processes by actual experiment, I hope they will be sufficiently interesting. But, after I have shown you the methods of analysing, I shall have to claim your attention to a few calculations, which, simple though they be, may to many be not acceptable; I have to explain to you how from such experiments we proceed to establish a chemical formula. Now I consider this a most important point, the very basis of all our future discussions; and I earnestly entreat you to give me a patient hearing. I hope to convince you that the apprehension of these formulæ, which are dreaded by some, as much as they are cherished by others, requires no mathematical attainments whatever.

In estimating the quantities of the constituent elements of organic compounds, it might appear to be the simplest method to separate the several elements, and to weigh them in the isolated state. In fact, such attempts have been made, but they were confined to the earliest stages of organic analysis. An isolation of the elements is generally attended with very considerable, if not insurmountable difficulties. In one case only, viz., in that of nitrogen, the separation as such is easy; but even nitrogen is not usually estimated in the isolated state.

The principle universally adopted in organic analysis consists in the conversion of the elements into compounds of salient properties, the composition of which is accurately established, and which may be readily produced, collected, and weighed. For this purpose, both the carbon and hydrogen are oxidized; the former being converted into carbonic acid, the latter into water; while the nitrogen, provided it is not determined in the free state, is made to unite with hydrogen, and estimated in the form of ammonia. The oxygen is never directly determined; but, the quantities of carbon, hydrogen, and nitrogen being ascertained, the remainder of the substance is inferred to be oxygen.

In order to proceed from the simpler to the more complicated case, let us assume that we have to analyse a substance containing carbon, hydrogen, and oxygen, but no nitrogen. Such a substance would yield, when heated in atmospheric air, or, better still, in pure oxygen, carbonic acid and water. The formation of these products presents no difficulty, but how are we to collect them? The method which originally suggested itself, viz., to perform this combustion in vessels containing free oxygen, has been altogether superseded by using instead of (or at all events together with) free oxygen, an oxygen-compound as the agent of combustion, which is capable of giving up its oxygen with ease at a comparatively low temperature. Such a substance is the common black oxide of copper. To convince you of the facility with which this compound yields its oxygen, I will introduce this Florence flask (the outer surface of which has been covered with a thin layer of this oxide) into the flame of an ordinary gas-burner. The very moment the oxide comes in contact with the combustible substances in the interior portion of the flame, it is deprived of its oxygen,—it is reduced (as we call it); and you now observe the brilliant lustre of metallic copper. If I remove it from the flame, the hot copper, coming in contact with the oxygen of the air, is oxidised again; showing that copper absorbs oxygen with the same facility with which it loses it.

But the following experiment may illustrate this point even in a more conspicuous manner. In this mortar I mix a small quantity of sugar, with finely-divided black oxide of copper. The intimate mixture is now introduced into a little retort, which is fitted into a tubulated receiver provided with a gas-delivery tube. On the application of heat to the retort, you observe that an active combustion goes on at a comparatively low temperature. The reduction of the copper becomes apparent from the red colour which the mixture assumes; and water collects in the receiver; while from the delivery-tube a considerable quantity of gas escapes, which, producing as it does a dense white precipitate in baryta-water, is at once recognised to be carbonic acid. Now, a perfectly analogous apparatus is used in organic analysis, with this difference only, that, while the contrivance before you was calculated to *exhibit* the products of combustion, the apparatus actually employed admits of *collecting* these products and weighing them.

The arrangement before you presents this apparatus in the simplest form The retort, you observe, is replaced by a long glass tube. Instead of the receiver, we have a tube containing chloride of calcium,- a substance which you probably know, absorbs moisture with the greatest avidity; while, lastly, for the delivery-tube dipping into baryta-water, there is appended a piece of apparatus to which I must call your particular attention It is filled with a concentrated solution of potassa, and serves to arrest the carbonic acid generated during the combustion. This little instrument, known by the title of Liebig's bulb apparatus, was invented by the celebrated chemist whose name it bears. The construction of this apparatus, simple as it may appear to you, has been most signally conducive to the development of the chemistry of carbon; it may be truly said, that this branch of science, as such, dates from the invention of the potash bulbs But let us examine a little more closely the advantages of this instrument, which I am enabled, as you observe, to exhibit to you in rather magnified dimensions. You observe, the gas enters at one end of the tube; it passes into one of the lateral bulbs, where it first meets with the potassa, it is next forced through the liquid column standing between the first and second bulb. In this second bulb, it remains for a moment until the bubble has been sufficiently enlarged to pass through the layer separating the second and third; this third larger than the others, retains it somewhat longer before it passes into the fourth. In this the absorption is generally complete; but, to secure the last traces of carbonic acid, the gas is washed once more by a vertical column filling the second limb and part of the fifth bulb. But I will show you experimentally how well this instrument fulfils its object. It consists of a common apparatus for generating carbonic acid, constructed, as you see, upon the well-known principle of Doebereiner's hydrogen lamp. This generator is connected with a T piece, provided with two stopcocks, which enable us at will to direct the current of carbonic acid, either through this lateral delivery-tube, which discharges into baryta-water, (the white precipitate in which shows you that we have actually carbonic acid), or through the potash apparatus. Now, you observe, we have rather a rapid current of this gas; but scarcely a bubble passes through the bulbs. The gas which passes through is nothing but the air originally contained in the apparatus In order to prove this, we will pass it into baryta-water, and, you observe, not a trace of a precipitate is produced.

But let us return to our combustion apparatus. You will admit, that the arrangement for collecting the products could not be simpler and more effectual. But how is the combustion actually carried out? For this purpose the combustion tube (this is the term used in the laboratory to designate the retort) is carefully filled with a mixture of freshly-ignited oxide of copper, and an accurately-weighed quantity of the substance which it is intended to analyse. This quantity is generally very small; from five to six grains are usually sufficient. We employ, of course, a far larger quantity of oxide of copper than is actually necessary for complete combustion. The mixture being introduced, the tube is laid horizontally on the table, and gently tapped, so as to keep its upper part clear and to allow a free passage to the gases generated during the combustion It is now placed in a furnace of iron plate, with a perforated grating to admit of a regular supply of air The tube is supported at small distances by a series of iron pillars, which prevent it from collapsing, if it should become soft on the application of too great a heat. The tube is next connected by means of a perforated cork with the chloride of calcium tube, and then by means of a little caoutchouc connector with the potash bulbs; the weight of the chloride of calcium tube and that of the potash bulbs having been previously determined in an accurate balance.

