

latter dealt with mysteries, and membership was generally attained by virtue of a dream vision. The Omaha were a thoughtful and practical people. The idea of personality is dominant in the language and in the religious beliefs and practices. The force within this personality was recognised as that of the will, and "the Sacred Legend, which preserved the experiences of the years, emphasised the vital fact that better conditions are always attained by the exercise of thought, not by magical interferences." Enough has been said to show that Miss Fletcher has given us a monograph that deserves the careful study of all ethnologists, and will still further increase their indebtedness to the Bureau of American Ethnology.

A. C. HADDON.

THE ROYAL MICROSCOPICAL SOCIETY.

ON Wednesday, October 16, a conversazione was held in the Great Hall of King's College, about four hundred fellows and guests being received by the president, Mr. H. G. Plimmer, F.R.S., and Mrs. Plimmer. The object in view was, so far as practicable, to gather together a series of exhibits which would indicate the many uses, both in science and commerce, to which the microscope is put at the present time. In addition, the conversazione afforded an opportunity for those engaged in microscopic work to show objects of interest or to demonstrate the use of apparatus or appliances for special purposes.

The centre of the hall was occupied with pond life exhibits, about forty microscopes having been arranged on the tables under the direction of D. J. Scourfield, and these were a centre of interest to a considerable number of observers throughout the evening. Other interesting exhibits were some very beautiful botanical slides showing mitosis, by H. F. Angus and E. J. Sheppard; a Siedentopf ultra-microscope and cardioid condenser system for the observation of ultra-microscopic particles, by J. E. Barnard; an Abbe diffraction microscope illuminated by means of a quartz mercury-vapour lamp, by J. E. Barnard and Powell Swift; an instantaneous reflex photomicrographic camera, by F. W. Watson Baker; some preparations exhibiting Brownian movement, by G. P. Bate; a complete optical bench and an apparatus for polishing metal surfaces, by Conrad Beck; an extensive series of saccharomycetes, by A. Chaston Chapman; a very interesting old microscope and accessory apparatus, by Prof. A. Dendy, F.R.S.; some diffraction experiments, by J. W. Gordon; a series of foraminifera, by E. Heron-Allen and A. Earland; microchemical reactions of a very striking character, by Prof. Herbert Jackson; an extremely beautiful series of photomicrographs in colour, by J. W. Ogilvy, and another series of stereophotomicrographs of water mites, also in colour, by H. Taverner. The possibility of applying his micro-spectra camera to the production of photomicrographs in colour was demonstrated by J. Rheinberg, and this exhibit attracted a great deal of attention.

Prof. Minchin, F.R.S., exhibited a series of trypanosomes which were of great interest. In the adjoining theatre, three lectures were delivered during the evening, Dr. E. J. Spitta giving a cinematographic exhibition of pond life, Prof. Hewlett lecturing on insects as carriers of disease, and Mr. Max Poser showing a beautiful series of liquid crystals by means of a projection micropolariscope, each of the lectures attracting a large audience. Apart from the social advantages of such a gathering, the exhibits were in all cases of real scientific interest, and demonstrated that the Royal Microscopical Society may look forward to doing an even greater work in the future than it has done in the past in bringing before scientific

workers the possibilities of the use of the microscope. That the instrument is now a necessity in nearly all branches of science is, of course, well known, but it is often used merely as a tool and not as an appliance which demands considerable skill in its use for the best results to be obtained. If the council of the society should decide that this conversazione is to be but the first of a series of annual gatherings to be held with a similar object, then the success which has attended this function may be regarded as an indication that its usefulness in the future may be considerably increased.

THE BRITISH ASSOCIATION AT DUNDEE.

SECTION M.

AGRICULTURE.

FROM THE OPENING ADDRESS BY T. H. MIDDLETON, M.A., PRESIDENT OF THE SECTION.

INTEREST in the practice of improved husbandry was first aroused in England by the books of Fitzherbert. The extent to which this author stimulated agriculture may be inferred from the appreciation with which his works were received in his own day, and copied by others for a century. He himself does not appear to have been acquainted with the classical writers. He describes the English practice with which he was familiar; he quotes frequently from the Scriptures and refers to early religious works, but only in writing of animal diseases, when he cites the "Sayinge of the Frenche man," is there any indication that he was influenced by foreign authors. Fitzherbert's "Boke of Husbandry" and "Surueyenge" while they are free from the direct influence of Roman writers, show us, nevertheless, that the English agriculture of his day owed much to Roman traditions. The careful business methods and accounting of the farm bailiffs of the Middle Ages, with which Thorold Rogers has acquainted us, were the methods which Fitzherbert learned and counselled, as they were the methods which Columella taught.

