

## REFERENCES.

S. W. Ross, B.Sc.: Purification of Zinc Sulphate Solutions Intended for the Electrolytic Recovery of Zinc. *Aust. Inst. of Mining and Metallurgy, Proceedings*, No. 95.

C. L. B. Goddard: The Risdon Sulphuric Acid Plant of the Electrolytic Zinc Company of Australasia Limited. *Aust. Inst. of Mining and Metallurgy, Proceedings*, No. 95.

C. L. B. Goddard: Brief Description of the Risdon Works of the Electrolytic Zinc Company of Australasia Limited. *Op. cit.*

C. L. B. Goddard: Electrolytic Zinc Company of Australasia Limited, Risdon, Tasmania, Co-Operative Activities. *Op. cit.*

Harry Hey (Chief Metallurgist, Electrolytic Zinc Company of Australasia Limited): Production of Zinc by Electrolysis. *Chem. Engineering and Mining Review*, February, 1932.

J. Hopkins (Assistant Superintendent Roasting and Acid Plants, Broken Hill Associated Smelters): Zinc Concentrate Roasting and Contact Sulphuric Acid Manufacture. *Chem. Engineering and Mining Review*, October-November-December, 1934-January, 1935.

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## BIOLOGY THROUGH NATURE STUDY.

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THE reproach urged by educational reformers against those who clung too closely to the classical ideal was that the culture given was too one-sided, being founded on one point of view, that is, appreciation of beauty of expression to be gained by the study of Greek and Latin authors. Thus the poets and other writers in those languages were studied to the exclusion of all else so that the national literature of a country was neglected, whilst many of those able to write passable verses in the classical style could not write correctly a paragraph in their mother tongue.

We have certainly changed all that, and in our schools English language and its literature hold the first place, though we note that there is still in certain quarters a suspicion, as it were, of all that is new and seems likely to disturb the prestige of the old. Thus our curriculum is still open to improvement, seeing that matriculation requirements rest mainly on English, mathematics and a language, in some instances a classical one. In other examinations a certain amount of English is compulsory for candidates, who may then select some six or seven other subjects, most of which are what we may term "booky" and which are apt to degenerate into tests of memory. Science, though admitted freely now to the curriculum,

is still too specialised, in the lower forms in particular, for the broader the foundation we can lay the greater can be the edifice erected thereon. As the average student enters upon the five year course with little or no preliminary training in observation, experiment or education, she is ill-fitted to profit even by elementary work in the sciences set forth in the syllabus.

Even the best seed does not germinate when cast on stony ground or by the wayside. Therefore there should be a preparation if teachers are to get the best results; not merely examination results, for these are, after all, secondary considerations, but results in mental development and the building of character.

In past years teachers often realised that a child who was dull and slow where lessons were concerned was keenly alive and interested in the field. Life outside school had an appeal which the ordinary lessons could never make. Though this was recognised it was not until recently that any attempt was made to use this really valuable asset so as to give an education based mainly, or certainly in the first place, on the senses, and then by observation, experiment and deduction to lead to what are generally considered as recognised school subjects. In spite of what has been done in this direction, teachers and others are still too backward in taking advantage of a preliminary training which brings the child at once into touch with the world around her. It is true that in many (if not in most) primary schools nature study is a regular part of the work; and in secondary schools a certain amount of field work is done in botany and geology, whilst in the physical sciences laboratory work bulks largely. My own conviction is that excellent though any science is in mental development, to specialise in one or two in the first years of secondary school work is to defeat the purpose of including sciences in the curriculum. All education may be compared to the opening of windows for the pupils that they may get wide views; therefore the more windows we can open the better.

Some years ago the then Director of Education, Mr. Peter Board, convened a meeting of teachers to consider whether the Intermediate syllabus should include a course in general science rather than the five separate subjects as set out, or even in addition to them. Unfortunately the result of the meeting was unsatisfactory, though many of those present were of opinion that it would be of greater value to have a wide field for those who were not going beyond the Intermediate standard, and that such a course

would also be an excellent preparation for those who would later specialise in either "natural" or physical science for the Leaving Certificate. Some of the teachers were opposed to the idea on the ground that it would be superficial, while others expressed a doubt as to whether teachers could be found competent to undertake such a wide course, since it would need very special training to enable anyone to take a class satisfactorily and in such a way as to help mental development and to avoid the mere memorising of masses of undigested information. Naturally it would call for a teacher specially trained, but such is surely not impossible, while the gain to the junior pupils would be immense.