The combustion might now commence, if we were sure of all the joints being perfectly air-tight. this is readily ascertained by experiment For this purpose we remove, by means of a suction-tube, a small quantity of air from the apparatus, and thus raise a short column of potassa in one of the lateral bulbs, the solution having originally stood level in both. If this column is sustained for about ten minutes, we consider the joints sound, and the combustion may commence.

The fuel employed by Liebig, and, in fact, almost universally used, is charcoal. The tube is slowly and gradually covered with ignited charcoal, commencing at the outlet end To avoid too rapid a propagation of the heat by radiation, the posterior portion of the tube is protected by a screen, which is gradually removed farther and farther from the outlet end. Water and carbonic acid soon make their appearance, the former being absorbed by the chloride of calcium tube, while the latter, unaffected by this salt, passes into the bulb apparatus

An hour or an hour and a half is sufficient to finish the combustion; the termination is recognized by no more gas-bubbles passing through the potash bulbs. But, although the combustion is complete, the products of the combustion are by no means entirely lodged in their respective receptacles; the whole tube is still filled with the vapour of water and carbonic acid gas. In order to collect the last portions of these compounds, we break the posterior point of the tube, and suck a slow current of air through the apparatus, which, displacing both the water-vapour and the carbonic acid, concludes the operation It remains now only to detach both the chloride of calcium tube and the potash apparatus, and to separately determine their increase in weight. We have then all the data necessary to calculate the percentage composition of the substance we have burned.

The method which I have described to you is that originally proposed by Liebig, and still employed by him; it is the method by which the great majority of organic compounds at present known have been analysed. The great merit of this process is the simplicity both of the apparatus and of the manipulation; it was in consequence of this simplicity that the apparatus became accessible to every one, and that so great a number of chemists were enabled to engage in the analysis of organic substances.

There are a few points to which, before leaving this subject, I have still to call your attention. The hydrogen of the organic compound to be analysed being always determined in the form of water, it is obvious that every source of accidental moisture has to be carefully excluded. For this purpose, the substance is submitted to analysis in a state of perfect dryness. The desiccation is generally accomplished in a water-oven, most substances losing their hygroscopic moisture at the temperature of boiling water. Should this be insufficient, they are introduced into a bent glass tube, open at both ends, which may be immersed into a vessel with boiling water, the temperature of which has been raised by the addition of common salt, chloride of calcium, etc., while a current of perfectly dry atmospheric air is sucked through the apparatus by means of the apparatus called an aspirator. The desiccation of organic substances is generally sufficiently easy, but it is extremely difficult to introduce them into the combustion-tube without moisture being absorbed from the atmosphere during this operation As we have seen, they have to be mixed with black oxide of copper, which is itself an exceedingly hygroscopic substance; moreover, the success of the analysis depends so entirely upon the care bestowed in making the mixture, that this operation invariably requires a certain length of time It may happen, that the combustion-tube, when filled, already contains a certain quantity of water; this uniting, as it must, with the water formed during the combustion itself, will of necessity raise the percentage of hydrogen found in the analysis. In many cases, especially when substances contain but a trifling quantity of hydrogen, (frequently compounds contain less than 1 per cent.,) a very serious error would be thus introduced into the determination of the hydrogen. To avoid this error, Liebig described a method for removing all accidental water before the combustion was commenced. It consists in surrounding the filled combustion-tube with hot sand, and removing the moist air by means of an ordinary hand-syringe; by opening the stop-cock of the syringe, air is now again admitted; but this air has previously to pass through chloride of calcium, and is thus entirely deprived of moisture before it reaches the combustion-tube. By repeating this operation four or five times, it is possible to replace the moist air of the tube with dry air; in other words, to remove the adventitious water.

Those who are in the habit of making organic analyses are of opinion, that the exhaustion of the combustion-tube is by no means the most agreeable part of the operation; it is, in fact, frequently omitted, it being, in that case, understood that the amount of hydrogen found is somewhat in excess.

On the other hand, a trifling deficiency is sometimes observed in the amount of carbon as furnished by this process; this arises often from the mixture of the substance with the oxide of copper not having been made with sufficient care; sometimes, however, it is owing to the peculiar character of the bodies which are analysed. Many substances, such as fibrin, albumen, etc., when heated, give off a large amount of combustible gases, while a difficultly-combustible carbon remains behind; thus it happens, that the oxide of copper having been reduced very completely in some places by the gases at first evolved, particles of carbon may remain unburnt among the metallic copper. In such cases, it is necessary to complete the combustion in a current of oxygen, which may be readily attained by placing a few fragments of chlorate, or better still, of perchlorate of potassa, in the posterior part of the tube; the oxygen disengaged from these salts in the last stage of the operation consumes any trace of carbon which may have remained in the tube.

The fuel originally, and still most extensively, employed in organic analysis is, as I have stated, common wood charcoal. In some parts of Germany, however, especially in the north, the charcoal has frequently been replaced by spirit of wine, and within the last year some attempts have been made in England to accomplish the combustion by means of coal gas. The change in the fuel necessarily involves some modifications in the process of the analysis, the apparatus certainly loses somewhat in simplicity, but several advantages are gained, which appear to compensate for the complication. An arrangement for effecting the combustion of organic substances by means of coal gas, is placed before you on the table. You recognize at once the original arrangement of the combustion apparatus. You also observe a combustion tube filled with black oxide of copper, a chloride of calcium tube, slightly modified in form, and Liebig's potass bulbs. But you see several appendages which I have to explain to you. First, let us look at the combustion furnace, whose construction will be at once obvious.

