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NATURE AS AN EDUCATOR.¹

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In the winter of 1856-7 I had the honor of delivering the introductory lecture of our Sommerville course, and took as my subject "Natural History in its Educational Aspects." Now, after the lapse of thirty-three years, and after the great changes which have occurred since that time, I desire to recur to the subject, and to ask what is the present aspect of nature as an educator relatively to education in general and to a society like this.

Let us consider in the first place how early, continuous and persistent are the operations of nature as an educator, regarding nature as a general name for all those objects which come under the cognizance of our senses, and from which we derive sensations and perceptions. It is scarcely necessary here to make any exception in regard to things artificial, for in reality these are all merely adaptations and imitations of nature. Nor need we inquire as to the reality or the origin of these objects, but may take them as the environment surrounding us on every side, and at all times more or less presenting itself to us.

From the moment when we first open our eyes on the outer world we are receiving impressions from external nature, which go on extending and multiplying at least until our attention is called away by pursuits and studies relating to the artificial life of man, and even then we recur when we can to nature as our most grateful teacher, nay, the friend and companion whose teaching has no hard tasks but is all pleasure. The weary schoolboy gladly turns

¹ Annual Presidential Address before the Natural History Society of Montreal.

away from dry text-books to ramble in the fields and woods. The child whose worldly horizon is limited by a dirty street or dull backyard rejoices to see grass and flowers and trees, and drinks in inspiration from them. Sitting one Sunday afternoon at the open window looking out on the college grounds, I saw a working-man walk past with a little girl at his side. Coming opposite the bit of old-fashioned, poorly kept garden, which thirty years ago I had managed to carve out of the unwholesome swamp which then lay in front of our college terrace, the child stopped to look at it, and said, "Papa, is that the Garden of Eden?" The poor little thing, who had perhaps never seen anything of a garden but the outside of its fence, had heard that once there had been a garden of the Lord—a free and happy abode of man. Some years ago I knew of a boy dying of consumption in a poor home, to whom a kind lady sent a bunch of rich purple grapes. He gazed at them, fondled them, could scarcely be persuaded to taste them, and said, "How pretty! I have heard of grapes, but I never had any before." Coming home some time ago from a little excursion in which I had secured some deer's antlers, I happened to drive up from the station at the early morning hour when our streets are swarming with factory hands going to their work, and I noticed how everyone turned and stopped to look at my prize, and how the faces of many lighted up as they saw in imagination a view of wild woods and bounding deer, which perhaps remained with them as a pleasant thought through the day. How is it that our boasted civilization shuts out so many from contact with nature? The God who long ago led Israel out of bondage provided that every Hebrew family should have for its very own some strip or patch of the green sward of the promised land, and the Great Teacher who came long after, drew His favorite texts from the trees, the flowers, the grass, the birds and the beasts. It is not the will of God that we should imprison ourselves between four dingy walls in the midst of His beautiful world.

But it may be said that the rustic who dwells in field and forest has as little of the real companionship of nature

as the dweller in towns. I doubt this, except in cases where mental or moral degradation has reduced the countryman to a mere machine. I have found much genuine love of nature and appreciation of natural things in the country, especially in those parts in which good education has been provided for the young. Even in city life this love requires but to be ever so little encouraged and it will come to the front with a bound.

If we ask how this is to be done, why should we not have teaching as to nature in homes and schools: little museums in schools, greater and really popular ones for our cities, botanical gardens open to all, zoological gardens where means permit? Why should not excursions into parks or the country, or visits to museums be made a necessary part of school instruction? The answer is simply because we are not sufficiently civilized to understand these things. Unfortunately also we make mistakes in our mode of introducing them. The mistakes in education here as in most other subjects are portentous. Mere book-learning or cramming of hard names for an examination is not study of nature, nor is mere laboratory work. Educators and the public are apt in these matters to rush from one extreme to the other. Seeing the folly of mere book tasks, it was decreed that there should be practical teaching. Teachers must dissect frogs and other creatures and teach their pupils to do the same. The result has been failure and damage to the knowledge of nature. It is one thing to see an animal alive and carrying out its natural instincts; quite another to cut up its dead carcass and learn hard names for its parts. A boy learns ten times more of nature by watching the frogs swimming and diving in a pond than by cutting them up ever so cleverly. I do not say that the laboratory teaching is useless when managed by a skilful and sympathetic teacher who can point out the meaning and uses of structures and their homologies with those of other animals. It has a real scientific use, but ordinarily it degenerates into a mere task and cram, and has as much relation to true science as the trade of a butcher has to that of an artist. A curious illustration of this was presented

some years ago, when it was decreed in England that Hygiene should be taught in the schools. The subject was a popular one, and would have been taken up with enthusiasm. But unfortunately it had been represented to the Committee of the Privy Council that it was necessary that the pupils should have learned Physiology before entering on Hygiene. Here was a difficulty which the teachers at once felt. Physiology was an unpopular subject. The trained teacher had learned to take his pupils through the anatomy of a few common animals; but to him a frog or a crayfish was no more than a sum in arithmetic, something to be learned as a matter of dissection and dry anatomy. The subject consequently was repulsive both to pupils and parents, and if this ordeal had to be first gone through there was an end of hygiene. Thus by a strange inversion of education and science, one of the most attractive and useful subjects had become a bugbear. It is to be hoped that just as English educators have got over many other follies they have also surmounted this.

