XXXIV.—MICROSCOPICAL OBSERVATIONS ON THE PATHOLOGICAL MORPHOLOGY OF SOME OF THE ANIMAL FLUIDS, BY DAVID GRUBY, M.D.—
No 2.

Translated from the Latin by S. J. Goodfellow, M.D., &c.

[Continued from page 206.]

OF PUS.

I HAVE considered the following questions concerning pus, which are sufficiently trite, indeed, but as yet have not been performed with the penetrating examination which the difficulty of the subject required, in order to ascertain:—

1. What is understood by the name of pus?
2. If a material difference can be shown between pus from a wound (pathological organ), and pus from the surface of an organ whose continuity is uninjured?
3. Whether a material difference is to be observed between pus and mucus?
4. If the product from the commencement of suppuration to the termination of the process be always the same?
5. What material changes are observed between pus produced from a normal process of suppuration, and that produced from an anomalous process.

Pus secreted by an abscess is a yellow fluid, of an agreeable animal odour, of the consistence of cream; that from the process of inflammation or irritation is composed of globules three or four times larger than those of the blood, and a fluid. Allowed to rest, a double stratum is perceived, the upper one being very fluid, the lower thicker.

The inferior stratum, submitted to the microscope, is perceived to be endowed with yellowish-white, and perfectly smooth globules, joined together by a viscid fluid. The globules exceed in size three or four times those of the blood; most of them are round, some are oblong, others wedge-shaped. They consist of a transparent envelope, with usually one, sometimes two, but seldom with no vesicle enclosed in them; the diameter of the central vesicle scarcely exceeds that of the blood-discs, the remaining space is filled by the small and large primitive molecules.—Plate 6, fig. 97.*

* Gerber thinks that pus-globules secreted from wounds, are nothing more than exudation-globules, which lie beyond the vivifying influence of the surface of the

The coverings exposed for a long time to distilled water, perceptibly swell, and are ultimately broken, the central vesicle, surrounded by the primitive molecules, remaining; but this being deficient, the congregated primitive molecules alone remain.—Plate 6, fig. 97, *m, n*.

Globules exposed for a long time to the air have yellow polygonal margins, which surround a white pellucid space.—Plate 6, fig. 98.

Acetic acid sp. gr. 1,030, renders the globules diaphanous, the coverings sensibly vanish, with from two to five nuclei, which at first were not clearly seen, remaining; the nuclei, which have an amber-yellow colour, are round, and their magnitude is in indirect relation to their number. Hence, when you perceive five nuclei, their diameter scarcely exceeds one-third of that of the blood-globules; but when two only are seen, their diameter exceeds the half of that of the blood-globules.

The nuclei within the margin have a black ring, and within this they show another black ring, enclosing a central lucid spot.—Plate 6, fig. 99.

The nuclei swim together in a certain symmetrical order in the surrounding fluid, which being evaporated, they disappear, and nothing except the rudiments of the envelopes, previously softened in acetic acid, again comes into view; they bear an irregular angular or spherical figure, with a very thin black or punctated margin, showing in their centre a white pellucid spot surrounded by extremely fine points.—Plate 6, fig. 100, *a* and *b*.

Oxalic acid produces the same change as acetic acid.

Tartaric acid quickly produces the same changes.

Solution of caustic potash 1,350, quickly dissolves the globules,

wound, and exposed to the influence of external agencies, and therefore forsaken, as it were, by the organizing principle, begin to degenerate in their organization, and to suffer changes in their chemical constitution, whilst those that continue in immediate contact with the living structures of the body, advance in their organization: those globules that are cast loose then die—*mors vitæ origo*.

“On the exudation-globules that are free, a number of delicate lines, radiating from a centre, are first perceived, which divide their peripheries into from six to eight (seldom more) segments; these lines become more and more distinct, and the capsule appears as if it were torn or cleft, but without separation of parts; in many globules, too, the nucleus now appears inclined to fall into from two to three pieces; the originally reddish-yellow colour of the globules fades, the segments of the envelope and divisions of the nucleus, which had been linear and sharp in appearance, become rounded off till they appear like aggregated granules, whilst the pus, now completely formed, acquires a greenish-yellow hue.”—*Gerber's Elements of Anatomy, translated by Mr. Gulliver.*

and form a white fluid resembling mucus, which is easily drawn into threads, and when dried, no form is any longer seen.

