have presented the same peculiar characters as were observed in the case recorded by that eminent microscopist, in his first account of this species, in the *Edinburgh Medical and Surgical Journal*. The vomited matter in that case is described as having the appearance of yeast, and the report in Burdett ward-book of the vomiting of this patient was that it looked like yeast. It was not till the following day that I had an opportunity of seeing this singular yeasty, pulpy mass, which I witnessed being ejected from the stomach. Its appearance was so peculiar that I at once placed it under the microscope, and then I immediately recognized those singular cubic and bale-like masses of vegetable development, minutely and regularly marked into sections of quadrupled subdivisions. There were also many tufts of margaric acid, with epithelial cells in abundance. There is much interest in the coincidence of the presence of the *Sarcina ventriculi* in vomited matter of the same physical characters, and it certainly gives force to the opinion of Goodsir, that in special cases the contents of the stomach suffer certain spontaneous or intestine changes, analogous to fermentation, and consequently opposed to the true digestive function, which must for the time be in abeyance, and that as the consequence of this fermentative process, certain vegetable structures are developed, of which the *Sarcina ventriculi* is an example.

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

(Fourth Series of Experimental Researches.)

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(Continued from page 263.)

XIV. INFLAMMATION CONSIDERED MORPHOLOGICALLY.

Vague generalizations with respect to the nature of the elements entering into the normal composition of the textures, and a neglect of the order of their appearance in the embryo, may be enumerated as obstacles to a knowledge of the real nature of inflammation and of the import of pathological facts. Among the *mucoous* membranes or textures many microscopical distinctions exist; and the same may be said also of the *serous* membranes. The outer covering or *tunica conjunctiva* of the eye-ball, differs from the *intestinal villi*; the *pia-mater*, from the *plexus choroides*, and the synovial membrane of the joints.

In researches directed to the attainment of a knowledge of the morphology of the elements of normal textures, for the purposes of practical medicine, it is important to arrive at some conclusion with regard to the relative values of a microscopical and chemical analysis; and the following considerations have prompted me to trust to the former as the surer and safer guide.

First, the microscopical investigations of SCHLEIDEN, SCHWANN, HENLE, BARRY, WHARTON JONES,

BENNETT, and others, have contributed to the development of a physiological law or order, by which abnormal changes may be rationally and scientifically tested; whereas chemical philosophers have done nothing in this respect. Secondly, microscopical analysis reveals elements and forms, as nearly as possible as they exist in the living structure,—nay, in the living body itself; whereas, a chemical analysis furnishes only the result of complex manipulations, in which unnatural agents are employed, unnatural changes produced, and unnatural products evolved. Thirdly, the materials for the growth and nutrition of living bodies are prepared or elaborated in the interior of closed vesicles or cells, so that when the cell-wall ruptures, and the interior matter is thereby exposed to new agents, new changes occur; and alterations of form and quality therefore anticipate a chemical investigation. Lastly, vegetable morphology, as a branch of scientific research, owes everything to the microscope, and nothing to the filtering paper, the test-tube, or the crucible; it is therefore reasonable to expect that the normal order of animal morphology may be equally as well illustrated by the same means. Not that microscopical and chemical investigations are to be considered as in any way opposed to each other; on the contrary, the question is, which, in the present state of our knowledge, affords the most useful and trustworthy information. Chemical facts in their relation to the structure and functions of living beings, appear to me, at present, as loose and isolated materials, which may hereafter find their useful applications; but to the microscope will, if I mistake not, belong the credit of enabling us to establish physiological and really practical principles.

In applying the law of morphology in explanation of the phenomena of inflammation, the distinctions between *organs*, *textures*, and *elements*, must be insisted on.

In vegetable structures,—leaves, sepals, petals, stamens, and carpels are organs.

It has been shown (I., p. 33) that leaves are composed of two distinct cellular textures, (the coherent respiratory, and the incoherent secretory,) of a supporting fibrous texture, spiral vessels, and stomata. The same kind of demonstration may be extended to all vegetables organs.

It has also been shown, (I. and II., pp. 33 and 61,) that the elements contained within the secretory cells are either a viscous protoplasm mixed with molecules, green granules of chlorophyll, with sundry properties and qualities; or (as in petals,) a coloured fluid with molecules. The differences in these elements being due to an elaborating process effected within the closed cells in obedience to a fixed morphological law.

The same kind of demonstration may be extended to animal structures. In the human body, for example, the liver, the lung, the brain, the kidney, and a bone, are organs; each organ being composed of various

textures, and each texture of special histological or morphological elements. Thus, the liver, which is a secreting organ, has the following textures and elements entering into its composition:—

1. *The hepatic parenchyma*.—A brittle, slightly-coherent, corpuscular texture, the elements of which are cells, containing in their interior a yellow fluid, with numerous molecules and globules of fatty matter, (together forming a kind of animal endochrome,) which, when set free by the dissolution of the cell-walls, constitutes the secretion termed the bile. The cells are congregated in small groups, termed lobules, each lobule having its own vessels and ducts.