It consists of a long box of iron plate, with a perforated bottom, and a top of wire gauze; this box is divided by an iron plate into a longer and shorter division (which I will distinguish as the front and back division). In the front division a perforated gas-pipe is fixed, parallel with the longest axis. The gas issuing from the holes in this pipe mixes in the chamber provided for that purpose with the atmospheric air entering through the bottom, and passes through the wire gauze, where it may be lighted, thus furnishing what is called in chemical laboratories the air-flame of coal gas; the cooling effect of the wire gauze prevents the flame from rushing back into the chamber. The back division of the apparatus has a rather more complicated construction. In the first place, you observe that it is again subdivided, by means of iron plates, into four compartments; then you see that it is provided with two gas pipes, instead of one; each of these pipes is furnished with a moveable piston. To the arrangement and working of these pistons allow me to call your attention for a moment, for on their proper adjustment depends the success of the operation. The lower one is simply a perforated tube like that of the front division, it is supplied with gas in front, at its left-hand extremity. As the piston stands at present, the gas passes only into the first compartment; and on lighting it over the wire-gauze at the top, we obtain a narrow sheet of flame, corresponding in width with the compartment; but on pushing the piston further along the tube, we allow gas gradually to enter into all the compartments, and increase the flame over the wire-gauze in the same measure as we proceed. As soon as the piston reaches the other extremity of the tube, we produce on the whole extent of the wire-gauze covering the back division of the apparatus, the same kind of air-flame which we originally saw lighted on the wire-gauze top of the front division. The arrangement of the upper pipe is different This pipe is supplied with gas at the opposite, the right-hand extremity. It is provided, moreover, with two rows of straight tubes, of very small bore, similar to those used in Leslie's burner; the open ends of these tubes pass through the meshes of the wire-gauze. As the piston is represented, the gas is supplied only to the two first tubes, (one on each side of the axis of the combustion-tube,) and may be lighted at the ends, forming, according to the quantity admitted, two larger or smaller jets of gas, which may be reduced to mere points of flame. By drawing out the piston I may light one pair after another, until the whole series is in combustion. The upper and lower tubes are perfectly independent of one another.

Now, complicated though this machinery may appear, it works with the greatest facility and precision. Of this I hope to convince you by experiment. Let us perform an actual analysis together. In this case we use a tube, open at both extremities. This tube contains a layer of perfectly pure and unmixed black oxide of copper, corresponding in length to the front division. By exposing this oxide to the air-flame in the latter, while a current of perfectly dry air is forced through it from one of the gas-holders, which, as you observe, may be connected with our apparatus, we expel every trace of moisture which the oxide of copper, may have absorbed during the process of filling. We next introduce the substance which we desire to analyze (I have taken sugar), and which, as you observe, having been put into a little boat of platinum foil, is placed in the combustion-tube; the boat occupies that portion of the tube which is situated over the back division of the combustion furnace. This being accomplished, the combustion-tube is connected in front with the chloride of calcium tube and the potash bulbs; at the back with the system of U-shaped tubes, containing sticks of potassa, and pumice-stone, moistened with sulphuric acid, and ultimately with the two small gas-holders I have already mentioned, and which are filled respectively with common air and oxygen. We now light the air-flame of the whole front division: so soon as the oxide of copper is in a state of full ignition, we open the stop-cock of the air gas-holder, and again force through the apparatus a slow current of air, perfectly dried, and deprived of any trace of carbonic acid it might contain by the system of tubes through which it has to pass. The rate of the current may be ascertained and regulated by the number of bubbles passing through a small bottle filled with sulphuric acid inserted for the purpose. We next begin to work with the back division of our apparatus; we push forward the piston of the lower tube, so as to admit gas to the first compartment, which enables us to expose the very extremity of the tube to an air-flame similar to that to which the oxide of copper is exposed all the while. We now slowly pull the piston of the upper tube, supplied at the time with a very moderate quantity of gas; the several pairs of jets being lighted successfully, we succeed in gradually exposing the boat containing the substance to a slowly increasing temperature. The substance begins to be decomposed, and a portion of its carbon and hydrogen is evolved in the form of volatile products. These vapours are carried by the forward current of atmospheric air towards the red-hot oxide of copper, where they are rapidly converted into water and carbonic acid, which are collected as usual in the chloride of calcium tube and the potash bulbs. These bulbs are in our case connected with an additional little tube, containing sticks of potassa. The object of this tube is supplemental to the action of the bulbs if the operation should proceed too rapidly, but chiefly to arrest any aqueous vapour which might be carried off from the potash bulbs by the current of air. The expulsion of all volatile matter from the substance to be analysed (the distillation of the substance, as it may be called), requires generally from ten to fifteen minutes; sometimes the whole substance is thus volatilized: in some cases, however, a portion of carbon remains behind. In order to burn this, the gas is turned off from the jets, and the whole platinum boat exposed to the action of the full air flame, which (by pushing forward the piston of the lower tube) is made to play over the whole wire gauze top of the back division. After a few seconds, the carbon has assumed the highest temperature it is capable of reaching in this apparatus. The current of air is replaced by a slow-stream of oxygen from the second gas-holder. As soon as the oxygen meets with the carbon, you observe a brilliant phenomenon of incandescence; the carbon is rapidly converted into carbonic acid, and after a few minutes, the platinum boat is perfectly clean and empty. The current of oxygen is still continued for some time, in order to re-oxidise the copper which has been reduced by the combustion of the volatile products the operation is finished so soon as the presence of free oxygen becomes perceptible in front of the potash tube, which may be recognised by a glowing match being held before the orifice of this tube. The current of oxygen is now interrupted, the apparatus detached, and the chloride of calcium tube, and potash bulbs are weighed, after the oxygen, which, as you recollect, is a little heavier than air, and moreover more soluble, has been replaced by sucking a current of air through them. The tube, still red hot at this time, is allowed slowly to cool, by gradually turning off the gas.

This mode of burning has many advantages, some of which I may be allowed to point out to you. The amount of carbon and also of hydrogen, especially the latter, is ascertained by this process to a degree of nearly absolute accuracy, since every trace of accidental moisture is excluded, the operation of mixing being altogether avoided The absence of accidental moisture enables us to use very minute quantities of substance, from two to three grains being in many cases quite sufficient,—a circumstance which materially accelerates the operation The first putting together of the apparatus of course takes some time, but, once fitted up, an analysis is made with great dispatch, inasmuch as the tube after the termination of the first combustion, is quite ready to receive another substance, the oxide being ignited and re-oxidised in the previous operation. Moreover, the same combustion tube may be used six or eight times, whilst in the ordinary mode, a tube has to be sacrificed almost for every operation The arrangement I have described to you is particularly useful when a considerable number of analyses are to be made.

