Literary Notices.

VEGETABLE MOULD AND EARTH-WORMS.

By Charles Darwin, LL.D., F.R.S.

The other day was published a book with the above title. In the year 1837 Dr. Darwin read a short paper before the Geological Society of London 'On the Formation of Mould,' in which it was shown that small bits of marl, cinders, and lime which had been strewed on the surface of several meadows, were found in a few years lying at the depth of some inches beneath the turf, but still forming a layer. This apparent sinking of superficial bodies had been explained to him by Mr. Wedgewood, of Maer Hall, in Staffordshire, to owe its origin to the large quantity of fine earth brought to the surface by worms in the form of 'castings.' These castings sooner or later are spread over the surface, and cover up any object which has been laid upon it. From further observations he was led to conclude 'that all the vegetable mould over the whole country had passed many times through the intestinal canals of worms.' Hence the term 'animal mould' would be in some respects more appropriate than that commonly used of 'vegetable mould.' This, then, is the theory which the Doctor sets himself to establish in this his newest publication. For forty-four years, at intervals of leisure, Dr. Darwin has striven to collect facts to support his theory, not only by experiments on the habits of worms when confined in pots in his own greenhouses and under his own eye, but by enlisting in his service his son and many naturalists whose habits of observation fitted them for such study; and the outcome of their labours is to show that earth-worms swallow a very large quantity of the earth which is taken out of the roads they form in the soil, and that also to a large extent they draw their supply of food from the earth they otherwise take into their stomachs, which, containing the roots of plants, the remains of insects, and other dead or decaying vegetable or animal matter, is acted on by the juices secreted by their stomachs, and is then, when useless for their sustenance, expelled on the surface of the soil in the form of worm casts. To such an amount is this the case, that in many pastures of England a weight of 10 tons per acre of dry earth annually passes through their bodies, and is brought to the surface on each acre of ground; so that by this means the whole superficial bed of vegetable mould passes through their bodies in the course of every few years. The effect of this operation is to rub together the particles composing the soil, exposing fresh faces to the action of carbonic acid and of the humus acids, which appear to be still more efficient in the decomposition of rocks. The bodies of large worms consist of from 100 to 200 almost cylindrical rings furnished with minute bristles and a powerfully developed muscular system, which enables them to crawl backwards or forwards. The mouth is situated at the anterior end of the body, fitted with a lip or proboscis, which is pushed forward when the animal eats. What they eat is received into the pharynx, passing into the œsophagus, where there are glands which secrete a large quantity of carbonate of lime. The crop, the gizzard, and the intestines follow. In these last the absorbent surface is large. Worms breathe by the skin, are destitute of eyes, though after long exposure to light seem to be affected by it, which enables them to distinguish between day and night. Neither do they possess the sense of hearing, but are very sensitive to any vibration of solid bodies. They have the sense of touch and a feeble sense of smell and taste. In addition to the food extracted from the earth they swallow, and in the process add to its powers of supporting vegetable life, they also draw leaves or bits of flesh, onions when they can get them, into their burrows to feed on them. Various experiments have shown that each worm excretes about 20 ounces of castings per annum, and the Doctor calculates 26,886 may live in an acre of old pasture ground when the natural food abounds and the turf is unbroken by the plough or spade. The power of this little creature in burying not only the small stones, but even large stones and the remains of ancient buildings, is really wonderful. The Doctor tries to prove, and so far with success, that the Roman remains in the south of England, and at such places as Abinger, Beaulieu Abbey, Silchester, and Wroxeter, owed their state of preservation to the action of worms, and that 'it is a marvellous reflection that the whole of the superficial mould' over any turf-covered expanse of country 'has passed, and will again pass every few years, through the bodies of worms;' 'and it may be doubted whether there are many other animals which have played so important a part in the history of the world as have those lowly-organized creatures.' In this book, so far as we can see, there is no reference to the doctrine of evolution, to support which mostly all of Dr. Darwin's recent writings have been directed; indeed, from the facts stated, it appears earth-worms have been created for the express purpose of preparing the surface soils of the world for the use of other living things, that the qualities they possess are perfect for the objects of their existence. Long before man had invented the plough, the land was, in fact, regularly ploughed, and still continues to be thus regularly ploughed, by earth-worms. Neither is the origin of the vegetable soil attributed entirely to them, as some expressions in his earlier writings seemed to point. At page 11 it is said, 'A layer, though a thin one, of fine earth which probably long retains some moisture, is in all cases, as I believe, necessary for their existence;' and again, at page 300, 'I do not know how thin a layer of mould suffices to support worms, yet a limit must at last be reached.' Their origin must then be subsequent to the formation of vegetable soil, and so long as it remains they have the means of existence provided for them.

