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THE REVELATIONS OF FIBRIN.

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Unexpected Proof of the Immortality of Life.

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I am well aware that the following may be received with incredulity, perhaps with a storm of opposition; not alone because of its contradiction of the teachings of science in the departments to which it relates, but also because of the startling character of the claims made. But the story is simple, and it seems to me that it ought to be told without reference to consequences. If false, its fallacy will soon be made apparent, and no serious harm can come from telling it. If true, its truth ought to be speedily known, for the possibilities that may come of it in unfolding many things in both life and disease that will be important for us to know. This is an age of investigation and of overturning old errors. "The national academy of sciences in a recent session at New Haven, Conn., decided that the existing theories concerning the sun will have to be abandoned as untenable." There are many other errors that will also have to be abandoned as untenable, and possibly the following may show up some of these. Because of the positive claims I first put forth last summer with reference to the remarkable revelations fibrin had given under different methods of treating it, a committee was appointed as is known by the Buffalo microscopic club to enquire into the subject. In connection with their labors a member of this committee put some fibrin from a washed clot of blood in some water in an open dish and set it aside to rot without the aid of extra heat. After two or three weeks of rotting this committeeman showed the sample to me, as containing what his entire committee regarded as good specimens of bacteria. Being entirely of their own manipulation and they being so confident as to the forms it contained, I obtained some of the fluid and experimented with it at my leisure. I put a drop or two upon a slide, placed a cover-glass over it and examined it with both a fourth and eighth objective. There was certainly great activity of life, or what might well be called life, under that cover-glass. I could think of nothing better to compare the moving forms there seen to than a school of minnows, to be seen where these miniature fish abound, darting here and there in the greatest activity or swimming leisurely along as the case might be. But these assumed bacteria had no organization in form, as head, body and tail, like minnows. They were mostly in straight rods without the ap-

pearance of head or tail, as large at one end as the other, white in color, and most of them appeared under a power of three hundred, about a sixteenth of an inch in length. They would swim or dart either end foremost apparently with equal ease. Their activity at times was something remarkable to look upon, then again they would remain passive, or show but slight motion. I prepared several slides in the same way from the same fluid, and studied the movements and appearances of these creatures with the greatest care. When quiet I saw clearly that they presented all the appearance of rods or short pieces of the threads of fibrin of the same length, as I had seen in great numbers of my own experiments. Then I turned the cover-glasses over, let the water dry off from the slides for fifteen or twenty minutes, examined them again, and there lay the dead bacteria in great numbers, as innocent and harmless pieces of fibrin as one could wish to look upon; and there were no forms present but such as fibrin gives. To prove that these were only forms of fibrin, I next took some pure fibrin that I had had digesting in chemically pure acetic acid for six weeks, crushed it down very fine with a spatula upon a slide, removed all the coarser particles, let the acid dry off, then examined them with the same powers before mentioned, and thus obtained precisely the same forms as those of the dead bacteria. No microscopist in the world could tell which was which unless he previously knew how the two were prepared. Again, in several instances, I obtained the same appearances from fibrin which I had digested in chemically pure nitric acid a month or more; and also from fibrin first boiled many hours, then baked to a chestnut brown, next pulverized a long time, then a little of this powder sifted into a drop of nitric acid on a slide, with a cover-glass placed over it and left to dry out slowly from under the glass. The best appearances in these nitric acid experiments were found by turning the cover glasses over and examining the region around outside of, and also just within, where the edge of the latter had rested. And here again, I repeat, were all of the forms of the dead bacteria reproduced.

My next work was to repeat my own experiments with rotting fibrin, previously reported, and daily watch every step in the