The experiment which I have shown to you has, I hope, made you familiar with the principal features of the determination of carbon and hydrogen I might have added a great many details,—I might have pointed out to you the additional precautions required when substances contain, besides carbon, hydrogen, and oxygen, nitrogen or chlorine, or sulphur,—I might have explained the combustion of liquids and that of gases; but I have excluded these details in order not to accumulate the number of operations which I had to describe. It remains now to give you an account of the method of estimating the nitrogen; but, acquainted as you are already with the general mode of proceeding in experiments of this kind, you will have no difficulty in understanding these processes even though the limited time at my disposal will compel me to be rather brief in their description.—*From the Medical Times & Gazette.*

ON THE CAUSE OF TUBERCULOSIS, WITH SUGGESTIONS AS TO ITS PREVENTION

By Dr J G. Atkinson, Physician to the Wakefield Dispensary

[Dr. Atkinson has had the opportunity of making extensive observations upon the subject of tuberculosis; every man who has died of this disease during the last five years at the Wakefield convict prison, having been narrowly watched by him during life, and the post-mortem examination witnessed by him when dead. He says,]

From the experiments instituted by Simon, it appears that during respiration the oxygen of the atmosphere combines with the blood-corpuscles, and that the consumption of oxygen and formation of carbonic acid stand in a direct ratio with the amount of these blood-corpuscles, and with the number of respirations in a given period; hence it is obvious that the oxygen of the atmosphere is consumed in the metamorphosis of the corpuscles. And it would further appear that the amount of fibrine always varies inversely with the mass of the blood-corpuscles, or, in other words, that the more corpuscles there are, the less in quantity is the fibrine—and *vice versâ*.

It appears most probable that as the blood-corpuscles principally consume oxygen during their change, it is by this process that the fibrine is produced, and that wherever an extraordinary consumption of corpuscles takes place, the quantity of fibrine in the plasma also increases. If by any means the circulation be quickened, or in other words, the mutual action between the blood and oxygen be increased, more blood corpuscles will be consumed in a given time.

Although the temperature of the body is nearly the same in all parts, in consequence of the metamorphosis of the tissues constantly going on, yet the temperature of the lungs is slightly higher than that of any other part of the system, which may be accounted for by the more energetic action of the oxygen on the mass of blood in these organs, than in any other parts of the body.

Now, Andral and Gavarret observe, that in all stages of phthisis analysis of the blood shows that the fibrine is always on the increase, and the corpuscles on the decrease, but that this increase and decrease vary proportionally with the progress of the disease. Liebig states that it must be received as an undeniable truth, that all the organic nitrogenized constituents of the body are derived from protein, when we reflect on the development of the young animal in the egg of a fowl, where, out of the albumen, feathers, claws, globules of blood, fibrine, membranes and cellular tissue, arteries and veins, are produced. Now, this albumen contains, for the quantity of nitrogen present, exactly the proportion of carbon required for the formation of these tissues.

Let us, for one moment, look into the nature of tubercle. Chemistry has thrown little light on its mode of formation. Simon states that it may be regarded as protein from which a portion of carbon and oxygen have been removed; or to speak precisely, it may be supposed to be derived from protein, which substance has lost, during the transformation, three atoms of carbon, and one of oxygen. The formula is—

	C.	H.	N.	O.
Tubercle.........	43	35	6	13
Protein	48	36	6	14

From the observations previously made, viz., that the more corpuscles there are, the less in quantity is the fibrine; and from the experiments of Andral and Gavarret, that the blood in phthisis contains more fibrine and less corpuscles; and, moreover, recollecting that the temperature is somewhat greater in the chest than in other parts of the system, probably because a more energetic action of oxygen takes place in these organs—it would appear fair to conclude from these facts, that in phthisis the combination of oxygen and carbon, in the lungs especially, is more active than in the normal state. Now we will say one word concerning the *remedies* employed and found most beneficial in this disease. They, for the most part, may be arranged under two heads, first—general tonics; secondly, those compounds which contain large proportions of carbon, such as cod-liver oil, naptha, &c. &c. It cannot be doubted that the remedial efficacy of the latter class mainly consists in their readily giving up the carbon, and we have shown a great want of this element in the tubercular deposit. We may also add, that in this disease all the adipose tissues of the body are almost become emptied.

In one case of phthisis, where the blood had been analysed in a patient who had taken cod-liver oil, it was found that the fat, when isolated, smelt strongly of the volatile fatty acid of cod-liver oil; and, moreover, that the solid constituents of the blood were observed to be of a very large amount.

So far so good—both theory and practice agree, but it appears to me that no cure can be expected from such a class of agents. They, no doubt, preserve the body from being so rapidly burnt up, but this is all we can possibly expect them to do. We do not get at the root of the evil, or at what is the primary cause of the tubercular deposit. Now, if the tubercle be protein, with a deficiency of carbon, there appears to be some reason for supposing, that in this peculiar diathesis the elements of organism do not adhere together with that degree of tenacity which constitutes normal health. Liebig says there is nothing to prevent us from considering the vital force as a peculiar property, which is possessed of certain natural bodies, and that this force is continually being opposed to the organism by a chemical force; and by the action of this chemical force, a separation of part of the body, in the form of lifeless compounds, begins; and if, from any cause whatever, the resistance of the vital force diminishes in a living part, the change of matter increases in an equal degree. In the vegetable kingdom, the resistance of the vital force is sometimes shown very powerfully, when we perceive leaves charged with turpentine or tannic acid resisting the affinity of oxygen for these compounds. On the other hand, when this force is lessened in the organism, we need not be supprised at great abnormal changes necessarily occurring. Again, the same author observes that the absorption of oxygen occurs only when the vital force of living parts is weaker than the chemical action, and that animal life may be viewed as determined by the mutual action of opposed forces, that the increase of the body is effected by the vital force, and the waste of the body by the chemical action of oxygen: and that the condition of the body which is called health, results from an equilibrium among all causes of wast and of supply. Now, I think we have evidence that, in this peculiar condition, the carbon of the body is too easily acted upon by the atmospheric oxygen, and therefore, that the balancing operation which takes place in the transformation of protein into carbonic acid, urea, water, &c., which constitutes health, is so far overturned, that a larger quantity of carbon is removed in proportion to the amount of nitrogen and hydrogen, which, in the healthy functions, are carried away by the kidneys, liver, skin, &c; hence these latter elements, not being taken away by their proper emunctories, combine in certain definite proportions, and constitute the deposit known by the term tubercle.

