portion of the hardened skin had been removed; that considerable difficulty had been after each operation experienced in keeping the arm extended, during the progress of the healing of the wound, caused by the division of the cicatrix, and that a common straight splint had been fixed upon the back of the arm, but from the pain and uneasiness consequent upon its constant pressure, it was found necessary to remove it very frequently, and at last to abandon its use altogether. I placed upon the arm my apparatus, and with a scalpel, just slightly divided the cicatrix upon the first day, placing the arm at the angle which this division allowed, without causing pain, and there fixed it by means of the joint-splint. Two days subsequently I again saw the child and effected another division of the cicatrix, about an inch from the first, again altering the angle of the arm, and at the same time that of the splint.

This operation I repeated at five different periods at about three days' interval, and at each time placed the arm and splint at the angle which I found compatible with the child's comfort; the arm had become perfectly straight in about six weeks; the splint was, however, still retained upon the limb, the straight position being occasionally changed for an angle more or less acute as the fancy took me, thus avoiding the chance of tiring my patient. During this latter period I ordered friction and fomentations, whereby I succeeded in softening very much the cicatrized skin. The arm in about three months had almost regained its natural appearance, and its usefulness is as great as that of its fellow

CASE V.

A man, thirty-six years of age, had the misfortune to fall and fracture his patella; he did not apply for surgical aid until some hours after the occurrence of the injury, imagining that he had only bruised his knee. Finding, however, that it became much swollen and very painful, he thought it advisable to seek relief, and upon examination I readily discovered that the above-named accident had occurred. I applied my apparatus, the upper edge of the lower splint pressing against the inferior portion of the patella, and the lower edge of the upper splint against the superior portion of the fractured bone. The two portions had become widely separated in consequence of the attempts made to walk and move after the fall, but this space was day by day much decreased by the gradual movement of the wooden splints nearer to each other, and which of course at the same time approximated the fractured surfaces of the patella. Leeches, poultices, and fomentations were during this period and until the limb was restored to use, frequently and satisfactorily applied; whilst the joint and fractured bone were kept perfectly at rest and all muscular action overcome by the constant application of the joint-splint.

I may mention that the limb was elevated in this case, as is usual in such accidents, at the same time that the splint was employed. These two measures combined, caused the patient no inconvenience, but on the contrary were a source of much comfort, and decidedly tended to the rapid and solid union of the fractured patella.

THE LAW OF THE MORPHOLOGY OR METAMORPHOSIS OF THE TEXTURES OF THE HUMAN BODY.

(Fourth Series of Experimental Researches.)

By WILLIAM ADDISON, M.D., F.R.S., Malvern.

I. VEGETABLE TEXTURES.

The science of morphology, which treats of the gradual transformation of the primary elements of vegetable structures into the various special organs of the species, has long formed an interesting and essential department of physiological botany. The plan upon which the metamorphosis takes place, "is"—according to Dr. LINDLEY—"notwithstanding the infinite variety observable, extremely simple, and executed by modifications of the leafy texture."

If the structure of a leaf of flowering plants be carefully examined in very thin sections, with a sufficiently high magnifying power, (750 diameters linear,) it will be found composed of *two distinct cellular elements*, a fibrous tissue, spiral vessels, stomata, and an immense assemblage of air-vesicles, or air-bubbles. On the upper surface of the leaf, is a thin transparent homogeneous membrane, divided into a number of cellular compartments irregular in form and outline, and variable in size in different species of plants. On the under surface is a similar membrane, in which the cellular compartments are thickly interspersed with the stomata. The cellular compartments and irregular outlines thus visible on the under and upper surfaces of the leaf, are the exterior outer portion of a very fine and strongly coherent cellular texture, running through the entire thickness of the leaf, and so disposed as to form numerous divaricating air-passages connected with the stomata.* Within the meshes of this coherent cellular texture, around the walls of the divaricating intercellular air-passages, and in close apposition with the air contained within them, is a less coherent cellular element or texture, consisting of smaller and but slightly adherent corpuscles or cells filled with the green granules of the *chlorophylle*, each granule consisting of a number of minute molecules.

The term cellular tissue or texture has been indiscriminately applied to so many portions of vegetable structure, that it is necessary to state prominently the point which a careful microscopical examination of a leaf appears to me to establish between the coherent cellular textures, the cuticle and supporting framework, and the incoherent cellular texture forming the parenchyma.

