

taining the pumice was heated red hot by a furnace, the bulb joined to it when it attained a vivid heat; the end of the porcelain tube which projects from the furnace being made thoroughly hot immediately before the cork is inserted, the cork itself being taken out of boiling water, and the neck of the bulb heated in a spirit-lamp immediately before it is inserted into the cork." A stream of heated air was passed through the apparatus, and the bulb boiled for ten or fifteen minutes. When cool the bulb was sealed. Peameal, hay, coarse flour, sage-leaves, and celery were the substances employed for the infusion; and Dr. Lionel Beale was present when some of them were examined on September 9. Small organisms were found in a bulb filled May 18 with peameal and water, and also in another filled with hay-water on July 18, and in a similar bulb filled the same day. Some dumb-bell crystals were also seen. In another bulb the result was "unsatisfactory;" even with high powers no certain evidence could be obtained, as was the case in other instances when "minute round spore-like bodies were seen moving about the field." Other series of experiments were undertaken.

Dr. Childs says, "Now, if we omit from these two series of experiments those which I have already shown reason to distrust, we have in all, seven in the first, and six in the second series, which seem fairly to test the question; and these having been examined by Dr. Beale as well as myself, bacteriums were found and seen by both of us in three out of the first seven, and five out of the remaining six."

Dr. Childs ascribes the discrepancy between his results and those of M. Pasteur to the fact of his having employed high powers, Ross's one twelfth and Lealand's one-twenty-fifth; while the French chemist contented himself with a power of three hundred and fifty diameters, which is certainly very insufficient. I have paid considerable attention to the exhibition of minute-headed structures in investigations of various kinds, and I have found the most delicate can only be rendered visible by powers double, treble, and quadruple those used by Pasteur, and by very careful illumination. Further than this the eye must get accustomed to the objects, just as astronomers know is necessary in separating close double stars.

Dr. Childs states that the cloudy appearance of a fluid is no indication of its containing bacteriums, or the reverse. He has now "no doubt of the fact that bacteriums can be produced in hermetically sealed vessels containing an infusion of organic matter, whether animal or vegetable, though supplied only with air passed through a red-hot tube, with all necessary precautions for ensuring the thorough heating of every portion, and though the infusion itself be thoroughly boiled. But how far this affects the question of spontaneous generation is quite another matter." It seems, as Dr. Childs says, that either the germs of bacterium can resist boiling water, that they are spontaneously generated, or that they are not organisms at all. The last he rejects, and there remain the two former, on which he does not decide.

Dr. Childs cites some similar experiments of Dr. Wyman, "in which organisms certainly appear under the same circumstances as they did in his own, and as they never did in M. Pasteur's; yet if the infusion were boiled for six hours no organisms ever appeared." This looks as if the germs were only destructible by prolonged boiling, but it does *prove* all that is wanted. M. Lemaire has shown "that the mere fact of an infusion being enclosed within a hermetically-sealed vessel, even without any application of heat, is in itself sufficient to check the production of organisms, for in such circumstances fermentation begins, but cannot continue." I have observed that if a small piece of organic matter is placed on Professor Smith's growing cell; and covered with thin glass pressed close upon it, though bacteriums appear, they soon die, and do not propagate.

My object in this paper is neither to advocate nor to oppose any theory, but simply to show what experimenters are doing on the subject, and what are their results.

It seems difficult to account for a large class of Pouchet's facts, upon the supposition that organic germs abound in the air, without ascribing to them a far greater minuteness than has hitherto been supposed, and without also presuming that the germs of simple organisms are capable of being developed into whole groups of organisms, commonly reckoned as distinct species. In one passage Pouchet says that air would be as heavy as lead if it contained all the germs the panspermists suppose; and if the phraseology be a little exaggerated, we ought not to discard too summarily the reasoning on which it is based.

