however, these activities with the return of a higher temperature. Dr. Cohn by a mistake cites Professor Frankland, together with Dr. Bastian, as entering the lists on behalf of the "generatio equivoca," and observes that so talented and exact a reasoner as Pasteur has no easy task in dealing with the French heterogenists. This is, he says, due not only to the illogical conclusions and the bad experimentation of the supporters of *generatio æquivoca*, but because there are still, in fact, certain conditions relating to Bacteria which are not fully understood, and which, though he is persuaded they do not directly affect the question at issue, yet render it possible to understand how contradictory statements arise. These conditions are those above noted as to the spluttering of the fluid[1] and the protective action of lumps in experiments where putrescible fluids are heated.

On a NEW ALGA, CRENOTHRIX POLYSPORA (Cohn), *from the* WELL-WATER *of* BRESLAU. By Dr. F. COHN. Translated in abstract by W. ARCHER, M.R.I.A.

WHILST the water-supply of many large towns, both at home and abroad, is, it is to be be feared, not everything that could be wished as regards purity, it is to be hoped that few are so badly off in that respect as, according to Cohn, the town of Breslau appears to be. The greater part of a paper in the first part of his 'Beiträge'[2] is taken up with an account of the microscopic analysis of samples from various public wells, which revealed all sorts of "abominations."

The sample in which the interesting new alga *Crenothrix* was first met with appears to have come from a part of the town which enjoyed the unenviable reputation of being a "Berüchtigte Typhusgegend," but as this water was full of many sorts of organic matter, living, dying, and dead, we may infer that the *Crenothrix* was not specially to be accounted a culpable agent in promoting the unhealthy character of the neighbourhood.

In this water, which was cloudy, owing to the quantity of Bacteria, Prof. Cohn noticed some little yellowish-brown flakes, of about 1—2 mm. in size, which soon settled to the

[1] Dr. Roberts has some remarks upon this source of error in a letter to 'Nature,' Feb. 20th, 1873, p. 302.

[2] Cohn: "Ueber den Brunnenfaden (*Crenothrix polyspora*), mit Bemerkungen über die Mikroskopische Analyse des Brunnenwassers," in 'Beiträge zur Biologie der Pflanzen,' Heft I, p. 108.

bottom, and combined there with others into larger flakes. These flakes were found to be composed of a number of colourless filaments of an alga, forming loosely contorted tufts, amongst which Bacteria, Vibriones, Amœbæ, and various Infusoria swarmed. The same alga was afterwards obtained from various wells, and Cohn supposes its habitat to be the bottom and sides of wells, whence pumping detaches and brings it up, for it has not occurred in any of the open waters, and its want of colour indicates its coming from places from which the light is excluded.

The filaments are long, of varying width, rigid and little curved, often mutually interlaced, and in structure they exhibit the characteristics of the Oscillarieæ, that is, each thread consists of a series of equivalent cells enclosed in a rigid sheath. The contents show no trace of phycochrome or of any colouring substance; in the larger filaments the cells appear as if hollow in the middle, from the contents forming a thickened parietal stratum, the interior being filled with a pellucid cell-sap. The sheath in the more slender filaments is extremely thin, but in the larger ones it offers a double contour and pergamentacous consistence; the contents eventually become removed, leaving the sheath empty. Cohn holds that, doubtless, this sheath originates from the outermost cylindrical lamellæ of all the cells, whose individual portions, as in the formation of cuticle, become mutually fused; the sheath appears as if it sometimes became swollen up. At first the sheath is colourless; it may subsequently become yellow or brown, which is attributed by Cohn to the deposition of hydrated iron oxide.

On account of the great differences in the diameter of the threads, one might at first imagine it possible that many different species were mingled. But on closer examination it is seen that the width varies in one and the same filament; the filaments are, in fact, not cylindrical, but wider at one end than at the other. They often appear to be attached by the thinner end, and gradually to expand thence to the other or upper one. Equally variable is the length of the cells compared with their width, which is dependent, of course, on the transverse division of the cells having more or less recently taken place.

