

schools existed in England before the Reformation, as for instance those at Wisbech, Week St. Mary, Wimborne, Durlington, and Chipping Campden, appears from Mr. Leach's researches before referred to (pp. 110-114). In fact, the very idea of receiving payment for teaching was scouted until the introduction of secular teachers about the beginning of the eleventh century.

And yet Sir Norman Lockyer speaks of "the iron heel of priestcraft"—an ugly word—as arresting the "new spirit" presumably of free education of the people. Nor is his complimentary reference to the Jesuits in France more according to facts. However what the Society of Jesus has effected for the cause of education, both literary and scientific, is too patent to any unbiassed student of the history of education to need discussion. Moreover, I should be needlessly occupying space in this journal.

A. L. CORTIE.

Stonyhurst College, October 23.

Organic Variations and their Interpretation.

I HOPE you will allow me to correct two serious errors in Prof. Weldon's reply to my criticisms.

I was never foolish enough to assert, as he implies that I did, that the theory of natural selection attempts to answer the question whether modifications originate accidentally or not. I said that this was the question between the adherents of the theory and its opponents. I quite agree with Prof. Weldon that the theory of natural selection does not involve a theory of the origin of variations. For that reason it is not by itself a theory of evolution.

Prof. Weldon asserts that I said there was no evidence of the entrance of fine mud into the gill-chambers of crabs during life. I said, or wrote, nothing of the kind. He found china clay in the gill-chambers of the individuals which died in his experiments, and I pointed out that this was no proof that the crabs had died because their branchial apparatus was unable to keep out the particles of clay. The clay was not found in the gills of the survivors, and he inferred that they owed their survival to more efficient filtration, due to their relatively narrower frontal breadths. I merely pointed out that the inference was not valid because the dead crabs had been in the muddy water after death, while the survivors were killed after removal.

I do not admit that Prof. Weldon has successfully vindicated his evidence or his conclusions against my criticisms; but as you, Sir, are unable to allow me any more space, I must thank you for printing my first letter, and leave further discussion of the matter for some other opportunity.

Penzance, October 22.

J. T. CUNNINGHAM.

SCIENTIFIC EDUCATION IN RURAL DISTRICTS.

AMONG the problems of technical education which County Councils have had to face, the most difficult is the bringing home of the importance of scientific training to those engaged in agriculture and in rural industries generally. A study of the results achieved in the various counties very clearly brings out the fact that while considerable progress has been made in manufacturing centres where the practical bearing of science is more or less obvious, the agricultural counties have hitherto failed to show a similar progress as the outcome of their efforts to improve the rural industries. Many causes are contributing in this country to check advancement in rural technical education. The general depression of agriculture, the conservatism and apathy of farmers and landowners, the high cost of carriage of farm produce, and the incompetence of technical instruction committees are among these causes; but it would be out of place to discuss such matters in the columns of a scientific journal, and we are content in admitting that the technical committees in agricultural districts have had a far more difficult task imposed upon them than the committees of urban manufacturing centres have ever been called upon to perform.

In bringing under the notice of the readers of NATURE an educational movement which we are firmly persuaded

is a movement in the right direction, we have primarily in view the fact—obvious to men of science, but, unfortunately, not so obvious to those more immediately concerned—that agriculture in its widest sense is as much dependent upon scientific research for its advancement as any other industry. The great importance attached to agricultural stations in the United States and Canada, and on the continent, and the splendid results in the way of agronomic research which are being achieved at these stations, amply testify that other countries are alive to their agricultural welfare. All that has been done in this country by those great pioneers, Lawes and Gilbert, has been the result of private munificence.¹