2. *The areolar texture*.—A coherent elastic texture, interposed between the lobular sub-divisions of the hepatic parenchyma, and forming a cushion or bed around the divisions and sub-divisions of the blood-vessels and bile-ducts. This texture is diffused throughout the whole organ, enters into all its recesses, and with the blood-vessels and bile-ducts, interposes between the lobules. The elements of this texture are waved fibres and curled fibrils.

3. *The hepatic indusium*, or peritoneum.—A thin membranous texture, which limits the external configuration, and gives a smooth equable surface to each lobular sub-division, and to the whole organ. This texture is coherent cellular externally, and fibrous beneath, where it is continuous, and blends with the areolar texture just described.

4. *The coats of the larger divisions of the blood-vessels and bile-ducts*.—This is a strong fibrous texture, differing from areolar texture by the fibres being straighter and condensed into layers, which cross each other at right angles, and inclose among them cell-like bodies termed *nuclei*, numerous molecules, and granular or fatty particles. The elements of this texture therefore are fibres, nuclei, molecules, and granules; and its nutrient vessels are technically called *vasa vasorum*.—(IV., p. 92.)

5. *The mucous texture of the interior of the bile-ducts*.—The elements of this texture consist of cells and fibres; the cells at the free surface are denominated epithelial cells, and when detached from the texture in an early unmetamorphosed globular form, are called mucous cells, or mucous globules.

The lung is composed of the following textures and elements:—

1. *The pulmonary parenchyma*.—An elastic, coherent, cellular texture. The cells of this texture are comparatively very large, and inclose spaces filled with bubbles or vesicles of air. The elementary membrane forming the cell-walls is thin and transparent, but strong and elastic, and covered all over with a close network of non-secreting capillary blood-channels.—(IV. and V., p. 92.)

2. *The areolar texture*, with the same elements, and performing the same kind of office as the areolar texture of the liver.

3. *The pulmonary indusium*, or pleura, limiting the external configuration of the organ, and of the same nature with its analogue in the liver; and although we may give to the *indusium*, or to the *lobular indusium*, of one organ, one name, and to those of another organ, other names, still it behoves us not to neglect the identity of their structural elements, nor their physiological and pathological relations.

4. *The coats of the larger divisions of the blood-vessels and air-tubes*.

5. *The mucous texture of the interior of the air-tubes*.

6. *The fibro-cartilaginous and cartilaginous textures of the windpipe and larynx*.

In the leaves of plants, a coherent transparent non-secreting aëriferous texture, with air spaces and stomata, and an incoherent, secreting, corpuscular, chlorophylle texture, with a supporting frame-work and spiral vessels, are conjoined, and co-exist; whereas it would appear, from the details of the structure of the liver and lung, that in animal bodies, the coherent transparent, non-secreting, aëriferous parenchyma, with its necessary appendages of air-passages and air-tubes, and the secreting, endochrome, corpuscular texture, with its requisite ducts and outlets, are separated, and form two distinct organs.

In the lung, (V., p. 92,) the fibrous elements of the texture of the larger divisions of the blood-vessels and air-tubes are continuous with, and terminate in, the coherent, non-secreting, cellular parenchyma; so it appears in the liver, and probably in other secreting organs, that the fibrous textures of the blood-vessels and ducts are disseminated, (in the capillary channels,) among the secreting cells of the corpuscular parenchyma. (IV., p. 92.)

The analogous fact may be seen in the embryo chick, where the walls of the vessels of the *respiratory* allantois are quite different from those of the *nutritive* yolk-sac.

Of the several elements of the liver and lung here enumerated as typical of the composition of the organs of the human structure, it is to be observed, that some are general, some peculiar, and in all cases it is the peculiar parenchymatous elements that constitute the distinctive character and execute the special function. The slightly coherent endochrome, and transient cells of the hepatic parenchyma are peculiar to the liver; the strongly coherent, vascular, permanent, aëriferous cells of the pulmonary parenchyma, peculiar to the lungs; muscular fibrillæ, to muscles; and nerve-tubes to nerves. But the fibrous elements of the coats of the blood-vessels, and of the areolar texture, are general, so that no visible part of the body, however small, is without them. Hence, every perceptible alteration of structure involves not one only, but many textures,—the parenchymatous texture, the texture of the coats of the blood-vessels, the areolar textures, &c.