One would fancy, however, that there is still need for reform, from the following terse and pungent summary of the matter in a recent address before the Royal Microscopical Society by its president, Dr. Hudson:—

“Which, then, is the more scientific treatment of a group of animals—that which classifies, catalogues, measures, weighs, counts and dissects, or that which simply observes and relates; or, to put it in another way, which is the better thing to do, to treat the animal as a dead specimen or a living one?—

“Merely to state the question is to answer it. It is the living animal that is so intensely interesting, and the main use of the indexing, classifying, measuring and counting is to enable us to recognize it when alive and to help us to understand its actions.”

He goes on to contrast the position of the mere learner of structures and hard names with that of the country lad who has studied nature in her own haunts:—

“He has watched the cunning flycatcher leaving her obvious, and yet invisible young, in a hole in an old wall,

while it carried off the pellets that might have betrayed their presence; and has stood so still to see the male redstart that a field mouse has curled itself up on his warm foot and gone to sleep. He gathers the delicate buds of the wild rose, happily ignorant of the forty odd names under which that luckless plant has been smothered; and if, perchance, his last birthday has been made memorable by the gift of a microscope, before long he will be glorying in the transparent beauties of *Asplanchna*, unaware that he ought to crush his living prize in order to find out which of some half-dozen equally barbarous names he ought to give it."

Practically, to give young people in cities the benefit of all this, it is necessary to have museums and public gardens. A very small collection, representing any definite series of objects, properly named and associated with those relations that give them interest, is of the greatest value. Larger public museums have wider uses. I have been struck with this in visiting the Liverpool Free Museum, where every object is so labelled as to tell something of its story, and where crowds of learners are constantly receiving instruction from well-prepared specimens.

Our little museum is capable of similar uses, but it requires much better display and labelling of its treasures, and funds to enable the Society from time to time to add to its attractions by introducing new objects. Public gardens, whether botanical or zoological, are also of the greatest use. I know of nothing which any of our patriotic citizens could do of greater utility than the opening of such a place where the useful and ornamental plants and the various animals of our own Dominion and of other countries could be seen and studied. Lastly, means should be provided for taking children under competent guidance on field excursions and to visit places of note and interest.

All this may be said to be desultory and unscientific, but it will lead to more precise knowledge, and will serve to develop the tastes and powers of those who are capable of doing better and higher work.

My own early training in this matter was when there were in most parts of this country neither public museums

nor laboratories nor systematic teaching, and it had for stimulus and guidance merely the encouragement given at home by parents who saw that the pursuit of natural history was an elevating one, and of one or two teachers who themselves cultivated some branches of natural science. As a boy I collected indiscriminately fossils, minerals, plants, insects, and later added to these birds, which I had learned to prepare, and the shells and other organisms of the sea. When I became the happy possessor of a microscope, such as could be had in those early days, I went largely into the minute forms of aquatic life and sketched their structures and noted their habits, becoming familiar thus with some curious animals and embryonic forms, which only long afterwards were rediscovered as described by naturalists, though most of those I met with were already known and described, but not in works then accessible to me. I had no idea of studying merely the forms and structures of these creatures and knowing their names. To me they were living things, having strange ways and modes of thinking and acting of their own. They were truly acquaintances and friends, with whom I communed in private and who were my most pleasant teachers. It was for this reason that eventually I gave up all the others for the fossil relics of former life, because these, in addition to the living interest of the modern forms, possessed that fascination which arises from antiquity and from the stimulus to imagination given by their varied and often obscure relations to the past and present.

Judging from such experiences, I believe that it is best for young people to expatiate over a wide field of natural learning and afterwards to select any special field. On the other hand young people destitute of any developed taste for general knowledge, and introduced to special studies at first, will very likely become the crudest and narrowest of thinkers and at once the readiest recipients of fanciful hypotheses and the most stubborn sticklers for mere details and names.

