White Fish, and 8000 Salmon Trout, the latter having been obtained from the lakes of Ontario. He has at the present time (April, 1879) 1,800,000 Salmon hatched, and in a few days will commence to distribute them among the most suitable rivers within reach of the hatchery. This will make a total of 4,800,000 salmon distributed from this one hatchery, in the short space of four years. The Bedford Establishment, although one of the smallest in the Dominion, has a hatching capacity of 2,500,000. There are at present eight fish-breeding establishments in the Dominion: two in Ontario, four in Quebec, one in New Brunswick, one in Nova Scotia; and it is proposed to erect an additional one, during the present summer, in New Brunswick. P. E. Island is certainly entitled to one. There will probably be distributed during the next four weeks from the hatcheries now in operation, within the Dominion, about 40,000,000 young fish, of which about 30,000,000 are the White Fish of the great lakes of the west. No doubt the culture of the Trout, the Oyster and the Shad will receive attention in Canada at an early day.

ART. XII.—EXPERIMENTAL MICROSCOPY.—BY J. SOMERS, M. D., *Professor Physiology, Microscopy, &c., Halifax Medical College.*

(*Read May 12th*, 1879.)

THIS short essay owes its existence to a wish expressed by members of the Council of the Institute.

It contains nothing original, or what any person familiar with the use of the Microscope, does not already understand. It was prepared to accompany a series of experiments presented to the members, and it does not pretend even to explain the nature of these, nor of the specimens exhibited.

The writer feels complimented in that he has been requested to fill at the final meeting of this season, a vacancy which has occurred for the first time for many years. One who never failed to present the results of his observations at the final meeting of the session, has closed his earthly labors. Endeared as he was to us all, not only for his zeal and arduous toil in the cause

of science, but also for possessing those qualities of head and heart which constitute the true gentleman; his death has caused a vacancy in our ranks, which time will scarcely obliterate. The memory of his scientific and personal worth will ever recur to remind us of the loss which science and our Institute has sustained.

Our subject for to-night is appropriate, in view of the honour recently conferred upon us by the Royal Microscopical Society of London. The fellowship which comes to our President, while he is in office, is a tribute to work which has been done by our body, and every member should feel a reasonable pride in the distinction, inasmuch as it is given in appreciation of work which all have tended to forward; furthermore we have reason for congratulation in the circumstance that the honour has fallen upon right worthy shoulders, those of a pioneer in the cause of science.

It would be out of place to take up your time in describing the construction, or even the history of the Microscope. Its beginnings, like that of many useful inventions, were very simple; the lenses with which Leuwenhoeck discovered the blood corpuscles, and Malpighi the capillary circulation, when compared with the compound Microscope of to-day, tells at a glance of the vast strides which microscopy has made within the two centuries which have passed since it began to be applied to the study of Biology. It will enable us also to comprehend and appreciate its value to the student of science, in opening to his bodily and mental vision fields of observation, which without it could never be explored.

A glance through the instruments before you will reveal that sublime sight which the immortal Harvey is said to have never beheld, "the circulation of the blood in the capillary blood vessels." This discovery was made twenty-six years subsequent to Harvey's publication of his discovery of the circulation through the heart and great vessels.

The development of the young Salmon from the ova can now be easily observed; and the various changes, from the swelling of the blastoderm to the formation of the perfect minnow, are very interesting. Embryology may be said to date as a scientific

study from the time, 1672, when Regnerus De-Graaz applied the Microscope to its elucidation.

The infusoriæ, so called, are very interesting to the Microscopist. The multitude of forms, variety of structure, uncertainty of the position of many of them, whether they belong to the animal or vegetable kingdom, increase their value as objects for study. They afford an immense field for original research, but partly explored. Here we find the battle ground where Vitalist, Evolutionist and Panspermatist can wage intellectual warfare.

The Microscope has rendered invaluable service in exploding false ideas and crude theories. If we take for example the spontaneous generation theory. Assuming all animals, the mode of whose generation is unknown or obscure, owe their origin to the spontaneous efforts of nature acting by force upon inorganic matter, the extent of its application would be proportionate to the sum of our knowledge of sexual generation, or of generation by division; hence, in looking backward at the history of this theory, we find it always resting on an ever shifting base; accepted by the ancients, it sufficed to explain the generation of reptiles, fishes, insects, and all animals of whatever kind, whose mode of re-production was unknown.