process with more care if possible than before. To do this I obtained some fresh fibrin by stirring it out of bullock's blood while yet warm, and washed it most carefully through water that had first been thoroughly boiled an hour or more. After this process the fibrin was a pure beautiful white, almost as white as snow, but fibrillated; that is, something like fresh cotton from the balls, but much more in closely matted masses than this. The microscope shows these masses to be made up wholly of threads of fibrin, some straight and some crooked, running in every direction through the mass. Several samples of this pure fibrin I set aside to rot in water first well boiled; one sample under warmth of a hundred degrees and upwards, another in a cool room, still another in a warm room, but without extra heat, and a fourth sample in double distilled water in a warm room. The one under extra heat and the two in the warm room all showed active life in twenty-four hours, rods and spirals from broken threads of fibrin appearing in considerable numbers, and in active motion. In twenty four to forty-eight hours longer great numbers of rods and spirals of fibrin had appeared, an eighth to half an inch in length, under a fourth objective; and many of them possessed of the most wonderful powers of volition that could be conceived of. The spirals would go through the fluid at times so rapidly that it was impossible to tell what they were until they had slowed down enough to see that they were spirals. They moved with the corkscrew motion invariably, and many if not all of them either end foremost with equal rapidity. Many of them were of the shape of a long and narrow letter S, while others had more spiral twists in them, extending out to what appeared under the power used to be a quarter to half an inch in length, and a few three-fourths of an inch or more in extent. And all or most of them showed, as before said, the most remarkable powers of volition. Many times have I seen hundreds of these at a single view in rotting fibrin, and all of them in more or less rapid motion. The straight rods also appeared in hundreds and thousands in the same or other samples of fluid containing rotting fibrin, and in almost if not quite as remarkable activity. Indeed, their motion was more difficult to account for in some instances than was that of the spirals; as such of the rods as were an eighth of an inch or less in length, would, some of them, dart with the greatest rapidity without perceptible effort before starting, but others would show a tremulous motion through their whole length, then dart. Others longer than these, or appearing from an eighth to half and three-fourths of an inch in length, would show the fish motion, or the longest of them the snake motion in swimming. Upon turning the cover glasses over in great numbers of these experiments, as in the others related, and letting the water dry off, the same invariable appearance presented, namely: rods and spirals of fibrin, and nothing but these and granules; excepting here and there one or two other forms that fibrin takes under some circumstances.

And all this is precisely what the conditions call for. For instance, when a clot of

blood is formed out of the body, it soon begins to shrink as is well known, and after several hours shrivels to about half its original size. This shriveling is due to portions of the fibrin threads which run in every direction through the clot, contracting upon themselves or curling into spirals, and thus drawing the clot together into a much firmer mass. A large proportion of said threads, however, or sections of them, remain straight. Very well; these straight threads, or sections of them, break up under decomposition into straight rods, the so-called bacilli, while the spiral portions of the threads furnish, under rotting, the spirochaetes, or spiral bacteria. Finally, both rods and spirals break up under further disintegration into the fibrin-granules that compose them, and these are the so-called micrococci, which appear in millions at the close of the rotting process. I have seen tens of thousands of them at a single view, after several days of the rotting of fibrin, and all of them in the greatest activity. In passing it may be well to speak of another point of some interest. Under successive breakings up of the threads of fibrin into rods, and these into shorter and shorter pieces, they are finally reduced to a length of about the sixteenth of an inch, under a fourth objective, and appear to remain at that length, before disintegrating into granules, for a longer time than at any other stage of their disintegration. And the same fact seems to hold good in part with the spirals.

In one specimen I saw a long thread of fibrin that had evidently just parted into rods, all of uniform length, about the sixteenth of an inch under the microscope; and all but three or four of these rods were lying in a gracefully curved line end to end, but parted at their ends about the thirty-second of an inch, or enough to see the separation between them distinctly. There were sixty-eight of these rods in that line; then the same thread, or a succession of precisely similar rods, extended off at a sharp angle from the other, but in a more abrupt curve, and in this curve there were twenty-five rods. The three or four rods that were not end to end in the line were nevertheless present, but had turned partly around upon their centers, as though in the first efforts of motion, and occupied the space where they had belonged, but crosswise, or at right angles, to the rest. Here they were evidently caught and held fast by the drying off of the water from the slide, so they could not move further. All these short rods presented precisely the same appearances in every respect, excepting that of motion, of those of like length that showed the greatest activity; and I have not the slightest doubt that, in two or three days, perhaps in a few hours more of the rotting process, all of those ninety-three rods of fibrin, that had so recently constituted the long thread described, would have taken on active life, and each an independent motion of its own. With the spirals, sometimes one end will break off in a short crook, or those of the shape of the letter S will break in two in the middle, and then it is amusing to see the awkward movements or attempts at movement of such pieces. They will attempt the spiral movement but cannot carry it out, or any other

motion, excepting that of awkwardness. I have seen hundreds of these in the course of my observations.