In seeking, therefore, to discover a remedy for this disease, our object ought to be to ascertain whether there are any agents dietetic or medical which could prevent this too quick transformation. In making this inquiry, we must first observe, there can be no question that the victims of this disease are chiefly taken from amongst that class of individuals whose general tone of system is lowered, as occurs among the pampered and over-protected children of fortune, or in those living in confined and unhealthy atmospheres, &c. &c. A remarkable fact exists, strange as it may appear, that in consumptive families the most dissipated and irregular in their habits, and those who have habitually exposed themselves to many of the causes liable to engender this diathesis, have yet frequently enjoyed longevity; whereas, in the same families, the most virtuous, and those who have guarded their lives with the greatest care and prudence, have fallen early victims. Hence, it is an interesting matter to ascertain how far alcoholic drinks in this disease preserve those constitutionally predisposed from these direful results. I think it is agreed that alcohol, like all other highly carbonized substances, does supply a certain amount of pabulum of the blood. Now, does it act in any other way? Does it at all prevent that disposition to oxidation on the part of the organism of which we have spoken, and thus by making the protein compounds less ready to combine with oxygen, render them less ready to be broken up? That it has this property out of the body is very evident, and may it not have an equal power when taken internally? There can be little doubt the alcohol is taken up and circulated in the system, primarily, as alcohol, yet its elements ultimately become separated—its carbon and hydrogen are given off as carbonic water and acid; for Liebig could not detect, either in the expired air, or in the perspiration, or in the urine, any trace of alcohol after indulgence in spirituous liquors. By the use, therefore, of alcohol, a limit must be put to the change of matter in certain parts of the body; for the oxygen of the arterial blood becomes venous, without the substance of the muscles, &c., having taken any share in the transformation. Thus, we perceive, without the manifestation of a corresponding amount of mechanical force, the heat of the body increases after the use of wine. We have here some explanation offered to account for the dark, venous, bloated countenance of the man who lives freely; and we may contrast it with the florid, arterial hue, so characteristic of the countenance of the phthisical patient. In the former case, we have the system surcharged with carbon—in the latter, the arterial blood becomes too highly oxidated. It is not then fair to conclude that alcohol acts in the first place, by preventing quick oxidation of the tissues, and then becoming decomposed, it supplies carbon? And if this be so, would it be attempting to carry out a principle too far, supposing that the peculiar acuteness, if not vigour of intellect, which is strongly observable in the phthisical patient might depend upon hyper-oxygenation of the blood circulating in the brain? just as we know of a temporary exhilaration of the spirits seems to be caused by the inhalation of oxygen gas. On the other hand, it is equally well known that a sluggishness both of mind and body is a necessary attendant on the beer-drinker, which most probably may be accounted for by the too carbonized state of his blood. It has been found in prisons that men are admitted, apparently in good health, and remain so for some months; that they then become dyspeptic, fall off in good health, and die of tubercular consumption, running through all its stages in a few months, and even, in some cases, in a few weeks. And I believe I am not wrong in stating that four-fifths of the deaths in prisons are the result of tubercular disease.*

It may be observed that, as regards diet, cleanliness, regular habits, and an equalized temperature, the greater part of them were infinitely better off than before conviction. The only cause likely to be detrimental to health, would be the effect produced on the mind by restricted liberty and prison discipline. Now, I may state that, with scarcely a single exception, these men have been more or less drinkers. The prison fare, however, does not permit the smallest allowance of alcoholic stimulus, unless specially ordered by the medical officer. Here it will be interesting to enquire, whether the loss of this agent has anything to do in producing the tubercular diathesis? I might also state as a remarkable circumstance, that the *post mortem* examinations of the convicts during the last five years which I have attended, every body examined, no matter how death had occurred, had tubercular deposits, on one or more organs, with the exception of one man who died of epilepsy. Again no class of men, on an average, take more stimulants than inn-keepers, or the old-fashioned but now almost obsolete coachmen. To this number I might add butchers, who, besides consuming large quantities of animal food, generally also drink freely; as well as men employed at breweries. Whether statistical evidence may prove or disprove the fact, I am strongly inclined to believe, from a recollection of cases, as well as from their general appearance, which is familiar to all people, that they are not liable, but rather the reverse, to tubercular diseases. If the inference be correct, from these and other similar illustrations which might be quoted, it would appear that alcohol, although most injurious and destructive, by producing multitudinous diseases, yet may it not in this instance act as a kind of preservative, by protecting the organism from the action of oxygen, which we believe we have known to be the immediate cause of the disposition of tubercle? If this be so, could not some chemical agent be discovered, which would have protecting, but not otherwise destructive, agency? For instance—I merely propose it as a theoretical suggestion—would tannic acid, combined with some highly carbonized substance, and a moderate

*Mr. Milner, Surgeon to the Wakefield Convict Prison, authorised the above observation.

supply of alcoholic beverage, or some such compound, have this protecting influence? I think it likely that if any such agent be discovered it will be found among that class which have all a like preservative property when used extrinsically to the body.

In Hasse's work, edited by Dr. Swaine, it is stated, "for the most part this is traceable to a catarrh, which, after a first attack, leaves perhaps but a slight cough behind, but, on frequent repitition, gradually and irretrievably lapses into confirmed phthisis; or the disease, almost equally often, sets in with hæmoptysis." If the author means by this the commencement of the disease, I cannot agree with him. I regard these symptoms as quite of a secondary nature. Although I am well aware that tubercular disease of the lungs has been considered the result of inflammation, yet I am disposed to believe that this is erroneous, and that tubercle is deposited in consequence of a peculiar state of the system, in which the transformation of the tissues has not been carried out in perfect equilibrium; and that when deposited, the tubercle may, and often does, remain for a longer or shorter period, without creating much local inconvenience or disturbance This will, however, greatly depend on the amount deposited, and on its rapidity, as well as on other collateral circumstances; and the catarrh, inflammation of the lung, pleurisy, hæmoptysis, &c., are entirely dependent on the mechanical irritation caused by the presence of the tubercle. I am strongly of opinion that the deposition of tubercle may be much more general than is believed, not necessarily shortening life, or perhaps inducing ill-health; but I think it both possible, and very probable, that whenever the vital tonicity is sufficiently lowered, this deposit may take place in any organ. Dr. Carswell thinks it possible that tubercle may be absorbed; and if deposited on the mucous membrane of the air passages, or of the bowels, I cannot see why it may not be thrown off and ejected, as any other foreign matter.