The study of the embryology of these creatures have satisfied all doubts relative to their re-production, yet are we very much in the position of the scientific world in the time of Aristotle, heterogeny is still received by many as a scientific fact, the base being shifted to a still lower stratum of life, where the process of reproduction is obscure or not yet known. The question then arises, have we really a spontaneous origin of minute beings; or is there a possibility of the existence of a process of generation amongst them, of which we are ignorant? We are, so far as this question extends, in the position of our predecessors, previous to the discovery of the Microscope. We cannot account for the existence of a Bacterium by reproductive generation, therefore it is generated spontaneously, if so, why not a snake? as Kercher believed. Writing to Redi, he gives the following recipe for manufacturing snakes:—

"Take some snakes, of whatever kind you want, roast them,

"and cut them into small pieces, sow these in an oleaginous soil, "sprinkle from day to day with water, taking care that the piece "of ground be exposed to the spring sun, and in eight days you "will see the earth strewn with little worms, which, being "nourished with milk diluted with water, will gradually increase "in size till they take the form of perfect serpents."—*Kercher Mund. Subterran.*

Redi determined to prove the recipe, and in doing so, exploded his friend's theory. He says:—

"Moved by the authentic testimony of this most learned "author, I have frequently tried the experiment, but I could "never witness the generation of those blessed snakelets made to "hand."—*Redi, Generat, Insectorum, 1686.*

Redi however found an abundant progeny of Maggots, which, being confined in a covered box, were in a short time transformed into flies. To Redi's observations science is indebted for some of the earliest definite knowledge of the generation and metamorphoses of insects.

If one of the ablest men of his time, which Kercher undoubtedly was, will to us appear at a disadvantage, because he too readily accepted a false theory, how careful we should be lest our successors a century or so hence may be in a position to subject our theories and experiments to the criticism of ridicule. The substitution of infusions of chopped hay or turnips in water and exposure to sunlight, for chopped snakes, milk, and sunlight, is startlingly like a repetition of the old process, and is likely to be followed by equally satisfactory results.

The revelations of the microscope in all that relates to the process of generation so far as positive facts are concerned, tend to prove the truth of the proposition that every living organism has been generated or produced by a pre-existing living organism. The theory of spontaneous generation had fallen into disregard until certain observations of Pouchet, put forward in the year 1847, caused its revival. Pouchet in his experiments seemed to show that certain infusorial animalcules were generated spontaneously, but subsequent experiments of Balbiani, in 1861, demonstrated the existence of sexual generation in these

organisms, heterogenists had then to recede a step,—new organisms were needed to uphold the theory. Bacteriæ came to the front.

The theory of spontaneous generation may perhaps be resolved by the question: Do living organisms come from, 1,—a spontaneous aggregation of particles, living or inorganic? 2.—Are they the result of the development of ova? Spontaneous action is defined to be that arising from natural disposition, tendency or inclination, or without external cause, that is, no cause can be assigned for its production—a confession of ignorance.

All that is positively known of the reproduction of living beings points to sexual generation as the means by which nature attains that object, even accepting certain variations of the process. If we reason from the supposition that living beings are formed by the fortuitous aggregation of particles, organic or inorganic, we assume a fact of which we have no example in nature by analogy, and one which we are incapable of demonstrating. We assume likewise that such aggregation or combination of molecules is capable of producing beings of a definite and uniform character, for which we have no basis.

If we on the other hand suppose the production of the lowest orders of beings to be owing to the development of germs or ova, separated from living beings of their own kind, finding suitable conditions, we rest upon a basis which is analagous to what occurs in all cases where the process of reproduction can be seen and followed, confessing merely our [illegible]lity as yet to demonstrate the process by which it is brought about.

The conclusion we arrive at from the foregoing is that living organisms reproduce beings like themselves, through successive generations, and life passes down the pathway of time always reproducing itself; that the mind of man, also a product of living matter, like that matter, is constantly reproducing itself, and often, when supposing it has arrived at the termination of a linear course, finds that it has only travelled in a circle. It seems to me that the only true philosophic view to take of the question is to assume that there is in nature no such thing as a spontaneous generation, admitting, however, the exact mode of production of the lowest forms is not at the present time understood.