Caustic ammonia does not change the globules.

Diluted nitric acid 1,170, corrugates the envelopes of the globules, and forms one contracted central nucleus, which is distinctly to be seen. Plate 6, fig. 102.

Diluted hydrochloric acid 1,070, like nitric acid, corrugates the envelopes, and one moderately clear and contracted nucleus is seen.

A solution of nitrate of silver 1,275, renders the coverings transparent, the remaining contracted nucleus being clearly seen.—Plate 6, fig. 103.

In alcohol 0,830, the envelopes of the globules become corrugated, the nucleus, when there is one only, equals twice the diameter of the blood-globules; or when three nuclei are found, they are even five times smaller than the blood-globules.—Plate 6, fig. 101.

The upper stratum is more fluid, is endowed with much fewer globules of pus, and a greater quantity of the white pellucid fluid. The fewer globules it contains the whiter is the colour, and the more of fluid (serum) is contained, the more fluid the stratum is found to be.

In large subcutaneous rheumatic abscesses, the different fasciæ, cellular tissue, and the smaller vessels and nerves, are found infiltrated with pus.

Globules of pus found in the parenchyma of organs, evidently separate its fibrils and fibres one from another and surround them; hence the colour of the parenchyma is changed to yellow, reddish-yellow, brownish-yellow, greenish-yellow, according to the quantity of pus-globules and the colour of the organ in its healthy state: thus, for example, cellular tissue, which is white, when infiltrated by pus, becomes yellowish-white, or from white, greenish-yellow.—Plate 10, fig. 64. The liver, also, when infiltrated with pus, from reddish-brown, becomes yellow; the kidneys, from red, change into a yellow colour. By this infiltration, the texture of organs loses much of its cohesion and tenacity, the organs are consequently rendered friable and soft, until the number of the globules shall have so increased, that the lacerated fibrils completely dissolve, and, mixed with pus are enclosed by the surrounding texture, which is as yet firm. This state of things is called an abscess. Some of the globules of pus which have been shut up for a long time in an abscess, are composed of an envelope filled with very small molecules, others of the small molecules only.—Plate 10, fig. 61.

But the globules taken from a metastatic abscess, thirty-six hours after death, were destitute of all covering.—Plate 10, fig. 62. Globules taken

from an abscess of the liver thirty-four hours after death, consisted of an envelope filled with the smallest molecules.—Plate 10, fig. 63. Pus from a wound suppurating torpidly for twenty years, with a base furnished with hard and long granulations, was yellowish-white, contained a few globules, and a great quantity of cells of epithelium in different states of evolution.—Plate 9, figs. 54, 55.

Exudated purulent peritoneal fluid of a yellowish-green colour, besides globules of pus with an envelope filled with small and large molecules, contained other globules which were destitute of all covering, and transparent, and of epithelium, beset with larger molecules.—Plate 9, figs. 56, 58; Plate 10, fig. 59.

The yellow flocculi swimming in peritoneal exudation, are composed of coagulated fibrin, enclosing globules of pus.—Plate 10, fig. 60. Recent peritoneal exudation, Plate 9, fig. 56, contains globules whose central vesicle is provided with the smallest molecules.

OF VARIOLA.

1.—*Modified Variola.*

Of the material changes which we find in the products of this pathological process, some take place during the formation of papulæ, or of vesicles, and others during the formation of pustules.

Being preceded by three days of inflammatory fever, the red spots, in about twenty or thirty hours, appear changed into papulæ; and the limpid fluid, in small quantity, which was extracted from the affected epidermis, offered an alkaline re-action; under the microscope, a few larger, white, almost pellucid globules appeared in it, together with animalcules composed of a globose or conoid trunk, very thin neck, which was crowned with a small hook, with which they exercised a continuous motion, by turning the neck forwards and backwards.—Plate 9, fig. 42.