Dr. Addison, having examined with a lens many apparently healthy lungs, absolutely found tubercles deposited more or less abundantly in one-third. From a perusal in Laennec's work, it seems evident that although he had by no means satisfied himself as to the mechanism of the tubercle, yet there appears little doubt he regarded it as a deposit taking place from some unknown cause, and he appeared strongly averse to the opinion that it was the result of inflammation. M. Louis alleges, that, with one single exception, he never found tubercles in any other organ without their existing in the lungs at the same time, insomuch that he seems positively to consider their presence in the lungs as essential to their development in other parts. I am disposed to believe that tubercle may be deposited in any other part where metamorphosis of tissues occurs; yet I think it more likely to happen in the lungs, in consequence of a more full and energetic action of oxygen taking place there than in any other parts of the organism. Hasse says that, in that acute form of tubercuar phthisis which often proves fatal in the third week, the vital symptoms are very peculiar, bearing a close resemblance to those of typhus fever, as to lead to mistakes, and the diagnosis can only be ascertained by the stethoscopic sounds? In corroboration of these views, I examined a man at the convict prison, who had been ill a few days, and diagnosed the case typhus He lived about a fortnight, and on a post-mortem examination, the whole of both lungs were completely studded with tubercles which had not yet formed communications with the bronchi, and tubercular deposits were found also in the adbomen and head. The late Dr. John Taylor of University College Hospital, informed Mr Millner that he had seen two similar cases, and that in both the disease at its commencement had been considered to be typhus Now I regard these cases as the result of a very marked deficiency of the vital force. Hence, during a very short period the protein compounds were so rapidly acted upon by the atmospheric oxygen, that the disease began and finished in the course of a few weeks—indeed, the rapidity of the tubercular deposit are so great, that patients absolutely die before the disease has extended further than simple deposition As some proof of the views I entertain, I will relate one or two instances which have occurred immediately under my own eye; but as many of the individuals spoken of are at present now living, I cannot of course, furnish names.

1st.—A family consisting of five sons and one daughter, all appeared to enjoy good health up to about eighteen. Out of this family, three sons died between the ages of eighteen and twenty five, of phthisis; the daughter is still living, although in very precarious health, evidently phthisical. All these were steady, industrious, and peculiarly careful of their health. The two remaining sons, now between thirty and forty years of age, when last heard of were quite healthy. Early in life, these two latter men were of dissipated habits, and lost many situations in consequence of their propensity to drink. One of them at the early age of nineteen, came over from India with an inflamed liver and dropsy, from spirit drinking; he was many months ill, but ultimately recovered. When last seen they were in robust health, but had bloated countenances.

2nd.—A family consisting of three sons and three daughters. They all had the characters of the scrofulous diathesis strongly marked—fair hair, clear complexion, blue eyes, thick lips, &c. The three daughters died of phthisis before the age of thirty: one son of tubercles of the brain.—the two remaining sons are still alive, of irregular habits, but in apparently good health.

3rd—A young man at the age of eighteen showed every symptom of approaching tuberculosis; he had already lost one brother and sister by pythisis. His medical man advised him to relinquish a profession of a sedentary nature, in consequence of the above facts. He did so, but unfortunately became dissipated. He is now alive, about forty years of age, a confirmed drunkard, and has suffered several times from delirium tremens.

We gather, therefore, from the foregoing observations, that tubercular deposits are eminently dependent as the primary if not the sole cause, on a diminution of the vital force.—2ndly, that in phthisis the body is rapidly consumed by the combination of its elements with oxygen.—3rdly, that the consumption of the body may be retarded by the ingestion of certain highly carbonized substances, as cod-liver oil, &c.—4thly, that it is probable the rapid oxidation of the body may be checked, or entirely prevented by the use of alcohol, or some agent acting in the same way.—*Lancet Dec.*, 4, 1852.

ON TUBERCULOSIS

By Henry Ancell, Esq. Lecturer on Materia Medica, and Medical Jurisprudence in the School of Anatomy and Medicine adjoining St Ge. ge's Hospital.

[First let us see what are the conclusions at which Mr. Ancell arrives after a consideration of the blood.]

Mr. Ancell infers, from considering the analyses given by various chemists, Drs. Fricke, Andral and Gavarret, and Dr Glover, first, that the blood in tuberculosis is deficient in the proportion of red globules; second, that the albumen is augmented in quanity but imperfectly developed and defective in quality; thirdly, that there is an excess of fibrine, but that this principle also is defective in its nature; fourthly, that the watery part of the blood is increased in proportion to the solid constituents; fifthly, that it is not ascertained whether the fatty principle is diminished; and in the sixth place, that nothing very satisfactory is ascertained as to the increase or diminution of the saline principles. A general view of the changes in all these elements and principles in tuberculosis, the author attempts to give in the following diagram.

	RED CORPUSCLES. Deficient in number	
	Deficient in structure.	Globulin *deficient.* Haematin *deficient.* Iron *deficient.*
TUBERCULOUS BLOOD, Defective in vital properties, the essential nature of the defect unknown.	LIQUOR SANGUINIS. Vitiated in quality.	Water in *excess.* Albumen, *in excess but defective in quality.* Fibrine, *rather below than above the standard, def. in quality.* Fats, *probably deficient.* Colouring matters *modified.* Alkaline Salts *deficient.* Earthly Salts *deficient?* Lime in *excess?*
	WHITE CORPUSCLES.	