In order to bring these desultory thoughts to some more

practical issue, let us think for a little on the uses of the study of nature, whether we regard these in relation to the forming of the character and promoting the happiness of the student or to business utilities to which knowledge of nature may be applied. At present we hear much of applied and technical science, and these are daily showing their inestimable value, but it must be borne in mind that the science that enables us to smelt an ore, to construct a machine or a bridge is useful only in so far as it promotes the welfare and happiness of humanity. Apart from these it would be wholly unpractical and useless. That teaching of science, on the other hand, which exalts and ennobles the man and develops his higher nature, even if it have no technical applications, is that which is directly practical in the highest sense. I do not say that these are necessarily two distinct kinds of teaching. They may be and should be combined, and while we seek principally to promote by the study of nature the well-being of the man himself, we must never forget the multiform uses of science in promoting human welfare through technical applications. We may return to this thought, but in the meantime I desire to speak of nature as an educator of the man himself, and especially of those powers which make him distinctively a man and the very image of God.

The president then referred in detail to the educational uses of nature in training the observing powers and those of comparison and causation, to its bearing on the culture of true and high art, and to the large views to which it leads of the universe as an ordered and regulated cosmos. He then proceeded as follows :—

I may be pardoned here for directing your attention for a few minutes to the testimony of a writer eminent as an authority in art and full of true feeling for nature, both in reference to its direct ability to the thinking mind and its indirect utility as a means of furthering material interest. Ruskin thus discourses on these points :—

“That is to everything created, something pre-eminently useful, which enables it rightly and fully to perform the functions appointed to it by its Creator. Therefore, that we

may determine what is chiefly useful to man, it is necessary first to determine the use of man himself. Man's use and functions (and let him who will not grant me this follow me no farther, for this I purpose always to assume) is to be the witness of the glory of God, and to advance that glory by his reasonable obedience and resultant happiness.

"Whatever enables us to fulfil this function, is in the pure and first sense of the word useful to us. Pre-eminently, therefore, whatever sets the glory of God more brightly before us. But things that only help us to exist are, in a secondary and mean sense, useful, or rather, if they be looked for alone, they are useless and worse, for it would be better that we should not exist than that we should guiltily disappoint the purposes of existence.

"And yet people speak in this working age, when they speak from their hearts, as if houses and lands and food and raiment were alone useful, and as if Light, Thought and Admiration were all profitless, so that men insolently call themselves Utilitarians, who would turn, if they had their way, themselves and their race into vegetables; men who think, as far as such can be said to think, that the meat is more than the life, and the raiment than the body, who look to the earth as a stable, and to its fruit as fodder; vine-dressers and husbandmen, who love the corn they grind, and the grapes they crush, better than the gardens of the angels upon the slopes of Eden; hewers of wood and drawers of water, who think that the wood they hew and the water they draw are better than the pine-forests that cover the mountains like the shadow of God, and than the great rivers that move like His eternity. And so comes upon us that woe of the preacher, that though God "hath made everything beautiful in his time, also He hath set the world in their heart so that no man can find out the work that God maketh from the beginning to the end."

"But the common consent of men proves and accepts the proposition, that whatever part of any pursuit ministers to the bodily comforts and admits of material uses is ignoble, and whatsoever part is addressed to the mind only is noble; and that Geology does better in re-clothing dry bones and

revealing lost creations than in tracing veins of lead and beds of iron; Astronomy better in opening to us the houses of heaven than in teaching navigation; Botany better in displaying structure than in expressing juices; Surgery better in investigating organization than in setting limbs; only that it is ordained that, for our encouragement, every step we make in the more exalted range of science adds something also to its practical applicabilities: that all the great phenomena of nature, the knowledge of which is desired by the angels only, by us partly, as it reveals to farther vision the being and the glory of Him in whom they rejoice and we live, dispense yet such kind influences and so much of material blessing as to be joyfully felt by all inferior creatures, and to be desired by them with such single desire as the imperfection of their nature may admit; that the strong torrents which, in their own gladness, fill the hills with hollow thunder and the vales with winding light, have yet their bounden charge of field to feed and barge to bear; that the fierce flames to which the Alp owes its upheaval and the volcano its terror temper for us the metal vein and quickening spring, and that for our incitement—I say not our reward, for knowledge is its own reward—herbs have their healing, stones their preciousness, and stars their times.”

But in that time of confused and bewildering philosophies in which we live it may be asked, Is this really the case? Does not the study of nature rather lead to positivism and agnosticism. That it may do so is, I fear, too obvious. That this is its legitimate tendency may be emphatically denied. The case stands thus. Nature is to any rational man of science an exhibition of superhuman force, energy, power. It is in like manner an exhibition of regulated and determined power, of power under law and working to definite ends, and this with so complete and intricate machinery that it is beyond human comprehension. That this should be a result of mere chance without will or design is infinitely improbable. That it results from the operation of an all-powerful will and intellect is a conclusion based on all we know of ourselves.