On the *third* day of the eruption, the limpid fluid extricated from the papulæ, contained, besides the molecules, a few pellucid globules, exceeding by two or three times the size of the blood globules, abounding with primitive molecules, which scarcely exercised any molecular motion. The animalcules, at one time curved, at another conoid or cylindri-form, the hook being retracted, sometimes exercise a very quick circular motion.—Plate 8, fig. 31; Plate 9, fig. 43.

The molecules without the globules are of different sizes; the smallest which are visible scarcely exceed the $\frac{1}{20}$ th, the larger $\frac{2}{20}$ — $\frac{4}{20}$ ths, and

the largest $\frac{5}{20}$ — $\frac{10}{20}$ ths of the size of the blood discs. The smallest globules scarcely exceed in size $\frac{1}{20}$ — $\frac{10}{20}$ ths of the blood-globules.—Plate 8, figs. 29, 30.

On the *fourth*, *fifth*, and sometimes on the *sixth* days of the eruption, the limpid fluid which is found in the vesicles in small quantity, presents globules almost pellucid, with large and small molecules, and here and there they are provided with central vesicles.—Plate 8, figs. 31, 35, 36 ; Plate 9, fig. 45. The molecules which fill the globules exercise a powerful motion even with the envelope broken, (the envelopes are not easily broken.) Animalcules and small globules, as above described, also appear.

On the *fourth*, *fifth*, and sometimes on the *sixth* and *seventh* days of the eruption, the fluid contained in the vesicles, has an alkali like the serum of milk. The globules of pus turgid with the larger molecules, are increased in number, and exhibit a yellow colour. Globules destitute of molecules are seldom seen in this fluid, and the molecular motion is very evident. In fat individuals, there is sometimes found in it a globule of fat. In some, large, round, or oval globules are seen, exceeding in size the globules of pus four to six times, endowed with the larger molecules, and of a marked yellow colour. The envelopes of some of the globules of pus are more quickly broken, and conoid and cylindrical animalcules are also seen.—Plate 8, figs. 32, 37.

On the *fifth*, *sixth*, and sometimes on the *seventh*, *eighth*, and *ninth* days of the eruption, the fluid in the pustules becomes thicker, and of a deeper yellow colour, and has scarcely any perceptible alkaline re-action. It contains many yellow globules, the envelopes of which are easily broken. Some of the globules are destitute of all envelopes ; but the more the pustules approach the stage of exsiccation, the more intensely the globules are marked of a yellow colour, and the quicker the envelopes are broken : hence they become irregular, some corrugated by drying ; others, their envelopes being broken, dissolve, and the molecules which they enveloped, I have observed, dispersed without order. The molecular motion at length ceases, and with the fluid may be mixed recent and older cells of epidermis ; this continues until all the fluid which held the globules and molecules suspended in it is evaporated, and inflammation having ceased, is not renewed. Hence a thick pus is continually secreted, until ultimately this becomes dried, turns into a hard crust, which we believe to be made up of a compound of small and large molecules, a few globules of pus, conoid animalcules, and dried cells of epidermis.—Plate 8, figs. 33, 34, 38—41 ; Plate 9, figs. 47—50.

2.—*True Human Variola.*

True human variola seldom occurs among us. I have observed this severe pathological process in one individual only. The pellucid lymph from papulæ, here and there broken, contains, on the *seventh* day of the disease, white globules, not perfectly round, but fimbriated on one side as if torn from the place of their growth, exceeding by four or five times the magnitude of the blood-globules, and which we observed to be provided with a pellucid covering and very small molecules. There are, moreover, formed in this fluid, small white or yellowish globules, and also a few globules of the blood.—Plate 9, fig. 52.

Death, which put an end to the disease on the following day, prevented, to my sorrow, any ulterior investigation.