It thus appears that after great chemical research, much is doubtful and uncertain, if not positively in a state of confusion. Mr. Ancell nevertheless thinks that the most general character of the blood in *tuberculosis* is diminished vitality, and that in reference to the diminished amount of the red globules, tuberculosis may be considered a consumption of the blood. The blood, he thinks, possesses, in the healthy state, a certain degree, and amount of vitality. This amount of vitality is denoted by its dynamic properties of endosmose and exosmose in the corpuscles, by its organic contractility, by its power of assimilating old and new matter to the form of the blood, by its power of forming red corpuscles and *liquor sanguinis*, the consumption of red corpuscles, and the waste of *liquor sanguinis* in nutrition. When the sum of these physiological actions, says Mr. Ancell, is within the phsiological range, and they are in harmony with each other, a sufficient number of corpuscles being formed and wasted, and all the constituents of the *liquor sanguinis* being complete and proportionate, and renovated according to the requirements of the different tissues, the blood possesses the healthy degree of vitality. In tuberculosis, on the other hand, the sum of these actions is below the physiological range; moreover, the proportions of the constituents of the blood are subverted, and their qualities are deranged. This denotes a low degree of vitality, which is consistent with the phenomena of the tuberculous predisposition, and with the sign of *tuberculosis* on its various forms.

Tuberculosis is a peculiar state of the blood, if not in the first instances, at least in a very early part of its history, and throughout, this condition of the blood not only continues, but in certain respects is increased, and becomes more intense. It is therefore not wonderful that analytical chemists differ in their results, and that it is so difficult to obtain results which are harmonious and consistent. The blood is in a constant state of change and fluctuation, according to the variable state of those functions on which the state of the blood depends—the condition of digestion; of assimilation, primary and secondary, of respiration; of secretion, probably as Dr. Holland suggests, of innervation. If digestion in the stomach and *duodenum* is imperfect and disordered, assimilation is imperfect and disturbed in consequence; and the chyle which is transmitted through the lacteals and veins is either imperfectly elaborated, and contains elements which it ought not to contain, or is destitute of elements which it ought to possess. If respiration be in fault, if the air breathed be bad from poisonous miasmata, we know from ample and undoubted experience that this acts in a most direct manner in deteriorating the qualities and condition of the circulating fluid. Looking at the inhabitants of miasmatic districts, and beholding their pale sallow faces and dingy coloured skins, affords sufficient proof of the correctness of this inference. There may further be something in the actions of the lungs, in the mode in which these organs act upon the air, that may modify and greatly influence the state of the respiratory function.

Further, if the various processes of secretion be feeble, inactive, and perverted; if articles which ought to be eliminated from the blood be retained in it; as the elements of bile of urea, and probably other substances; it is easy to see that the blood so constituted cannot be in a healthy state. This is a frequent condition of disease in the blood in gout, rheumatic gout, chronic rheumatism, and several other morbid states connected with impaired and retarded digestion.

But, independent of all these sources of contamination and disease of the blood, it would appear that this fluid, under certain circumstances, loses of itself, as it were, its proper nutritious and reparative power. The blood evidently possesses a power of assimilating certain foreign substances—all the organic products employed as articles of food. It is not ascertained whether it owes this power to some inherent property, or to the saline matters with which it is normally impregnated. All that is known is, that when the saline matters are deficient, disproportionate, excessive in one direction and defective in another, the blood loses its power of nutrition, of rather becomes unfit for nutrition, and disease follows:—paleness, feebleness, loss of flesh and strength, in short, an anæmious state. This condition the late Dr. Prout seemed disposed to attribute to the deficiency of saline ingredient, which he believed were requisite to the normal healthy constitution of the blood; and, in consequence of which being deficient, those actions and processes, probably electric, or electro-magnetic, for the requisite applications of the nutritious parts, did not take place. All this must of necessity be matter of conjecture, and, though it is not desirable to admit unknown causes of morbid conditions without sufficient proof, yet various facts seem to shew, that of this there is as much probability as of many other morbid states.

One observation more only on this subject we make. There is too great a disposition in all instances to consider disease as a positive state:—as something having an active existence. To do so is quite natural; for it would be difficult to speak or to reason about it without doing so. At the same time it ought never to be forgotten, that disease is, correctly speaking, a negative condition. The positive condition is health; the absence of this condition, the negative of it, is disease. So with regard to morbid states of the blood, and especially that called *tuberculosis*, they are merely the absence of the healthy state of this fluid, whether this consist in the presence of morbid matters that ought to be rejected, or in the absence of healthy elements, the presence of which is requisite. The blood ceases, from various causes, to possess those principles and properties which fit it to act as a nutritious fluid. It accordingly does not nourish, and the organs and body at large are wasted, from not being supplied with materials to repair waste. It is true that the blood, besides losing certain principles and properties, possesses others which are not natural—which are in short morbid. But it is to be remembered again, that these morbid principles are not really new principles, but *degraded forms of original principles*. Even the analytical researches quoted by Mr. Ancell show how slight is the change, how small and insignificant, apparently, is the deviation, in the most intense instances of tuberculosis. No element or principle is absolutely wanting. One is a little in excess, another is a little in deficiency; and these are all the tangible points on which the pathological inquirer can fix. Perversion, even in the proper sense of the term, it is impossible to detect. The blood is in some manner without those principles and qualities which enable it to be employed as a nutritious fluid; and this seems to be all that can be said, after much microscopical examination, and not a few chemical experiments.

[Mr. Ancell considers the following inferences are established from his investigations into the state of the blood in tuberculosis.]

"The debility of the tuberculosis indicates a *direct* loss of power, and the whole of the phenomena of the predisposition and the symptoms of the disease shew—

"1. That from the earliest invasion, the sum of the vital force is either below the standard of health, or it is relatively low as respects the structure and organization of the individual.

"2. That this diminution in the sum of the vital force depends especially upon diminished vitality of the blood, and of the cellular, gelatinous, and muscular tissues produced and nourished from an imperfect blastema derived from the diseased blood.

"3. That as tuberculosis advances, the sum of the vital force for the whole system continues to diminish, this loss of vital force being exhibited not only in the defective manifestation of voluntary and involuntary muscular power, but in cellular and muscular tissues to the change of matter in the animal body; hence, in tuberculous subjects, the rapid diminution of the red corpuscles of the blood, the deterioration of the vital qualities of the *liquor sanguinis*, and of the blastema, the diminished plastic power of the cells, the low calorific power, and the emaciation.