If a thin section be taken from the main rib, or any of the other ribs of a leaf, the cellular texture disclosed has the following properties and appearance. It is strong and coherent; the spaces of the cells are

* These air-passages when a section of the parenchyma has been made, display *oval foramina*, similar to those seen in a section of a lung.

nearly or quite free from chlorophyll granules, and the cell-walls are comparatively thick, the structural material not occupying the central parts of the cells, but being collected at the cell-walls and apparently outside and between them.

If having previously sliced away the outer integument of the leaf, a thin section be taken of the green parenchyma, the cellular element displayed has a very different appearance. It consists of smaller distinct cells arranged around oval or rounded vacant spaces, and if the succulent leaf of *Sedum acre* be crushed between two slips of glass, the incoherent cellular elements are found scattered and dispersed upon them.

It is well known that two important functions are performed by leaves—respiration and secretion; and it appears from my examinations that in the leaves of *phanerogamia*, each function has its appropriate anatomical structure—the coherent cellular textures ministering to the form of the leaf, and to respiration; the incoherent cellular texture, to secretion or nutrition. That the interior of a leaf is full of air, may be demonstrated by a microscopical examination of the parenchyma; and that the air is situated in numerous air-passages, is also equally evident, at the same time. That this air may be forced out by heat, is readily shewn by immersing a leaf in boiling water, when the under surface becomes thickly coated with minute air-bubbles, which appear to escape by the stomata; for the upper surface of the leaf, if uninjured, never allows of the escape of similar bubbles. When, therefore, the broad upper surface of a leaf is exposed to the noon-day sun, the air occupying the air-passages must expand; and if all the passages be filled with air, some portions of it, altered doubtless by the respiring functions of the incoherent cellular texture, must escape, either through the stomata, in which the air-passages terminate, or by other means. But when the sun's rays are obscured by passing clouds, and at night, the air within the leaf, becoming colder, will contract in bulk, and there will be space for fresh portions of the outward air to enter. Heat or caloric, therefore, is the *efficient cause*; and change of temperature—sun and cloud—day and night—the *conditions* of respiration in the leaf; *inspiration* taking place during the passage of clouds, and at night; *expiration* going on when the sun shines upon the leaf.

In most of the herbaceous plants, the green matter of the lower leaves visibly disappears during the inflorescence and the growth of the seed, that is to say they wither and dry up. This is remarkably the case in the *sedums*, *lilies*, &c., and the fact is observable in all tender plants, should there be any lack of moisture at the important time of flowering. The following, among many other examples, may be related in illustration:—If a plant of the garden nasturtium (*Tropaeolum majus*), be pulled up whilst in vigorous growth in the autumn, and thrown upon the ground in the sun,

it will continue flowering for a month or six weeks, putting forth new shoots, new flowers, leaves and seeds; but during all this time the older leaves are gradually, from below upwards, one after another, exhausted of their green matter, withering and shrivelling up. From these and many other facts well known to botanists, but which it is unnecessary to particularize, it is concluded that the green matter contained in the cells of the incoherent cellular texture of the leaf is of the nature of a secretion elaborated within the cells, giving sensible properties or qualities to the leaf, and essential to the growth of the subsequent parts of the structure, the flower, the seed, or the bud; while the coherent cellular texture gives form and stability to the leaf, and administers to the function of respiration.

The distinction between the coherent and incoherent cellular textures clearly exists in nature; the former may be seen in the wood and pith; the latter in the bark and leaves. These two textures may be oftentimes conjoined, and run by transitional stages into each other; still they are as frequently disassociated, and when they are so, they are as distinct in appearance and mechanical properties as they seem to be in function.*

The general nature of the parenchymatous part of leaves, which I have termed the incoherent cellular texture, has been well explained by LINK and others, and was figured by MOHL, in 1828; but the most complete account is that of M. ADOLPHE BRONGNART, in 1830, of which the following is an abstract:—

The cuticle is a layer of cellules, adhering firmly to each other, and sometimes but slightly to the subjacent tissue, from which they are entirely different in form and nature—in form, for the cellules are depressed, and in consequence of the variety of outline they present, form meshes, either regular or irregular; and in nature, because these cellules are perfectly transparent and colourless, and probably filled with air. They scarcely ever contain any organic particles, and are probably but little permeable, either to fluids or gaseous matter; while on the other hand, the cellules of the subjacent *parenchyma* are filled with the green substance that determines the colour of the leaf. Beneath the upper cuticle are two or three layers of oblong cells, generally of much less diameter than the cells of the cuticle, and therefore easily seen through it; the cells have little intervals or spaces between them, and in leaves that have stomata on their upper surface, there are among the cells some large spaces through which the stomata communicate with the interior of the leaf. On the under surface of the leaf, the cells of the *parenchyma* are irregular, often having two or three branches which unite with the

* Cellular tissue is found in three essentially different states, *membranous*, *fibrous*, and *parenchymatous*;—membrane and fibres combined form a fibro-cellular, and parenchyma and fibres form a fibro-corpuseular texture.

limbs of the cells next them, and so form spaces which are larger than the cells themselves, and either correspond directly with the stomata, or are in communication with them.*

(For examples of the incoherent cellular parenchyma of a leaf, and of the coherent cellular structure of the cuticle and ribs, I refer the reader to Dr. Lindley's "Introduction to Botany," plate 1, fig 2, 3, 6, and 7; plate 3, fig 5, ed., 1832.)