OF LYMPH AND PLASTIC EXUDATION.

The plastic lymph, an integrant part of the living blood, united to serum and the red particles, constitutes blood. The living blood circulating in the organism, when investigated by the microscope, appears composed of two elements :—

a Of globules ;* and,

b Of a pellucid fluid, in which the globules float ; the liquor sanguinis :—

Fresh blood taken from the circulatory passages, received in a sufficiently deep vessel, and kept at rest for some time at a moderate temperature, coagulates, and its constituent parts separate from each other.

The globules, on account of their great specific weight, fall to the bottom ; but the liquor sanguinis also divides :—

1st. Into plastic lymph (fibrin) which coagulates, and united with the globules forms the clot, but accumulated on the surface without globules, forms the so-called phlogistic, buffy crust ; and,

2dly. Into serum, in which the clot floats.

The globules of the blood are again endowed :—

1st. With an envelope ; and,

2dly. With a nucleus.

* Particles or discs would be the more correct appellation for these corpuscles, since all *recent* microscopical observers agree in opinion that they are not globules ; but, as the author in the original work has given to them the name *globuli*, the Translator, from a wish to deviate as little as possible from the literal translation, has allowed it to remain.

The envelope of the globules is a red substance, soluble in water, from whence the blood takes its red colour, and is called cruor (*hæmatosin*) ; but the nucleus is not soluble in water ; it is white, and is called fibrine.

The plastic lymph, on account of its lighter specific weight, coagulates, and constitutes the superior part of the clot (namely, the so-called phlogistic or buffy crust), exhibiting a yellowish-white colour, and is of very firm consistence, tenacious, elastic, and transparent.

The blood coagulating quickly, offers no phlogistic crust, for the globules of the blood, on account of the more rapid coagulation of the plastic lymph, are not permitted to fall to the bottom ; hence they become suspended by it, and do not change the place which they occupy. They tinge the clot in every part of a red colour ; hence, on account of the equable distribution of the plastic lymph, the clot preserves an equable tenacity and firmness in every part.

The serum of the blood, extricated from the clot by the coagulation of the plastic lymph, appears of a greenish-white colour, and is a thin and transparent fluid. Blood, quickly coagulating, extricates but little of the serum, because a part of the serum remains shut up in the plastic lymph ; the quicker, therefore, the coagulation of the blood, the smaller the quantity of serum which is extricated ; and, vice versâ, the slower the coagulation, the more of the serum is extricated, (i. e. in blood free from any dyscrasy) ; so that the quantity of serum extricated is in direct relation with the quantity of phlogistic crust ; for when there is a large phlogistic crust, then there is a large quantity of serum, and when there is no crust, then but little or no serum is extricated.

Blood stagnating in the heart and large vessels, life being extinct, separates in the same manner into its constituent parts, viz., into clot and serum, the clot, as in vessels out of the organism, adapting itself to the form of the vessels in which it remains. In the heart and large vessels it forms oblong, globose, cylindrical, or conoid pieces, the superior part of which, of a white colour and gelatinous, constitutes the phlogistic crust, composed of plastic lymph ; but the inferior part of the coagulated blood, of a deep black, is composed of the globules of the blood. These coagula are called polypi of the heart. The recent plastic lymph of these polypi, investigated by the microscope, is composed of soft, very thin, transparent fibrils, running in a straight and parallel direction, and enclosing among them very small molecules.—Plate 10, fig. 65.

The plastic flocculent exudation of purulent puerperal peritonitis, is composed of plastic lymph and globules of pus.—Plate 10, fig. 60.

The yellowish gelatinous plastic exudation produced from recent peri-

carditis, is composed of transparent, very thin fibrils, running parallel, or for the most joined into fasciculi, and also of the smallest molecules and globules, exceeding by twice or thrice the diameter of those of the blood.—Plate 10, fig. 67.

The hard, plastic, greenish-yellow exudation from the mucous surface of the uterus, is also composed of soft, parallel fibrils, intermixed with numerous molecules, and the globules of pus are seen equally distributed among the fibrils.—Plate 10, fig. 66.