A careful perusal of this book is well worth the attention of the young agriculturist. Not only is the lesson it exhibits of the marvellous power of littles of value, but the method of observation which the Doctor follows is admirable. Step by step he traces out the life and actions of these lowly creatures, and assertion rarely finds a place in his pages; and whether we differ or agree with the writer, all must admire the care, clearness, and candour with which he treats the subject. Space can allow few further remarks. Many a controversy has arisen on the benefits conferred by rooks and other birds in picking up insects injurious to plant life. Earth-worms, however, have always formed the chief object which crows or sea-gulls search for in their constant visits to newly ploughed land, or to what lies under the bits of turf or stones which crows so carefully turn over. Those, therefore, who supported the opinion that by the great destruction of earth-worms caused by the rooks or gulls, far more injury was done to the cultivator than good by the few other insects they could pick up, have much support from this book. The story of the life and work of these lowly creatures as told in these pages is truly interesting, and the beneficent effects of their humble labours is made manifest by the natural drainage they provide and the chemical and mechanical results of their minute but beneficent operations.

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THE SCOTTISH VETERINARY COLLEGES.

Interesting inaugural addresses were delivered last week in connection with the opening of the winter session at the above colleges. We can only find room this week for brief summaries of the addresses.

Royal (Dick's) College.

Principal Walley, in addressing the students attending the above institution, gave an interesting historical sketch of the past and present of veterinary teaching in this country. After referring to the present flourishing condition of the veterinary schools, the Principal went on to say that as regarded scientific matters they had stood comparatively still. This was accounted for by the fact that as a profession they were poor; as teachers they were hard wrought; and as investigators they were so handicapped by a restriction which put them in the position of being, as compared with their Continental brethren, not leaders, but followers. No argument could justify suppressive interference with such experiments as those recently carried on by their colleagues in France, and from which such glorious results had been obtained. Neither could the suppression of experiments to determine the effects of medicines on animals be justified. They heard of the discovery of new systems of preventing and curing disease; they could not adopt these because they knew nothing of them practically, and dared not have recourse to the only means of becoming acquainted with them. It might be said they could utilize the new remedy in their own practice. They could not do so, because they knew nothing of its effects on different animals they had to treat, or the doses in which it should be administered; whereas, if they were not hedged in by complex legal formalities, they could, by a few experiments, determine all such points, and add largely to their store of weapons wherewith to fight disease. As it was, every time they administered a new drug to a sick patient they performed an experiment of the very worst kind, because, while trying to discover the effects of this drug, the patient was losing ground which might otherwise have been conserved. Mr. Walley proceeded to pay a high tribute to the services rendered to veterinary surgery by the late Professor Dick, and concluded with a few observations as to the spirit in which the students should enter on their intended profession.

Bailie Hall proposed a vote of thanks to Principal Walley for his address, which was seconded by Emeritus Professor Balfour, and cordially awarded.

Councillor Russell, in proposing a vote of thanks to the Chairman, said we were on the eve of very great discoveries indeed—perhaps they had been made already — which would prove the greatest blessing to the human race; and those discoveries had had a foundation in veterinary practice. He had had occasion to look into veterinary books and compare the practice in olden times with the modern, and he thought the benefit animals derived from the change in practice was largely due to the instruction communicated in the colleges of recent date, and to the assimilation between the two kinds of professors of the healing art. He endorsed what the Principal had said about the restrictions imposed upon the experimenting upon animals, with the view of getting information for their own treatment and that of human beings. He could personally state that the Act had proved a great hindrance to experiments which were not of a painful nature. Certain experiments, for example, were being conducted by two members of the British Medical Association upon disinfectants. They experimented with vaccine lymph; but although they were allowed by law to vaccinate babies, they were not allowed to vaccinate calves, and consequently their experiments had to be stopped, and they had to lose a whole summer and get a licence from the Home Secretary to vaccinate a calf—(laughter).

New Veterinary College.

The winter session of this College was opened by an address from Professor Hunter. Principal Williams occupied the chair.