Mr. Edwin Lees, who is well known as an indefatigable and practical botanist, has permitted me to state his opinion upon the structure of a leaf.

"I have perused Dr. Addison's account of the vegetable tissue, and seen his demonstrations with the microscope repeatedly. It appears to me that the distinction of coherent and incoherent cellular structure, is not only correct in fact, but of considerable importance in a physiological point of view. It is clear that the coherent cellular structure forms the supporting frame-work of the leaf; and that it abounds with air is satisfactorily proved by Dr. Addison's experiment of immersing a leaf in boiling water, when the under surface gives exit to numerous air-vesicles. It therefore appears correct to attribute to this structure an important function in respiration; and it appears equally correct to suppose that the system of nutrition and secretion goes on in the cells containing the granules of chlorophyll, which are frequently found but very slightly coherent. The coherent and incoherent structures are not easily demonstrated perhaps as distinct structures in every leaf, but I believe they exist. Though well aware with other botanists that leaves carried on the operations of respiration and secretion, yet the different functions attributed to the two kinds of cellular tissue have never previously, I believe, been insisted on. The fact necessarily leads to inductions before undeveloped."—EDWIN LEES, F.L.S., *Fellow of the Botanical Societies of London and Edinburgh.*

If the structure of a petal be examined in the same way with a microscope, we find a coherent cellular structure, abounding with air, to which indeed the whiteness and opacity of a white petal is wholly due. This coherent cellular texture has various forms, and the transparent homogeneous cell-walls are frequently marked with delicate *striae*. The cells usually contain either a coloured fluid, or numerous coloured granules and molecules; and it is evident if the structural elements of a petal are formed by a process of metamorphosis from the leafy texture, that it is the green granular chlorophyll of the cellular parenchyma that has experienced the greatest amount of change;—in other words, whereas the colour of the leaf is green, and the colour of the petal blue, scarlet, or yellow,

so therefore, if the structural elements of the petal are metamorphosed out of the leafy texture, it must be the incoherent cells containing the green matter,—the secreted and proper juices of the leaf, that have experienced the greatest amount of change. If we extend the microscopical examination to lower forms of vegetation, we find the fibrous or woody textures, and spiral vessels to disappear, the leaves of mosses and the fronds of ferns consisting wholly of cells, filled with a green matter, and rendered coherent by a thickening of their walls. Still lower, we find in the *conferve* elongated cells, joined end to end, each cell containing green granules of chlorophyll. Lastly, there are vegetable textures, consisting of cells filled with green matter, and of so slight a coherency, that the merest touch is sufficient to separate them from each other.

The order of vegetable structure then appears to be:—

1. Forms consisting of *incoherent cellular texture*; masses of cells or corpuscles with an interior (generally green) matter. These are the lowest forms—*algæ* and *lichens*, in which every cell or corpuscle is both a respiring and a secreting structure.

2. Forms consisting of *coherent cellular texture*; cells with an interior (generally green) matter, cohering either end to end as in the *conferve*; or on all sides as in *fungi*, *mosses*, and *ferns*. Here again every cell is both a respiring and a secreting structure.

3. Forms consisting of a *compound cellular texture*, in which two distinct cellular elements with distinct functions are conjoined and co-exist; the coherent cellular element connected with the stomata and air-passages ministering to respiration, and the incoherent with the green granules of the chlorophyll within them executing the function of secretion. And it would appear that in the leaves of *phanerogamia*, there is a large quantity of air stored up in the air-passages, formed by the coherent cellular texture for the uses of the incoherent cellular texture. As we ascend in the scale of life and being, so we find more and more clearly special organs or textures appointed to special functions; let me therefore recapitulate the points I wish to urge upon the reader's attention. In the lowest forms of vegetable structure, the functions of secretion, growth and respiration, are conjoined in each cell or corpuscle, and these cells in many cases cohere so slightly, that the texture falls to pieces on being touched or handled. In some instances the structure is no more than a light cellular powder, and in others mucoid or soft. But in the leaves of *phanerogamia*, there is a coherent texture supporting the stomata and administering to the respiratory function; and also a less coherent texture executing the function of secretion.