The fact that the threads of fibrin must and do break up under decomposition in the way described—straight threads into rods; spiral threads into shorter spiral pieces; and both of these by further rotting into the granules that constitute them—is very simple and must be self-evident to any one who will give the matter a little thought. It is indeed an absolute certainty, proved by many hundreds of experiments and observations the last nine months, that fibrin threads do so break in pieces under decay, and are not primarily dissolved down into fluid forms. And this is but the carrying out of the principle and methods of all organic forms in nature, under decay, going down and down by successive steps into primary granules, and in the inverse order of their first building up. In the clotting of blood out of the body its fibrin, which is the only thing in it that causes it to clot, organizes first from its fluid state into granules, and these join together into rods and the latter into threads; whereas, under decay, all of this is exactly reversed, pieces breaking out of the threads, and then breaking up into shorter and shorter lengths, and these finally into the ultimate granules. But the facts that each rod or spiral that breaks out of a thread of fibrin under decay, comes back to life and the most remarkable activity; that when a rod or spiral breaks in two, each piece takes up or goes on with an independent life of its own; and that each and every granule of fibrin that the rods and spirals ultimately break down into, also takes up an independent life of its own—no matter how long they may one and all have been apparently dead or entirely inactive—are, or become, the most astounding facts that science has ever been called upon to contemplate. As already said, I have repeatedly seen hundreds and thousands of rods and spirals, and tens of thousands of granules of fibrin, in different specimens, at a single view, all of which had apparently died with the animal from which they came, but all came back under rotting to the most violent activity.

Another important fact it may be well to give here in passing. Within the last three months I have seen in various specimens of decomposing healthy fibrin, hundreds of Koch's bacilli tuberculosis, or forms that looked exactly like a specimen of said bacilli, prepared in Eberth's laboratory in Germany last summer, and brought to this city by the physician who assisted in the preparation. And this brings up another point of much interest. Fibrin softens after a week to ten or more days of rotting so that it will take color, or absorb coloring matter into it, but not before. This is suggested as the reason why Koch did not succeed, on his journey to Egypt last summer, in staining his assumed cholera bacilli. Cholera kills or ends in convalescence before time has elapsed to soften the rods of fibrin found in its serous discharges; besides, it is not a disease of suppuration to soften them in that way. Tuberculosis on the contrary, and all other suppurative diseases, but especially the former, give ample time to soften the rods of fibrin,

so they will take color, hence such can be colored, but not those found in cholera. Inflammation and suppuration are a rotting process; therefore, the threads of fibrin that *always* form in matted masses in an inflamed part under congestion and inflammation are broken down by suppuration, much as they are by rotting fibrin out of the body. Hence the so-called bacilli, or the rods from broken threads of fibrin that appear in all suppurative discharges; while in long suppurations like tuberculosis said rods are more broken into shreds or frayed out to thus appear like Koch's bacilli and different from those in acute abscesses.

Say the bacterists however to all this: "You let the germs of bacteria get into your specimens and they were there developed into all the forms of bacteria which you saw." But stay, there is much more in this connection to be considered. All advocates of bacteria say these organisms are vegetable and only vegetable in their structure and nature. But is there not the greatest absurdity involved in the claim that the great activity of life and the remarkable powers of volition described, which only belong to animal life, should be possessed in an equal degree by vegetable cells and fibers? This question shows that a great scientific error must have been committed in connection with this subject. How can vegetable cells and fibers dart across the entire field of view of the microscope almost in an instant, dozens of times their length with the smallest of them, and quickly dodge out of the way of objects in their course like a fish, as is to be frequently seen in their movements, and yet they be only vegetable in their organization and functions? Is such a position tenable for a moment in science?

But this is not all. In placing pure fibrin in a cup of distilled water to rot, there is nothing, of course, but these two substances in the cup. In case, then, of the germs of bacteria getting into the cup as many claim, to be there developed, they find nothing there on which to feed but the pure fibrin; that is, threads, rods, spirals or granules (as the case may be) of fibrin. And as no moving forms will develop in that cup excepting such as fibrin gives the claims of these being bacteria, involves the assumption that the latter take the precise forms, as well as the color and action, of the things on which they feed. This is a flat contradiction of all nature and involves a greater absurdity, if possible, than the one already pointed out, of such extraordinary powers of volition and activity being possessed by forms which are vegetable and only vegetable in their nature. How grotesque would our forms be, and those of all the animals below us, if we assumed the combined forms of what we eat. Fibrin is indestructible below its granular stage; and in reaching that stage by rotting, it exactly repeats every form of the assumed bacteria, from bacilli down to micrococci. Hence these forms of fibrin being present all the way through the rotting process, and nothing else showing, they must be accounted for. Where are they, then, and what are they, if they be not these falsely assumed bacteria? Scientists can never settle this question until they make

full allowance for the presence of these forms of fibrin in all diseased conditions.