The plastic yellowish-white exudation formed on the external surface of the heart for three or four days (the villous heart), consists of soft, gelatinous fibrils, united into fasciculi, and running in a parallel direction, which enclose within themselves a few white transparent globules, exceeding by twice or three times the diameter of those of the blood, and filled by the smallest molecules.—Plate 10, figs. 68, 69.

The white, somewhat rough, plastic exudation of the villous heart, formed from the *sixth* to the *eighth* days, is composed of roughish, single fibres, running flexuously.—Plate 10, fig. 70.

The hard, white plastic exudation of the villous heart, formed from the *fourteenth* to the *twenty-eighth* day, is endowed with hard fibres, forming oblong and round areolæ.—Plate 10, fig. 71.

OF THE WHITE PELLUCID FLUID SEROUS EXUDATION.

The limpid serous fluid of a bladder, formed by the application of a blistering plaster, investigated by the microscope, consists of two constituent parts, viz., a perfectly fluid part, and a few white globules floating in it. These globules are diaphanous, and scarcely exceed twice the diameter of those of the blood. They are invested with a very fine, smooth envelope, which includes the smallest molecules. Here and there, also, globules occur destitute of all covering, and endowed with naked, very small molecules.—Plate 10, fig. 78.

The limpid serous fluid received from the papulæ of modified variola, contains, besides the larger globules, others in no respect different from those of the serum.—Plate 8, fig. 29,

The limpid serous fluid extricated from recent infiltration of intestine of abdominal typhus, contains the same globules of serum.—Plate 10, fig. 77.

The limpid serous fluid filling the interstices of the fibrils of the plastic exudation of the villous heart, contains globules not differing from those of the serum.—Plate 10, figs. 67, 69.

The white pellucid fluid of a serous cyst (*morsus diaboli*) contains white, perfectly round, smooth globules, destitute of all covering, smaller, or a little larger than the globules of the blood.—Plate 10, fig. 81.

The white pellucid serous fluid, with which the skin is rendered turgid in œdema, contains white or yellowish globules with stellate points.—Plate 10, fig. 79.

OF THE ULCERS AND TUMID MESENTERIC GLANDS OF ABDOMINAL
TYPHUS.

(*Of Ileo-Typhus—Ulcerous Ileitis—Gastro-enteric Fever, inclining to Nervous—Gastro-enteritis—Nervous Inflammatory Fever—Versatile Nervous—Nervous Fever with Stupor.*)

Abdominal typhus, that multiform disease, designated by so many names by the most celebrated authors, has as many forms. In this place we shall speak of the pathological mutations of the substance and texture of the inferior part of the ileum; also of mesenteric glands adjacent to this, and of the changes in the spleen.

In bodies examined on the *fifth* day of the disease, besides a turgid state of the membranes of the ileum, there is seldom any kind of disease to be seen.

Those who die on the *tenth* day, besides a turgid state of this membrane of the ileum, show roughish, somewhat elevated lenticular or oblong patches, the extent of which exceeds one or two inches, called crude infiltrations by the most celebrated anatomists. The mucous membrane covering the *lenticular* infiltrations, *slightly* adheres to them, and is easily removed from the part, and thrown into folds; but the mucous membrane lying over the *oblong* infiltrations, adheres *firmly* to them.

The muscular coat is intimately joined to all the crude infiltrations.

The infiltrations thrust forward the mucous membrane, whose surface is equal and smooth, whilst they are lenticular; but when it covers the oblong patches, it is uneven and furnished with many small elevations and depressions. The places which the oblong patches occupy, correspond to the seat of the glands of Peyer.

The texture of the infiltrated patches is firm, tenacious, white, or yellowish-white, and a white, limpid, serous fluid is extricated by pressure, which, investigated by the microscope, contains white globules, composed of a smooth covering filled with the smallest molecules. The

globules are round or oblong, and exceed the diameter of the blood-globules once or twice.—Plate 10, fig. 77.