A retrograde metamorphosis in the parenchymatous texture of the brain, lung, joints, and bones, cannot take place without sundry degrees of morphological transformation in the contiguous textures. In the lung the fibrous texture of the coats of the blood-vessels, the fibro-corpuseular secreting texture of the air-tubes, the lobular indusia, the areolar fibrous texture between the lobules, and, finally, the pleura itself, all partake in the phenomenon. Thus, during the progress of consumption, there is an increased secretion from the air-tubes; a thickening of the interlobular areolar textures; destruction or thickening of the coats of the blood-vessels; and, finally, adventitious membranes and abnormal secretions on the pleura. If ulceration of the mucous texture of the air-tubes occur, the fibrous texture beneath is thickened and consolidated; and when the secreting texture of the alimentary canal softens and ulcerates, pseudo-fibrous membranes glue the convolutions of the bowel to each other, one texture retrograding into a fluid pus, whilst adjacent ones, of a higher type and different order, are becoming thicker and more consolidated,—scrofulous and inflammatory actions running on together, not in the same texture, but in the same organ.

Amidst the manifold phenomena, and the multitude of qualities and textures produced, during the growth of living bodies, and during the progress of scrofulous and inflammatory diseases, by the agency of cells, the following two events appear constant and influential:—

1. The enlargement of the capacity of some cells, the thickening and coalescence of their adjoining walls, and their durability in sundry forms as persistent elements of the fabric.

2. The transient existence of other cells, the thinning and dissolution of their walls, and the consequent discharge of their contents,—a gelatinous, fibrillating protoplasma, or a limpid secretion.

And as cells (I. and II.) are—

1. *Incoherent and fluid*, in blood, pus, &c.;
2. *Slightly coherent*, forming soft and brittle solids, in the brain, the hepatic parenchyma, and the corpuseular secreting textures; or,—

3. *Strongly coherent*, in the parenchyma of the lung, in the pith and leaves of plants, and in woody and osseous textures.

So the protoplasma may be—

1. *Incoherent, gelatinous, and fluid*, in lymph, liquor sanguinis, mucus, saliva, and other secretions;

2. *Slightly coherent and granular*, in the flakes and clots of pus, tubercle, tuberculous matter, &c. ; or,—

3. *Strongly coherent and fibrous*, in coagulated fibrin, in the areolar and ligamentous textures, and in false or adventitious membranes.

Combinations of these cellular and protoplasma elements give rise to textures of sundry kinds, and of various degrees of cohesion,—to *gelatino-corpuseular*, or

gelatino-cellular, *fibro-cellular*, *fibro-granular*, &c. In the egg of a bird we have an example of a gelatinous protoplasma, derived from cells in *the white*, and of a slightly coherent, cellular, or corpuseular texture (the cells abounding in granular matter,) in *the yolk*. And in all cases the normality or abnormality of the prevalent elements must be determined by the natural type or standard, by their conformability or unconformability to the law of the morphology, or the law of the growth and nutrition of the structure.

It has been shewn in the blood-vessels ministering to the growth of the transparent textures of the human embryo, that we are sometimes able to discriminate with the microscope the red blood in the centre of the vessel (*a*); a layer of protoplasma (*b*); the texture of the wall of the vessel (*c*); and the parenchyma (*d*.) (VII., *Fig. I.*, p. 117.) And it is evident, if unconformable elements accumulate in the protoplasma space (*b*), that they must, in the progress of nutrition, mingle with or supplant the normal elements of the coats of the vessel (*c*), and thence enter into the composition of the parenchyma (*d*), ultimately appearing in the secretion (or excretion,) if the texture be a secreting one, or being eliminated from a non-secreting (or non-excreting,) one, they constitute an abnormal discharge. Unconformable and incoherent cells predominating, alter the physical properties of the coherent textures; and if they supplant the normal elements, the texture is said to *ulcerate*.

In the blood-vessels which traverse the transparent, adult, fibrous, or areolar textures, we see no indication of a protoplasma space; nor do we find incoherent, cellular, or corpuseular forms interposing between the red current and the walls of the vessels, and it is on this account inferred that nutrition and growth are not going forward actively in such vessels. But when these textures become inflamed, not only are the vessels multiplied in number, but their walls become thicker; unconformable, cellular, and protoplasma elements make their appearance between the blood-current and the texture, occupy the intervals between the normal fibrous elements, accumulate on the exterior of the vessels, and are cast off in the excretions. Hence, then, we see the propriety of the terms *protoplasma* and *protuplasma*; for lymph, in the ordinary acceptation of the term, is only one of the forms of the nascent, nutrient, metamorphosing matter; and the walls of capillary vessels differ in different textures, differ in the same place in the embryo and growing from the adult texture, and are subject to sundry alterations in inflammatory and scrofulous diseases.

(To be continued.)