"4. That frequently, but by no means universally, the nutritive powers of the blood, as respects the nervous tissues, remain undiminished, this tissue not requiring for its nutrition compound principles identical with it to be introduced into the blood with the food, and having a nutrition peculiar to itself, differing from that of the cellular and muscular structures. Hence, the diminution of vital force is not exhibited in the nervous system, but as conductors of the force generated by the change of matter in the whole system, the nervous system remains intact. The particular condition of the vital force is nevertheless manifested through the nerves: hence activity and action without power, morbid irritability, &c. It is the highest manifestations of the vital force dependent upon nervous structure, as sensibility and mental phenomena, which so frequently remain unaffected during the physical degeneration. These phenomena are often rather augmented than diminished, the nervous matter, although perfect in structure, being more exposed from the waste of its cellular coverings; hence, frequently increased sensibility to impressions in tuberculous subjects; and this occurring in the predisposed from the earliest age, and throughout a series of years acuteness of intellect is often exhibited.

"In estimating the symptoms of tuberculosis in a practical point of view, their absolute value, taken singly, is comparatively little, since one and all occur in other diseases. It is the relative value—the association of several—or the harmony of many in one case; the manner in which they arise—and their mode of succession—which distinguishes them from the symptoms of other diseases, and assists us in the differential diagnosis. Many of these symptoms are found associated in chlorosis, simple anæmic debility from venereal excesses, and other conditions of the economy. To those who have well considered the details of the tuberculous constitution, the difficulty of the diagnosis is considerably diminished. The symptoms, viewed in combination and relatively, rarely mislead, especially when they are decided in their development, constant and progressive. In difficult cases our judgment may be frequently determined by a knowledge of the antecedent existence, or the absence of the predisposing and inducing causes—as, for instance, of the hereditary taint, or a long-continued anti-hygienic regimen. In reference to the general disease, it is to be kept steadily in mind, that the diagnostic object is not to determine whether a local tuberculous development exists—tuberculosis pulmonalis or abdominalis—but rather to determine *whether the patient is truly affected with the blood disease, and thereby threatened with its local manifestations.* The successful treatment of the disease of the blood in this stage, based on a knowledge of its nature and causes, is, in many instances, certain. The successful treatment of the disease, after it has localised itself, is frequently impossible.

"While I refer all the symptoms described to the tuberculous state of the blood on the one hand, there is frequently, as they present themselves in various groups, a direct relation subsisting between them and the pathological effects of tuberculosis, to be described in another chapter. The defects of the osseous system arising from perverted organisation and nutrition of the bones, are in direct relation to the scrofulous affection of the bones, which so frequently occur. The malnutrition of the lungs and thoracic parietes are in direct relation to the occurrence of the disease of the lungs. The weak organisation and depraved digestive fluids of the alimentary canal, taken with bad diet and other anti-hygienic influences, are in direct relation to mesenteric phthisis. Again, as illustrating the relation of cause and effect in the ultimate result, while the subjects of tuberculosis are fed with unwholesome and insufficient diet, they present after death, more frequently than other tuberculous subjects, pathological lesions of the alimentary canal. Fournet states that tuberculous subjects who had been fed on sufficient and wholesome diet, scarcely ever experienced disturbances of digestion until towards the close of life, and after death he did not find a trace of intestinal tuberculization, while in those who, on the contrary, had been badly nourished for a long time, the dyspeptic symptoms were very prominent, and intestinal tuberculization was almost constant. I believe this statement to be somewhat too exclusive. But at the same time the complicated relations subsisting between—1, the effects of the blood disease and the local disease; 2, the effects of the external agencies on the animal economy modified by the blood disease are undoubted; and when we consider them it only enhances the necessity which exists of our improving the pathology of the general disease.

"The uniform association of structural and functional aberration in the tuberculous constitution is very striking. The remark made by Louis, that 'a function may be more or less seriously interrupted for a long time without the organ presenting any appreciable change of texture,' is undoubtedly true; but we must not look over the qualification—*appreciable*. This great pathologist evidently meant—without any of those well-marked pathological results which may usually enter into the post-mortem description. A change of function always implies a modification of structure, and most especially so in a tuberculous subject. In such a subject debility, defective digestion, and depraved secretion, for instance, never occur without implying a modification of structure in its nature tuberculous.

"Such, according to my view of tuberculous and scorfulous affections, is tuberculosis, as an essential disease of the blood, to which man, and the animals immediately beneath him in the zoological scale are subject more or less, at all periods of life, from early embryotic development to old age and decrepitude. Many will regard the disease thus described as an abstraction; and it must be admitted, that as it comes under the cognizance of the practitioner, it is rarely made the subject of his consideration and treatment until some local affection of a particular tissue or organ has proceeded so far as to complicate its symptoms, and still more rarely does it proceed to a fatal issue without some local affection having supervened. Nevertheless, throughout the progress of all the local diseases constituting varieties of tuberculosis, the symptoms and characteristics of the general affection may be recognised; it occasionally happens that tuberculosis proceeds in the adult to the last stage of marasmus and a fatal issue without hæmoptysis, the aggregation of tubercle, or any obvious local affection. This is a more frequent occurrence in the early periods of life. It frequently appears also, that some local affection—as tubercles in the lungs—supervenes, but of so circumscribed an extent, that it interferes little with the functions of the organ, or the general symptoms of tuberculosis, or of the tuberculous predispositon, and from hygienic or other causes the general affection subsides, and nature renders inert the local mischief by a cretaceous formation of fibrinous deposit. Occasionally the local affection is too trival to compromise life, and yet the patient goes on dying of the general disease. This frequently happens in children, and sometimes in adults, as proved by symptoms before death, and the existence of too circumscribed an organic affection, detected *post-mortem*, to account for death; but the most frequent result is, that organic disease sets itself up, and complicates, and very materially modifies and precipitates the symptoms, progress and termination of the general affection.

"The essential condition of the blood, upon which the signs and symptoms of tuberculosis depend, is still a problem. In fatal cases one or more organs, as the lungs, the brain, the mesentery, and the intestines, have generally become so far affected as to be incompatible with the continuance of life. In a future chapter the special pathology will be fully considered, and to complete the history of the disease, the influence of the various organic affections over the orginal disease, and in the production of the usual fatal termination, ought to be estimated; but it may here be stated, that the diseased condition of the blood, the deterioration of the circulatory and more stationary fluids and solids, the emaciation, and the failure of vital force, are of themselves, in this general disease, totally apart from any special affection of an organ fully adequate to produce such a result; and there can be no doubt that, in many instances, death is as much the consequence and the natural termination of the general disease as of disease of any vital organ.—*Edinburgh Med. and Surgical Journal, April*, 1853, *p.* 416.