My contention was then, as it is now, that few subjects are better calculated to train and develop the opening mind than nature study, and that this subject should be taken in the *primary* schools, not as a sort of glorified object lesson, but as real and solid training in observation, experiment and deduction. There is even more to it than this. One of the greatest assets in teaching young children is their sense of wonder by which we can rouse and hold their attention and interest. Many modern tendencies have been to destroy this sense of wonder without giving anything else in its place. Yet nature has wonders compared with which fairy tales are trite and legends tame. Is the life and work of the honey bee less thrilling than that of the legendary gnomes and elves? The migration of birds and that also of fish cannot fail to stir the imagination even of the dullest, whilst the insect world teems with instances of achievements which mock the exploits of legendary heroes, and of adaptations as marvellous as the changes believed to have been brought about by fairy magic. Have we any right to shut the children out of such a fairyland? Have we any right to bid them enter, after having first killed their interest by dry facts and unfamiliar nomenclature?

Our system of education is still too "booky"; life is not founded on books, nor are the majority of our pupils likely to develop a special taste for literature. *Of the thousands in the primary school, only a small percentage will go on to secondary work, and of these the majority will stop short at the Intermediate.* Therefore unless we can rouse an interest in life as well as in books, the education of the majority will remain rudimentary.

As we know, the best part of education comes often after school is over and when the individual takes on further work for herself. Much of what has been learned

at school will be quickly forgotten once the pupil enters the school of experience. She may or may not find a use for the very elementary mathematics she was taught there, or for the limited geography and the scrappy history, but nature study will have unlocked for her the doors of a world with which she will be in touch to the end of the journey. A walk in the bush or by the seashore will reveal to her a thousand familiar things and lead to fresh observations and fresh discoveries. Thus not only will a purpose have been served in mental development and the building of character, but a training will have been given which will enable the individual to make a wise use of her leisure.

Again there is more to it than this, for though life without interest would be "weary, stale, flat and unprofitable", interest itself must be more than a mere filling in of leisure time. We are living beings, and our very existence depends on our concurrence with the laws of life and death—inexorable laws which can never be evaded.

Hence no secular subject can be more important than biology. The facts of existence are too important to be ignored. Nature teaches that plants and animals which fail to adapt themselves to conditions cannot survive, and even *Homo sapiens* must conform to the same laws if he is to live healthily and wisely.

Children are quick to observe. As a matter of fact the average child is more observant than the average adult, possibly just because in the former case the natural tendencies have not been atrophied by artificial restrictions. The study of life is interesting to the child, for she prefers always the living to the non-sentient, and will often endow with life and active powers her lifeless toys. Hence the careful training in nature study quickens observation and deductions, widens sympathies, and thus lessens cruelty, which is, in most cases, the result of non-comprehension of the suffering inflicted. Moreover, an interest is added to life out of school and the way is prepared for later studies of a more specialised nature. No better preparation could be imagined for a course in elementary biology than nature study under a wise and sympathetic teacher. As a teacher of this subject I always endeavoured to impress upon my pupils (in this case students in training) that the aim of our work should be to ensure the seeing eye, the hearing ear and the understanding heart.

Education cannot be wholly a matter of books; indeed some reformers would have books neglected until

the children have learned to use eyes, ears and hands. There is something to be said for that point of view.

Granted that nature study, apart from its value in itself, is the best preparation for a science course, the question may arise, "which science should be followed?" Observations of rock formation, of natural features such as rivers, valleys, coast-lines, etc., may seem to point to geology, whilst the study of plant life, of the wonderful adaptations to environment, the devices for dissemination and the like would indicate botany as a natural extension of the subject; whilst the varied forms of animal life, their adaptation to their habitat, their bodily functions and their requirements would seem to assume that zoology and physiology should be taken. In my opinion to select any one of these to the total extinction of the others would be to destroy the value of much that has been done. In nature study we do not take plants by themselves, as in a herbarium, but in the field, where their very existence is often linked with animal and insect life. The pupils will have learned, also, that every living thing must adapt itself to its environment, unless it has the means of moving from one place to another; they will have seen how light, soil, water and other factors influence both plants and animals. To be sure, nature study includes also a certain amount of geology, of astronomy and of meteorology, as well as sufficient physics and chemistry to help the young observer to understand why water flows downhill, why ordinary plants cannot thrive in darkness, why the frail shell can resist the battering of ocean waves though it succumbs to a tap from our finger-nail, how trees stand the strain of the weight of foliage and of the force of the wind, and why water in a pool becomes foul and muddy while in the lake or sea it remains clear. All this and more comes into nature study, which is calculated to widen the mind so as to see life as a whole. Can we conceive a better preparation for a course in biology?

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