In many filaments the end-cell becomes by far longer than any of the others, and at the same time broader, and of an elongate ellipsoidal figure, calling to mind the spores of *Cylindrospermum*. Such an elongate end-cell, when it occurs, finally arrests the growth of the filament in the direction of its axis; the cell below it thereupon divides obliquely, grows out

sideways, subdivides, and forms a lateral branch (suggesting the mode of growth in Scytonemeæ). The enlarged end-cells are filled by a finely granular protoplasm (recalling the manubria of the Rivularieæ). The author had not been able directly to follow out any further development of these great spore-like bodies. He had seen, however, these end-joints empty, as if the contents had emerged through the perforated apex, and he thinks that certain colourless short filaments, with very delicate membrane, without sheaths, and with a peculiar slow gliding movement, which he met with in the material, may have originated from the large spore-like bodies and that these may, therefore, possibly have some place in the cycle of development of this plant.

But if the formation of these spore-like end-joints was a comparatively rare occurrence, another form of development was very general. This begins by the colourless contents of certain of the cells of both thick and thin filaments becoming retracted from the wall and condensed into round plasma-masses, and the filaments appear jointed in a moniliform manner. The further progress seems to follow two modifications, which the author distinguishes as macro- and microgonidia-formation.

The "microgonidia" are the most frequent, and seem to occur constantly in the thicker filaments. The cells of these increase first in width, and simultaneously become divided transversely, so that they form a series of discs, their length being scarcely more than a fourth of their width; these then divide vertically into four cuneate segments, and the latter, again, in a manner not readily followed out, repeatedly into a number of minute portions, designated by the author as microgonidia. This process begins first at the top of the filament, and gradually proceeds downwards. The individual gonidia are apparently primordial cells, which in arrangement originally corresponded to the joints of the filaments, but soon get disturbed, whilst the original septa are broken or resorbed. The sheath takes no share in this process, but forms a clavate "sporangium." The gonidia shove themselves forward, "somewhat like the zoospores of *Achlya*," but with a slowly gliding motion, to the apex, where they congregate in thousands, the hinder finally pushing out through the apex those in advance, the formation of more new gonidia going on all the while in the next deeper portion of the filament. The emerged gonidia have round or somewhat elongate figures; they show a central vacuole, but no membrane; their shorter diameter varies from about 1 to 3 m.m.m.; they are often twice as long, and

then constricted at the middle; many are transversely divided; they do not apparently move beyond a very slow rolling motion.

The formation of the "macrogonidia" seems almost never to occur in the same filament. It is distinguished by the fact that the cells subdivide into only two, or at most four portions (in the smallest threads they are formed in a single series), and the macrogonidia, accordingly, are larger (being from 3 to 5 m.m.m. in diam.); in other respects they behave alike, that is, they emerge slowly from the apex of the investing sheath. They are seen to be short cylindrical cells, with parietal protoplasm and watery cell-sap, and soon exhibit a transverse division.

In this manner, in the course of time, a mass of the *Crenothrix*-threads may emit the whole of their contents as gonidia into the surrounding water, where they lie in clusters, and, like the cells of *Palmella*, combine in masses by a common mucous matrix.

The further development of these gonidia Cohn was unable to follow, but he has no doubt that both forms of gonidia germinate into new *Crenothrix*-threads; he frequently found minute *Crenothrix*-threads which manifestly proceeded from the germinated gonidia; these occurred sometimes in bundles, and even though so minute began to show the characteristic widening towards the upper ends. There does not appear to be any difference between the "micro-" and "macrogonidia," beyond the circumstance that the former give rise to more slender filaments.

As to the systematic position of *Crenothrix*, Cohn considers it an alga, because of its close affinity to certain undoubted Algæ, though the want of colouring matter might seem to point to the Fungi, but on that ground the flowering plants *Monotropa* and *Lathræa* would be relegated to Fungi. The structure of the filaments in *Crenothrix* closely approaches Oscillarieæ, which, as a rule, contain phycochrome, but amongst them are found also colourless genera, especially *Beggiatoa* and *Spirochæte*; so far as *Hygrocrocis* represents a proper genus, the author would refer it also here. The author holds that the colourless Oscillarieæ live not only on inorganic but also on organic compounds (Hedwigia, 1865). In their mode of nutriment the colourless genera, *Beggiatoa*, *Spirochæte*, *Hygrocrocis*, *Crenothrix*, &c., seem to accord with the water-fungi, whilst their organization agrees with the phycochrome-containing Oscillarieæ. From these *Crenothrix* is distinguished by the unequal filaments, thickened towards the apices, by the subdivision of the cells in the direction of

the longitudinal axis, and, above all, by the numerous free gonidia densely filling the clavate "sporangia."