I am sensible that the terms incoherent and coherent, as applied to the leaf, do but partially and inaccurately express the distinctions insisted on between the

* See, for a more detailed account of the structure of leaves, "Lindley's Introduction to Botany," particularly p. 85, ed., 1832.

secreting, the soft and brittle, cellular textures, and the non-secreting, coherent, and elastic ones; between the green cellular parenchyma, and the outer cellular membrane of the leaf. The distinctions are, however, very palpable, and in animal structures so important, that I purpose, in order to avoid confusion of terms, and yet preserve the distinctions set before us by nature, to use the term *corpuscular texture* for the very soft, opaque, and friable cellular textures, limiting the term *cellular* to those which are coherent, transparent, and elastic. For example, the liver and intestinal villi, I would say, are *corpuscular textures*; the lung a *cellular texture*;—the two former being opaque, friable, and incoherent; the latter transparent, elastic, and coherent; and if so, then there is *prima facie* evidence of an analogy between the blood of animals and the parenchymatous texture of a leaf.

REMARKS ON FEVER.

By WILLIAM DAVIES, M.D., Physician to the Bath United Hospital.

(Read at the Quarterly Meeting of the Bath and Bristol Branch of the Provincial Medical and Surgical Association.)

The few remarks which I am about to submit to this meeting have reference to a disease which has, perhaps, given rise to more discussion in the medical world than any other, and concerning which there still remain various and conflicting opinions,—this is fever; and in what is to follow, I would be understood as referring to the common or idiopathic continued fever of this country, the general features of which every medical man is familiar with, more especially those who have past any part of their professional career in Edinburgh or Dublin.

My remarks shall be first on the nature of continued fever; and secondly, on the pathology of head-complication, as illustrative of what has preceded, and with reference to practice.

The two following propositions must be granted:—First, that the disease is communicable—or that an individual subjected to a sufficiently close intercourse with another labouring under continued fever, may become similarly affected.

Second. That in order to a disease being communicable; it is essential that certain matter shall pass off from the body of the individual affected, and be received into that of him who is to suffer. It is unimportant whether this entrance is effected by inoculation, or by means of atmospheric transmission; at present we have to do with the latter.

Now, if an individual were much confined to an apartment in which there were patients labouring under continued fever, breathing air loaded with the exhalations from such patients,—and if, after a time, the individual thus circumstanced were to be seized with

the same disease, and others following after him subjected to the same influences, and sharing the same fate, with sufficient frequency and certainty to justify the conclusion that the one was the cause of the other,—and we were asked by what means or through what channel the system of the one became affected by the exhalations from the body of the other, we should, I think, have little hesitation in answering, that the matter exhaled from the bodies of the fever-patients entered the lungs of the healthy persons, along with the atmospheric air, and thus found entrance into the blood, where it accumulated until its amount was sufficient to impede the healthy functions of the body—that is, until fever was produced.

Again, if we were farther informed, that twenty previously healthy persons, from different localities, were similarly subjected to the influences above-mentioned, and that every one of these twenty persons was attacked by the disease, but that none of them were so until after an exposure of one or more weeks, some of them after a lapse of three months, and no two of them at precisely the same interval of time,—this would add confidence to our opinion, and we would say that the interval which elapsed between the first exposure and the seizure, marked the period during which the poison was accumulating in the blood, and that the difference, as regards length of interval, between exposure and attack, was an index as to the vigour or weakness of the different constitutions.

Our informant does not stop here, but tells us, that during the early period of the attack, and whilst it is at its height, the power to infect is not nearly so great as during the decline of the disease, and the advance towards convalescence. Here is another element in our belief, and we say, that whilst the disease is declining, and the patient recovering, the system is engaged in freeing itself of the poisonous matter, which is being evolved at the various emunctories of the body.

Now, these are not speculations, but carefully ascertained facts, and lead, I think, very conclusively to the belief, that in continued fever, the blood is primarily affected. I will not enter into the question, whether the constitution of the blood itself is changed by the action of the poison of fever, or, whether the blood merely serves as a vehicle for the conveyance of that poison in a free state to the various organs. This is a question unimportant as regards my present object, and moreover, we do not possess materials sufficient for its elucidation.

I will now proceed to a few practical deductions from, and illustrations of, the foregoing remarks.

Every practitioner who has seen much of continued fever in this country, is aware that the great danger he has to apprehend is the supervention of cerebral symptoms; here the intestinal follicular lesion is comparatively rare, and thoracic complication seldom