The matter has been well summarized by a former pupil of my own, now a missionary in India, Rev. A. R. MacDuff, B.A. He says in effect :—

1. The apparent universe is phenomenal. A reality must be behind it, The things which are seen (the phenomenal) are necessarily temporal, the unseen is the eternal.

2. This reality must be persistent, not temporary. God only hath immortality.

3. This Divine reality must be incomprehensible in its essence and in the extent of its working. "Canst thou by searching find out God?"

4. But this incomprehensible reality is everywhere present in the most minute as well as in the grandest phenomena, in the fall of a sparrow as in the creation of a planetary system. "Whither shall I go from thy presence? In Him we live and move and have our being."

5. This infinite reality is more nearly akin to the spiritual nature of man himself than to any other energy known to us. It is, therefore, living, personal and free. "He that made the eye shall He not see?"

So far the teaching of nature may carry any man willing to be guided by his own senses and reason. Beyond this lies the sphere of revelation, or that of direct communication of the Divinity with man. With revelation nature has nothing directly to do, except that it can see its possibility—for just as the Divine mind can reveal itself in the instincts of an animal, so it must be able to influence and inform the higher nature of man.

Here, however, we can reach an easy and plain possible solution of all the difficulties which half-informed men heap up around the relations of science and revelation. Given the admission that the phenomena of nature are not merely imaginary but based on a reality, and given the admission that the Divine reality has revealed Himself to inspired men or through a Divine Man, and supposing that scientific study on the one hand and Divine revelation on the other may deal with the same phenomena, certain conclusions as to their relations at once become

obvious. (1) Scientific inquiry being inductive must proceed from individual facts by slow and gradual steps to general laws, while revelation may state the laws at once without descending to particulars. (2) It follows that these two lines of thought approach phenomena from different sides. One takes them in detail and then generalizes. The other regards them as emanations of a Divine mind. (3) At first the results reached may be far apart and may seem contradictory, but as they become more perfect they must approach and eventually coalesce.

The case is as if we imagine some great mill or machine-shop to be studied by two different persons in different ways. The first may be a skilful machinist and may enter the factory, note-book in hand, and examine each machine and process, and so arrive at last at a knowledge of the whole which may enable him accurately to describe all its machinery, and to form conclusions as to its uses and relations. The second may be no machinist, but an educated and intelligent man. He is introduced to the superintendent of the factory as his guest, and learns from him its general nature and uses, the history of its inception and growth and his plans for its future improvement and development. All this he may learn without any study of the machinery; and he also may write an account of what he has seen and heard. But how different will be the two productions, and how difficult might it be for a third person to combine the two accounts, so as to make plain their mutual coherence. This could only be done by some one enjoying the double advantage of the friendship of the superintendent and the technical knowledge of the machinery. So it must ever be with science and revelation; and until men equally appreciate both, we cannot have the best results either in Science or in Theology.

Revelation itself has been defined on the best authority as relating on its practical side to three great graces, Faith, Hope and Love, the greatest and most enduring of which is the last, for God Himself is Love. In regard to love or kindly affection as a motive and practice, science cannot doubt that however little of this may be seen in the lower

strata of nature, it is and must be the soul of its higher forms. Hope as to this is apparent in all even of the speculations of rational science, for pessimism is not scientific. With reference to faith as a scientific grace there may be more doubt, but this is dispelled by the consideration already referred to, that nature itself teaches of the unseen, and that the foundation of science is a belief in our own intuitions, in the evidence of our senses and in the reality underlying phenomena. Without faith, therefore, science could not exist any more than religion. This being the case, it becomes plain that however faith or religion may for a time be dissociated from experiment, observation and induction, they must ultimately be resolved into a rational unity. Science must admit that she is the handmaid of religion, and religion must say to science that she is no more a servant but a friend. If we are true students of nature we shall all more and more approach to this conclusion as we rise from one step of knowledge to another, and obtain broader views of nature and a better comprehension of the superlative littleness and infinite greatness of man himself as a part of nature and as the image of God.

In conclusion, the address referred to the work of the Society in the past sessions. It appeared from the records that fifteen original papers were read at the monthly meetings, the greater part of which have been published in the journal of the Society — *The Canadian Record of Science*. Of these papers seven were on Geological and Mineralogical subjects, and contained many new and important facts in Canadian Geology and with reference to the mineral resources of our country. The authors were Dr. Harrington, Prof. Donald, Mr. Deeks and the President. The remainder were on new facts in Biological Science, both Zoological and Botanical. The authors were Prof. Penhallow, Prof. Wesley Mills, Rev. Dr. Campbell, Mr. Caulfield and Mr. Stevenson. Two papers of great interest in Canadian Science, as well as in relation to eminent Canadians, were that in the career of the late Prof. C. F. Hartt by Mr. G. F. Matthew and the Biographical Sketch of the late Mr. Charles Gibb by Prof. Penhallow.