There is, however, another genus of the Oscillarieæ *Chamæsiphon*, Braun and Grunow, to which the author regards *Crenothrix* to be more nearly related; that genus forms short, erect, shortly jointed filaments, attached by one end to other Algæ, solitary or aggregated, each enclosed in a hyaline sheath of a narrow pyriform or clavate figure. The cells are produced by successive division, become rounded off, and emerge through the apex of the sheath as "resting spores," which germinate without "fecundation." From this *Crenothrix* is distinguished by the long filaments forming interwoven masses and by the numerous macro- and microgonidia, and it would appear to stand, as it were, between this genus and *Lyngbya*. In the latter Cohn thinks, from certain previous observations, "gonidia" may occur.

In a former memoir[1] Cohn had expressed the view that the phycochromaceous Algæ might be regarded as approximating to the Florideæ in a negative character evinced by both, that is, in the propagative cells being destitute of motile flagella, in contradistinction to the zoospores of Chlorosporeæ and Phaeosporeæ. *Crenothrix* affords a new connecting link between the two Classes, as it shows a considerable affinity to *Bangia*. In a marine species, *B. subæqualis*, Kütz., the sheath becomes transformed into a clavate sporangium, whilst the contents became transformed into round or ovate gonidia, which emerged from the sheath, and grew into new filaments, sometimes remaining attached by one end to the primary one. Solier and Derbes the author mentions as attributing to certain marine species of *Bangia* flagellate cells regarded as antherozoids,[2] but he thinks it probable these certain motions may have been confounded with monads or *Chytridium*-zoospores, and that they really show a great analogy with the microgonidia of *Crenothrix*. He regards, then, the genera *Oscillaria*, *Lyngbya*, *Crenothrix*, and *Bangia*, as forming a natural series connecting Oscillarieæ with Florideæ. But Cohn draws attention to the resemblance of the *Crenothrix*-gonidia to certain conditions of *Bacteria*. As is well known *Bacterium termo* occurs in certain stages as colourless mucous masses (*Zooglæa*, Cohn), from which the individual Bacteria emerge, by solution of the matrix, as free cells. Now, the author observed, in the water in which the *Crenothrix*

[1] Cohn: "Beiträge zur Physiologie der Phycochromaceen und Florideen," in 'Archiv für mikr. Anat.,' Bd. iii, t. ii.

[2] Solier and Derbes: "Mémoire sur la Phys. d. Algues" ('Supplément aux Comptes rendus de l'Acad. de Sci.,' Tome I, p. 64).

occurred, colourless mucous masses, containing minute bacillar cells (5·25 m.m.m. long and about one fourth that width), single or in pairs, with darkish granular contents. During observation he was surprised to see these cells begin to move with a revolving kind of motion; suddenly some swam out away from the mucus, and then returned; in a word, these little free cells showed all the characters of *Vibrio lineola*, Ehr., showing that that form passes through a *Zoogloea*-state, that is, a still, so to say, *Palmella*-like condition. Now, the isolated microgonidia of *Crenothrix* resemble certain of the larger *Bacterium*-cells, occurring in the same water, the more so as both were mostly met with constricted at the middle, that is, in various stages of transverse division, and combined together (in millions) by a common mucous matrix. Still, while the resemblance is surprising and the confounding of the one with the other easy, the author is disposed to think that there is really no genetic connection between the two forms.

On XANTHINE *and some of its* CRYSTALLINE COMPOUNDS. By B. WILLS RICHARDSON, F.R.C.S.I., Surgeon to the Adelaide Hospital, Dublin. (With Plate VI.)

FOR the opportunity of examining microscopically some of the salts of xanthine I am indebted to the kindness of Dr. Neubauer, of Wiesbaden, who sent me a specimen of xanthine from urine, as well as one prepared artificially from guanine. As urine, according to Dr. Neubauer, contains only about one gramme of xanthine in 600 pounds; my obligation to him is therefore not an inconsiderable one.

Xanthine itself, being amorphous, is not an attractive microscopic object. Its colour, when dry, is a light buff, but when mounted in either Canada balsam or gum dammar the semitransparent particles have a tint which I have imitated by darkening King's yellow with a little lamp-black. The larger particles do not transmit light.

The crystals of the hydrochlorate of xanthine represented in Pl. VI were prepared in the following way:—A few particles of the amorphous xanthine were put upon a glass slide placed upon a warmed iron plate; hot strong hydrochloric acid was then dropped upon them, and they were stirred together with a fine-pointed glass rod. They were allowed to cool slowly; and when, after the expiration of several days, evaporation was completed, and the crystals were perfectly