In view of the fact that the results of scientific research are bound with the progress of time to make themselves more and more felt in all kinds of rural industries, and bearing in mind also the slow rate of development in this direction in our country, we are convinced that the best chance of enabling our agricultural population to appreciate the importance of research and to meet competition is to give the rising generation an opportunity of acquiring some knowledge of sound scientific principles as a part of their early training. If the present generation of farmers and landowners cannot or will not bend to the inevitable, and endeavour to cope with difficulties by scientific method, then, at any rate, let facilities be given to their children for the acquisition of such scientific habits of mind as will enable them, without actually becoming experts in any particular science, to realise exactly how they are situated with respect to their competitors. It is hardly necessary to point out in these columns that in all rational schemes of technical education this principle is recognised as sound. It is remarkable, in view of this acknowledged principle, that so many technical instruction committees should have attempted to begin their work at the wrong end, and should have expended large sums in encouraging sporadic teaching by specialists to adults who, for lack of proper training, are totally unprepared for specialisation in any direction. In most cases a critical analysis of the results obtained under this system shows that unintelligent manual dexterity is the utmost that can be achieved. This, in our view, does not constitute technical education; certainly, so far as agricultural industry is concerned, this kind of instruction is not likely to be of any permanent value.

The agricultural industries may be regarded as furnishing a rallying point round which several distinct branches of science meet. To insure success in such occupations when all the resources of science are being utilised by our competitors, it is becoming more and more imperative that the education of the farmer should, at any rate, be placed on a scientific foundation. We cannot, unfortunately, look at present to the elementary schools for any help in this matter. The children leave too early in life, and such science teaching as they receive (if any) is quite inadequate. The sporadic system encouraged by some County Councils has already been condemned. Still more unfortunate appears to us to be the frittering down policy of administering the technical education grant in the form of doles to districts in proportion to the number of the inhabitants. The few want educating in the thinly populated agricultural districts quite as much, or even more, than the many in the towns. It is more costly to educate the few than the many; therefore the rural districts require more financial aid proportionally than the towns. Under the system referred to, the country districts get less. If an "intelligent foreigner" who came over to inquire into our educational systems since the passing of the Technical Instruction Act, were told that the degree and quality of the education given to a boy or girl had been made dependent on the number of inhabitants per square mile

¹ The fructicultural station established by the Duke of Bedford and Prof. Pickering at Ridgmount also comes under this heading.

in which the child happened to reside, he would be justified in passing on with a smile and a shrug.

Owing to the insufficiency of the educational machinery in country districts, and the disproportionate assistance given to urban centres under the decentralising policy, another evil has arisen which threatens to cripple still more seriously the already languishing rural industries. By the examinational selection of pupils for scholarships the best intellectual products of the country districts are gradually being weeded out, and all the skill and intelligence for which the land is thirsting is being diverted into other channels. This process, if allowed to go on, can only have one result: there will be left such an inferior residue that some future Minister of Education will have to deplore, even more emphatically than did Sir John Gorst in his memorable speech in the House of Commons last June, the barrenness of the outlook with respect to rural education. Still louder will go up the cry of the economist, that while the land is lying barren for want of skilled attention, and the villages are becoming depopulated, the towns are becoming overcrowded to the starvation point of competition.

In order to counteract these evils, it is desirable that the resources of science should be made as available to the inhabitants of the country as to the dwellers in towns. A long acquaintance with the habit of mind of the average British farmer has convinced us that the only chance of salvation in the future is to bring the educational machinery into his neighbourhood. It is useless to tell him that he must send his children to some distant school or college where science teaching forms part of the curriculum. He knows nothing and cares nothing about science. He looks upon learning as a dangerous thing, and associates chemistry with bogus fertilisers. An experiment which leads to no practical issue causes a chuckle, and if a downright failure is the result, he is rather pleased than otherwise. The so-called "agriculture" of the certificated schoolmaster, which was let loose in some counties in the early days of the technical education movement, is very largely responsible for hardening the scepticism of the practical farmer towards science.