But, however much the foregoing might be thought to prove, investigations were not stopped there. I next dissected out the central cord in the great tendon of the leg in a hind quarter of beef that had hung in the market ten days, and put that aside to rot in water first thoroughly boiled. Why take that particular part? Because, first, all tendons are made of fibrin; that is, they are made of a mass of the finest threads bound and packed together in the firmest manner, each of such threads being made of a succession of fibrin-granules, the same as other fibrin threads. Second, because it is generally considered that the tendons show the least sensibility that can be called life, of any animal structures, excepting the bones. And, third, because that tendon had never before been exposed to the air to be infected with so-called bacteria. Well, as stated, I placed this in well-boiled water to rot, and watched the results. In twenty-four hours the granules of fibrin, which composed the threads that constituted the tendon, began to appear in great numbers; that is, to break off, or separate from the ends of such of those threads as came to the surface, and soon showed active motion. In two or three days their number had increased enormously and their activity had become much greater. But, from the beginning of this experiment, the results were almost the exact opposite in one respect of what they were with fresh fibrin from a washed clot of blood. With the latter the rods and spirals broke out from the threads of fibrin under rotting and appeared first, while the granules did not appear in great numbers until after the rods and spirals had broken up into them. With the tendon, on the contrary, the granules appeared in great numbers almost at first, and few rods showed at any time. Why was this, if this tendon was made of fibrin? Why should not the results be uniform with fibrin from all sources? simply because in the tendons the threads of fibrin are so woven in with each other, and so firmly bound together, that it is difficult to cut them with the sharpest knife. Fibrin washed from blood is, on the contrary, loose and flocculent, and very easily broken up or torn to pieces. Hence with the former, or the tendons, the rotting process can only separate or disintegrate the granules one after another from the ends of such fibers as come to the surface and can be thus separated; while with the loose fibrin, decomposition can and does reach the loose threads readily; and from the first breaks them up into sections or rods and spirals before these are broken down into granules.

There is a stranger fact still, however, in this matter to be explained. I have said that in decomposing fibrin, "there are no forms present, but such as fibrin gives." Without explanation, those who repeat my experiments, will find evidence that they would consider a positive contradiction of this assertion. They will see flat, oval bodies, appearing from an eighth to a quarter or third of an inch in length under a fourth objective, half to two-thirds as wide as long, many of them somewhat more pointed at one end than the other,

and all of them possessed of extraordinary powers of volition. They are much the shape of the sporangia, and generally show as great activity as is to be seen anywhere in microscopic animal life. Now, if the reader has a Carpenter's "Human Physiology," let him turn to the section on "fibrous tissues" and he will there find a cut showing a bundle of fibers of areolar, or connective tissue. In this cut nucleated cells are pictured, scattered all through the bundle, and a few loose cells free from the fibrers are also shown. These nucleated cells are an exact representation of the oval bodies of which I speak. Well, these cells also come back to life out of dead and rotting fibrin, as well as the rods, spirals and granules; and their activity is as great. Whether those that have already been developed in connective tissue, as Carpenter pictures them, and have served out much or most of their life and purpose there, whether these come back to active life as they do in the fresh but dead fibrin, I have not yet been able, for want of time, to fully prove; but the conditions call for that as much as for the granules of fibrin in tendons coming back to life. This connective tissue is fibrin, or that is about its only food, as it is of all the tendons.

Thus we have life out of death, or various living and exceedingly active forms out of apparently dead fibrin; even out of what has been thought to be still more lifeless tendons; and in such enormous numbers as only the sands upon the sea or the stars in the heavens can compare with. And thus also has been unexpectedly secured the first physical proof that the world has ever had of the immortality of life. Every individual human life contains an aggregation of thousands of millions of other individual lives, or what become so when the granules of fibrin are permitted to show their individuality, and all dominated by a superior life; just as a great nation is composed of many millions of individuals, or as humanity as a whole consists of thousands of millions of human beings. And this is but the carrying out in our individual bodies of the great principle of association and combination that runs through all nature. If it should be objected to all this, however, that no adequate purpose appears for the bringing back to life of all rods, spirals and granules of fibrin as described, one answer is that this subject is entirely new, and the objector cannot yet know what valid objections to raise, until he knows far more of the subject than now, or until it is thoroughly studied in all its branches and bearings. But a more substantial answer is that fibrin is indestructible, and contains most, if not all the vitally organizing forces of the organic world; hence when done with one body it returns under every favoring circumstance of decay, etc., back to its granular stage, to begin again at the lowest round of the ladder to rebuild from there, first the simplest life, then on and up to the highest lives, then back through decay to granules, and so on through a ceaseless round of organization, decay and reorganization, again and again, through all earthly time. Or, what is just as important, more important indeed to us individually, fibrin is contained in all our