Professor Hunter in the outset referred to the amount of pleasureable excitement with which veterinary students usually entered upon the course of training for that profession. He then gave a vivid description of the present state of the germ theory in its different phases. The origin and continuance of many of the most contagious diseases, he said, had been explained by the existence of certain organisms that were found in the fluids of the bodies of animals. After citing several instances, Professor Hunter remarked that mere burial was not a sufficient means of prevention; he would strongly recommend the burning of dead animals. He then went on to speak of the varied requirements of those engaged in the practice of surgery and medicine.

Principal Williams proposed a vote of thanks to Professor Hunter, and in doing so referred to the Veterinary Surgeons Act, recently passed. That Act, he remarked, precluded any man from calling himself a veterinary surgeon who had not properly qualified himself. He went on to say that it was a matter of great surprise to him that this country, having a veterinary department connected with the Privy Council, did not endeavour, at least, to prevent the spread of foot-and-mouth disease in England. They had been very clever in Scotland, and had kept it out. It was remarkable that the Privy Council had not thought something of the idea of attenuating the virus, and of trying to prevent the disease which had paralyzed the trade in cattle for such a long time in England. It had also paralyzed the cattle trade of farmers in Scotland, for they could not get cattle. During the last summer he had conducted a series of experiments connected with the louping-ill in sheep. From the results of these experiments he could not help mentioning that amongst the lower animals he thought there were diseases of which they knew nothing at all about. He would like to impress upon them the necessity for the institution of a chair of comparative pathology in some of the great universities. In order to do this it would be necessary for the Government to train a man to it. Not because a man had written a book should he have the chair, but a man should be trained to it. A young man who had been scientifically educated, who knew the difference between a sheep and a lamb, should be highly trained, and then sent out to the world—say ten years to collect his subjects. At the end of that time he should expect that man to give his results to the world. That would be a benefit to the public at large, and more particularly a benefit to those engaged in agriculture. It was of importance that all the diseases of the lower animals should be thoroughly understood by all the community. That man must be independent; he must be paid by the Government to conduct these experiments, to investigate and solve the many problems which were entirely dark even to the most experienced. In conclusion, Principal Williams remarked that the number of students enrolled that day for the ensuing year exceeded that enrolled on the corresponding day of any previous year.

PROPRIETORS' EXPENDITURE ON LAND.

The Earl of Strathmore writes to the *Dundee Advertiser* as follows:—My attention has been called to a letter from Mr. Hunter which appeared in your newspaper of the 26th, from which it seems that that gentleman quite misunderstands the remarks I made in referring to his speech at Forfar. He says—'I knocked down what he did not set up, and left untouched the case he did set up,' and he then proceeds to treat me in the same fashion, and to prove his case by repeating statements as to the increase of rentals in Scotland, which I had not denied.

I can scarcely believe that Mr. Hunter could seriously imagine that I was disputing the fact of that increase; what I did dispute, as was well understood by those present, was Mr. Hunter's estimate of the amount contributed by the landlords towards that increase. I said that after making injuiry in several quarters I found the results very much the same as in my own case, and I gave the exact outlay and increase of rent on my own estate. In order to do so fairly I took, not an arbitrary term of 23 years, from 1853 to 1876, but two periods which seemed the most natural ones to be selected—the decade from 1870 to 1880, which includes the six years during which Mr. Hunter says half the annual increase of 20 millions was made, and the time during which I have been in possession, from 1865 to 1880. I believe that the figures I gave, and the statistics to which I had access, fairly represent the landlords' outlay on most estates in Scotland, and prove that the proprietors have expended on them a sum nearly, if not quite, equal to the increased value of their land. The capital value of that increase Mr. Hunter puts at 600 millions. That statement I did not challenge. But when he added before a meeting of tenant-farmers that the landlords had not expended more than 100 millions towards realizing that increase, I felt that such a statement was misleading, and I proved from my own experience and that of every landowner whom I had consulted that it was not warranted, and did not convey a correct impression. Mr. Hunter's obvious meaning was that the greater part of the remaining 500 millions was contributed by the tenants, for he proceeds to say—'A large portion of these 600 millions—how much it is impossible to say—but a large portion represents the results of the tenants' expenditure.' From what I know of my own tenants I am aware that Scotch farmers do make a very large expenditure in cultivating the soil, but the permanent improvements necessarily fall upon the landlord.

I need not say much on Mr. Hunter's distinction between repairs and improvements. Every practical farmer will acknowledge that good and substantial repairs are an improvement to his holding, and they certainly form a portion of the necessary outlay by the landlord.

Having made this explanation, I will only add that I have no intention of continuing this correspondence.

The Garden.