Perhaps we are over-sanguine in the belief that the agricultural salvation of our country depends on the scientific education of the coming generation. At any rate the belief has taken practical form, and a school of science has been founded at Bigods, near Dunmow in Essex, by one of the writers (F. E. W.), which it is hoped will set an example throughout the country. No claim is made for any particular educational originality in this venture. The *raison d'être* of the school is that it serves a thinly populated agricultural district where there is no organised science school in existence. There are districts of a similar kind all over the country, and there is a distinct need for such schools in these districts. The Essex County Council has extended some aid towards the Bigods school, and it is to be hoped that other County Councils will follow suit in their own districts. Certainly no better use of the "whisky money" can be made in agricultural districts than in establishing schools of science where the children can receive a sound training, extending over the three or four years between their leaving the elementary school and their entry into life as bread-winners. In some cases it might be possible to develop existing schools in the desired direction; but, on the whole, a fresh start would seem to be the preferable course. The average country grammar school is generally too much hampered by ancient tradition to meet modern requirements; the education in such foundations has not a sufficiently scientific bias, and the particular class of students whom it is our desire to see catered for, do not take kindly to the grammar school curriculum, apart from the question of cost, which is more than the small farmer or proprietor can afford.

With respect to the curriculum at Bigods, we have at present adopted that laid down for schools of science by the Science and Art Department. In most respects this scheme seems adaptable to our requirements, which may be described briefly as an education which, while allowing a certain amount of time for literary subjects, gives also a general scientific training with some manual training. No specialisation will be allowed till the pupils have passed through the elementary stage, and in the advanced course the sciences bearing on agriculture will be given extra prominence. A large mansion has been placed at the disposal of the school as a residence for the principal and for boarders who reside too far off to come to the classes daily. There is plenty of land about the establishment for experiment plots, apiaries and poultry runs, and a farm adjoining the estate is available for field demonstrations. For the advanced classes the services of the County Council Staff Instructors, who are experts in their various departments, will be requisitioned. The school has made a start with some forty pupils, of whom about twenty-three are considered qualified to go through the school of science; while the remainder are in course of training for this curriculum. One especial feature of the scheme is the mixed education of boys and girls together in the same class. This system has been found to work admirably in other schools, both in this country and elsewhere, and it is intended to give it a fair trial in Essex. So far as experimental science is concerned, girls certainly are quite as keen and do just as well as boys if they are properly taught. The only point of difference in the education of the sexes is that the girls sacrifice some portion of the manual training and science in favour of domestic subjects, such as cookery, needlework, and domestic economy. Chemical and physical laboratories, a workshop and well-equipped laundry are, of course, essential parts of the institution.

The educational experiment which has been inaugurated in Essex is one which we venture to think is worthy of success and encouragement. The main difficulty with which we shall have to contend will no doubt be that of persuading the parents to allow their children to remain long enough at the school to complete their education. At any rate, the chance has now been placed in the way of the inhabitants of a district which has hitherto been devoid of institutions for carrying on any systematic scheme of secondary education. The firm belief that such establishments will do more permanent good to the agricultural welfare of this country than any amount of sporadic teaching or evening courses to people already mentally and bodily weary with a long day's work, has prompted the expenditure of money, time and thought, which have been necessary to found this school. Of equal weight has been the conviction that the mental discipline imparted by sound instruction in the principles of such sciences as are taught under the curriculum, is the best of all equipments that can be given to the agriculturist on his entry into active life. In order that would-be benefactors of rural education need not be alarmed, it may be pointed out that large institutions are not essential. At Bigods the laboratories of the school of science are available for about twenty-five pupils. We shall be satisfied if for some years this department of the school can be maintained at this number in the elementary and advanced stages. The great desideratum of the time is the establishment of numerous small but thoroughly efficient secondary and technical schools in appropriate centres, so that all the rural districts may be catered for. The general level of intelligence in the neglected country districts is bound to be raised in the long run by such means—not only by the direct effect of the training, but indirectly by reacting upon the elementary schools and compelling them to increase the efficiency of their teaching.

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RAPHAEL MELDOLA.