The ileum of patients dying on the *fifteenth* day of the disease, offers infiltrated patches, covered here and there near the valve of Bauhinus, with hard brittle greenish, or greyish-yellow, or brownish crusts, the thickness of the crusts increases to half a line and beyond; but the thickness of the infiltrations from half a line to almost two lines.

The crusts investigated by the microscope are composed of a substance irregularly granulated. They adhere at first firmly to the infiltrated patches; but somewhat later they adhere slightly, and are easily separated from them.

The slightly adherent crust, being removed, leaves an ulcerous infiltrated patch, whose margins are hard and elevated, but whose bottom is uneven, hard, slightly excavated, and covered with a very little fluid of a greyish colour.

Under the microscope, round white globules are found in the fluid, of which some are composed of a smooth envelope, enclosing the smallest molecules, others of the smallest molecules only. Their diameter exceeds twice or four times that of the blood-discs.—Plate 10, fig. 72.

The infiltrated substance taken from the margins of the ulcer, offers, under the microscope, conoid or elongated corpuscles, [mostly in the broader part, enclosing a central vesicle, their narrower part is prolonged into a thin fibril; intermixed among these, white, transparent, round globules appear, four or six times larger than those of the blood, and filled with the very smallest molecules.—Plate 10, fig. 73.

The infiltrated substance taken from the bottom of the ulcer, contains the same microscopic forms,—Plate 10, fig. 74, (depicted close together.)

The intestines, investigated on the *twentieth* day of the disease, exhibit few entire, infiltrated patches, but many ulcers, partly covered with crusts, partly clean excavations already freed from the crusts, the margins and the bottom being somewhat rough.

On the *twenty-fifth* day of the disease, the margins are somewhat elevated, the bottom of the ulcers appear but little rough, and here and there a crust is still found.

Those who die on the *thirtieth* day, exhibit ulcers with the bottom somewhat depressed, thin smooth margins; here and there fibres of muscular membrane appear in the fundus; in some the bottom is closed by the peritonæal membrane; in others it is perforated, and

a free passage given to the contents of the alimentary tube into the peritoneal sac.

On the *fortieth* day of the disease, generally no more ulcers are to be detected; in their place, small smooth depressions of mucous membrane are found, provided with no intestinal villi and no follicles; the peritoneal serous membrane investing this small part, is remarked of a livid colour. The intermediate net-work, covering the depressed patch of mucous membrane forms oblong and angular areolæ.

On the *sixtieth* day the depressions of mucous membrane are furnished with elongated cylindrical villi, distant from each other, and also with a few simple and shallow follicles.

The net-work of intermediate vessels forms angular, round, or oval areolæ.

Those mesenteric glands, which lie next the ulcers, most often swell; they grow red or livid, are rendered softer or more fluid; the degree and extension of the pathological changes in the glands being seldom found in indirect relation with the changes in the intestine.

The fluid extricated from the tumid, red, and livid glands, and examined by the microscope, is greyish-white; it contains, besides some globules of blood, a good many round, white globules, exceeding in extent from three to six times the blood-discs, with a smooth envelope full of the very small molecules. Globules are here found, furnished with one or more central vesicles.—Plate 10, figs. 75, 76.

The changes of the spleen in abdominal typhus, respecting its increase of volume; of absolute and specific weight; change of density, and colour; I shall leave to be treated of in another place; here it will be proper to note, that globules occur in the inflamed (hepatized) substance of the spleen endowed with the smaller molecules, which are seldom provided with a smooth envelope, and elongated white corpuscles, the representation or form of which the reader will find in Plate 10, fig. 62.

(*To be continued.*)

XXXV.—OBSERVATIONS ON FIBRE.*

By Martin Barry, M.D., F.R.S., L. and E.

THE author observes, that in the mature blood-corpuscles, there is often seen a flat filament already formed within the corpuscle.

* Extracted from the Annals of Natural History, in the Lond. and Edinb. Journal of Medical Science. In our next number, we intend offering some remarks with reference to this interesting subject.