CALENDAR OF OPERATIONS FOR NOVEMBER.

Vegetable Garden.—The operations of clearing the ground of all exhausted crops, manuring and digging all plots in the garden that are cleared, and generally putting all points in winter order as advised in the calendar for last month, should be proceeded with this month where not finished. Many weeds will yet make active progress, and even scatter their seeds, to the great disadvantage of next year's labour account, and should not be allowed to live. Of course it will be understood that weeds hoed down at this season of the year will root and establish themselves readily again if not removed; they should therefore be raked off and taken to the rubbish heap, where they will increase the bulk of useful compost. Frosty mornings, when they come, should be taken advantage of for the purpose of doing any wheeling of manure or compost. Carrots, beet, salsafy, scorzoners, potatoes, &c., if not already stored away, should be dealt with at once. (See instructions in reference to these in October calendar). Artichokes of the *globe* sort should be dressed for the winter; the outer leaves should be cut away, and the inner ones tied together with a piece of matting. Five or six inches of fresh stable manure should then be laid round and close up to the crown of each plant, trimming up in the shape of a cone, and covering up with the soil, preserving the cone shape so as to throw off rain. This vegetable suffers quite as much from protracted wetness around the crowns as from cold, hence the necessity of arranging the covering material in the shape of a cone. It is to be understood that the centre of each crown must be left open; they must have air and light, otherwise they will rot. Rhubarb may be put in for forcing into any outhouse in which a store of fermenting material can be placed; a temperature of 60 to 65 degs. is all that should be aimed at, and if kept steadily at this, produce of first-rate quality will be the result. Seakale may be forced in the same way, lifting the roots from the open ground, and planting them in any dark outhouse in light soil on the top of a bed of well-sweetened manure or manure and leaves, the latter being best as being less liable to become excessively heated. Complete darkness, which is less essential to rhubarb when forced, is indispensable to seakale, in order to blanch it perfectly. Swedish turnips are now largely used as a substitute for seakale, both in private establishments and for market, and a very excellent substitute they make. They are done in the same way; the roots being taken from the field and the tops cut off not so close to the crown as to injure it; they are then placed on a little soil on the top of the manure. The produce is cut, of course, before the leaves begin to expand, and complete darkness is equally essential in order to blanch it perfectly as in the case of seakale. Forcing may, of course, be done in the open ground, but it is attended with more risk and more labour than when an outhouse or cellar can be devoted to the purpose.

The Fruit Garden.—Planting, if any is to be done, should be attended to as early as possible. In order to have the best selection of trees send your orders to your nurseryman at once. It is an almost invariable rule in nurseries that 'first come is best served,' hence the advantage of being the first to order. Don't let your trees lie about after they come to hand, but plant at once; more harm is done to trees of all kinds by this sort of treatment than from any other cause, and the nurseryman is often blamed for the result unjustly. In planting fruit trees, no matter whether the ground is deep or shallow, never plant deeply. The nearer the roots are to the surface the better, and this should be strictly kept in view in all fruit-tree planting in this climate, where we need all the benefits of the action of sunlight and heat that we can get to counteract our watery air and too much saturated soil. After planting, secure each tree so that it may not be disturbed by wind, and mulch the surface with moderately fresh stable manure as the roots extend. If there is any fruit yet to gather and store, let it be got in at once; it can do no good by being left longer on the trees. Pruning should be performed on gooseberries, apples, pears, plums, cherries, raspberries, and currants, and the ground manured or top-dressed between the plants. Avoid pruning in frost. Leave the pruning of peaches, nectarines, and apricots till spring or after the more severe frosts are over. The training of all fruit trees on walls and espaliers should be proceeded with in suitable weather as soon as the pruning is done. Top-dress and clean plantations of strawberries, if not already done. Look over fruit in store, carefully picking out those that show signs of decay, to prevent them from affecting the sound fruit.

Emigration to Canada.—The official returns show that in the nine months ended the 30th September 40,197 immigrants (including 8953 from the United States) entered the different provinces of Canada. The number for the year 1880 was 38,505, of whom 10,961 were from the United States.

The Climate of Manitoba.—The Rev. Dr. Bryce of Winnipeg says the remarkable dryness of the atmosphere during the Manitoba winter is shown by the large quantity of electricity present. It is a common amusement in mid-winter to rub one's slippers on the carpet and bring the body in a minute or two to so surcharged an electric condition that any one touching the nose or the ear will take off a spark, and a perceptible shock result.