food; is decomposed, that is, disintegrated, by our digestive organs, to re-enter our blood and tissues, and re-infuse new and fresh life into us continually, or daily while we live. In this view decomposition or disintegration is or becomes but a segment in the great circle of life, as necessary to the reinvigoration of life already existing, and to the creation of new life, as is life itself. Decay is not, therefore, the limited, narrow and revolting process of nature that it has hitherto been looked upon as being; but a great necessity to the continuance of all life, and of each through its appointed time. How much deeper significance this gives the subject than does the bacteria theory; and how much broader basis does it give us for a true science of evolution than what we have hitherto had.

That fibrin is indestructible is a scientific fact that admits of no question. The elder Professor Silliman, over fifty years ago, reported a Mr. Hatchet as having boiled fibrin five hours a day for three weeks, changing the water every day, without destroying it. That greatest of all authorities on physiological chemistry, Professor C. G. Lehmann, says, "it is a chemical fact that pure fibrin is incapable of complete solution." In my own experiments I have never been able to destroy it. I still have the first sample of blood that I set aside to rot nine months ago under a heat of 100° to 200° all this time, and its granules are still apparently as white, pure and perfect as when they first began to break out from the threads a few days after the rotting was commenced. I also have a specimen of fibrin that has been digesting in chemically pure nitric acid six months and its granules are apparently the same as the next day after they were put in the acid. Indeed, they will organize now into threads as readily as they did the hour the latter were disintegrated into granules. To make the test still more severe, I boiled fibrin many days, baked it for three hours, then burned it black, triturated that several hours, and sifted some of this powder into pure nitric acid. After all this its granules were as pure and fresh apparently for new work as in fresh blood; and many of them organized into threads, much as they often do in a drop of blood under a cover glass. Fibrin being, therefore, indestructible, that, in itself, must have a great meaning; and coupling that with the fact that its granules have the wonderful powers of volition described, the two facts put together mean that such granules are, or contain, most if not the whole motive powers of organic life.

These granules combine in numerous ways, more generally of course into threads and these into net works, but also in other forms; and under these combinations show marked attractive powers, in drawing other matter into their meshes, and there arranging it into various organic forms. I have certainly seen what appeared to be clear proof of the methods of cell development, and how these lower manifestations of combined life are started in their onward course. But it will take another paper to explain this. The powers of motion given the granules of fibrin are what enables them to seek and find their proper positions in organizing into threads in the clotting of blood, in building up tissues, and in all their other organic work. I have repeatedly seen granules of fibrin in different fluids, even in nitric acid, traverse a distance of several times across the field of view in the microscope, pass many other granules, both single and in clusters, often come in contact with them, perhaps stop a moment, then go on, until they would finally appear to find their proper place and association and there remain without further motion.

Now, let it be understood that this paper is not the result of theorizing, or the work of the imagination; but is based solely upon what has been actually seen under the microscope with high powers—most of it seen dozens and much of it seen hundreds of times. So we are here dealing with realities as to life, and not with imagery, as has hitherto generally been the case on this subject. Materialists have long called for actual demonstrable proof of the immortality of life from the advocates of that belief, and in the absence of such proof have demanded the latter to keep silence, while they interpreted nature from a wholly material standpoint. Now we have such proof as cannot be put aside, but must be considered in all its length, breadth and bearings. Having thus shown the immortality of simple primary life, is it unreasonable to ask in conclusion if the soul must not be immortal as well? Can it be possible that that almost infinitely higher development in us that makes our individuality, namely, the combination of intellect to understand such things, and of moral sentiments to move men to the grandest deeds for human good—can it be possible, I repeat, that this perishes, is annihilated, or simply ceases to exist, while mere life, or the lowest form of it in the granules of fibrin, is immortal? Does the very highest manifestation or development of life, the mind, die, while the lower life lives? The simple asking of these questions seems to me their sufficient answer.

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