M. Pasteur has collected, by means of an aspirator, the minute particles floating in the air, and entangled them in a tuft of gun cotton, which, being dissolved, left them behind, and he raised a crop of organisms from the germs the air contained. These objects were distinguishable with the low powers he employed; but who shall say what is the smallest germ, or what portion of a

minute globule to which that name is assigned is the real germ? The question of the size of germs is not altogether unconnected with that of their destruction by heat or acids. Probably the germ of a higher animal or vegetable is a highly complex structure; in fact, a congeries of simple germs arranged in a definite manner. This may be accepted whether Darwin's remarkable theory be correct or not, and heat, or the action of an acid like sulphuric, abstracting water, may destroy the vitality of a compound germ by dispersing the particles, taking away their freedom of motion, or altering the order in which they are arranged. A single germ may be far more indestructible, and may survive a temperature or the action of a re-agent that would be quickly fatal to a complex germ.

Important discoveries always cause a surprise, except to a few minds who have had some prevision of them. To ordinary mortals that which seemed impossible is very likely to be true, and although the mystery of life will probably remain inscrutable, honest researches into the origin of minute forms are sure to reveal striking and unexpected truths. I therefore recommend English observers to enter upon their investigation without compromising themselves by adopting theories upon insufficient grounds.—*The Student*.

### Address of Principal Dawson at the Annual Conversazione of the Natural History Society of Montreal, Feb., 1869.

*Ladies and Gentlemen.*—It is my pleasing duty to bid you welcome to the Seventh Annual Conversazione of this Society—a Society which has not ceased, since its incorporation in 1832, to lab our for the promotion in this city of a taste for natural science and allied subjects; and this, with marked success. In addition to its Lectures and Meetings, I may mention as a permanent monument of its utility, the issue of nine volumes of its Proceedings, containing more than 4,000 pages of matter of the highest scientific value, and of the utmost importance to the knowledge of nature as it exists in this country, and to the development of our resources. No other institution in Canada can pretend to have made any contribution to the Natural History of this continent approaching this in value and extent. I may also mention its Museum, which has within the last few years made great progress, under the care of Mr. Whiteaves, and by the patient labour of our cabinet-keeper, Mr. Hunter. When I look through this museum to day, and observe its admirable arrangement and the great amount of scientific material of real value which it contains, I can scarcely believe that it has grown from the confused and paltry collection which was huddled together in our former rooms in Little St. James street. Nor has its growth ceased. The additions made within the last six months amount to 200 species of vertebrate animals, a large number of invertebrates, and about 200 fossils, besides many other objects. Taking together, the collections of this Society, of the Geological Survey and of the McGill University, Montreal now stands far in advance of any other city of this Dominion in its museums of Natural Science; and thus affords greater facilities than any other to the student of Canadian Natural History and Geology. This is no mean advantage, and is especially appropriate to a commercial and manufacturing metropolis; and it will be far more strongly felt when we shall have in connection with the University, or with any other agency that may be established, Schools of Science for the training of our young men in the practical application of Science to the Arts. In this respect, this Society has all along been in advance of the age; because here, as elsewhere, the accumulation of museums must always precede the establishment in any large and effectual way of the higher grade of scientific schools. A knowledge of this fact, has, I confess stimulated my own efforts in behalf of this museum and that of the university, since I hoped that here, as in the old world, the collection of objects would afford a safe basis for the erection of scientific education. There are some branches of knowledge and culture, and these very valuable in themselves and the training they afford, which require nothing but teachers and books for their successful prosecution. But training in science, to attain to any useful results, must have large preparatory appliances in collections and apparatus. This along with the apathy which naturally exists as to anything of which the public has had no previous experience, is no doubt, a cause of the lamentable fact that Canada has not yet attained to the establishment of one scientific school, while in the mother country, in the various states of the continent of Europe, and also in the United States of America, such schools largely supported and amirably appointed exist in great numbers, and are productive of immense results in the promotion of the scientific arts and manufactures. In the Christmas vacation I enjoyed the pleasure of visiting some of these institutions in the United States, in which the means of old University foundations are made