It was between 1523, when Fitzherbert's "Boke of Husbandry" was first printed, and 1557, when Tusser published his "Points of Good Husbandry," that the classical writers began to exert a direct influence on English farming. In 1532 there appeared Xenophon's "Treatise of Householde," "ryht counnyngly translated out of the Greke tonge into Englyshe by Gentian Hervet," which at once became popular and ran through a number of editions. At least as early as 1542 editions of the works on agriculture and gardening of Cato, Varro, Columella, and Palladius¹ were published in England, and they must certainly have been known to Tusser, for in his "Five Hundred Points of Good Husbandry," composed some years later, there is clear evidence of the influence of the writings of Xenophon and Columella. From the latter author Tusser adopts the method of a calendar, and he appears now and again to adapt Roman maxims to modern conditions. Thus in his calendar Columella says of March that it "is the proper time to cleanse meadows, and to defend and secure them from cattle; in warm and dry places indeed that ought to be done even from the month of January," and Tusser in his calendar for March rhymes:—

"Spare meadow at Gregorie Marshes at Pask
for feare of drie Sommer no longer time ask
Then hedge them and ditch them, bestow thereon pence,
corne, meadow, and pasture aske alway good fence."

It might be, of course, that in discussing the same subject, a subject moreover which does not admit of much difference of opinion, the similarity of the above-

¹ A translation of Palladius into English was made about 1420, but it was not discovered and published until within recent times.

quoted passages is accidental; but many of Tusser's rhymes so closely follow Xenophon's "Householde" and Columella's Eleventh Book that I am satisfied Tusser was familiar with both these ancient writers. Here, for example, from Tusser, is the charge concerning sick servants which Ischomachus gives to his young wife:—

"To Seruant in Sicknesse see nothing ye grutch,
a thing of a trifle shell comfort him mutch."

And here is a maxim for the housewife that Columella enforces:—

"The woman the name of a huswife doth win
by keeping hir house and of doings therein
And she that with husband will quietly dwell
must thinke on this lesson and follow it well."

Until the dawn of the twentieth century no mere man would have been found to question the conclusion come to in the above verse; nevertheless, the emphasis on the "quietly dwell" indicates that in this particular case the inspiration is derived from Columella rather than from Xenophon. For while the woman described by the Greek writer is likened to the queen bee, by the Roman there is much lamentation because of the emergence of the "butterfly." Columella refers to the diligent dames of ancient Rome who lived at home and studied to improve their husbands' estates, and contrasts them with their successors in the first century, who had become indolent, refused to make their own clothes, and spent their husbands' incomes on dress. He then remarks, "Is it a wonder that these same ladies think themselves mightily burdened with the care of rural affairs, and esteem it a most sordid business to stay a few days in their country houses?"

It was, then, the practice of husbandry that engaged the English agriculturist's attention from the time of Walter de Henley to Thomas Tusser, and the purpose of my digression into domestic subjects is to show that when the ancient writers were rediscovered in the middle of the sixteenth century, it was not the frequent references of Xenophon to the science of husbandry but his economic and moral teaching: not Columella's First Book, with its appeal for doctors and disciples who might apply themselves to the study of agriculture, but his Eleventh Book, with its calendar of operations and its directions for the ordering of the bailiff and the bailiff's wife, that attracted Tusser and his readers.

The awakening of interest in husbandry was largely due to the rapid changes in the economic conditions of England which set in about Fitzherbert's time.

The change in the cost of living directed men's attention to the husbandry and housewifery recommended by Fitzherbert and Tusser. The smaller landowners, who could no longer afford to live on their rents, and who saw that yeomen and tenant farmers were prospering, turned their attention to farming, and agriculture became an important occupation of the educated classes.

The yeoman and tenant farmer did not ask for textbooks on agriculture, but the new agriculturists required information, and thus there arose at the end of the sixteenth century a great demand for books. The booksellers were not slow to make provision for the demand, writers were secured, books were published, and of the more popular many editions were sold.

Sir Richard Weston, a Surrey landowner, who succeeded to his estates in 1613 and who had travelled in Brabant and Flanders, was the first English agriculturist to introduce practices approved on the Continent. He grew turnips for feeding cows, a century before the time of Turnip Townshend; nearly three hundred years ago he was experimenting, as we are still doing, with clover seed grown in different countries; he had thirty to forty acres of clover sown with barley, and he was inveighing against the sophistication of "out-

landish" grass seeds and contriving plans for raising pure stocks at home in the approved fashion of to-day.

It was not only from Brabant and Flanders that travellers brought to England information about foreign agriculture. As one result of the development of commerce voyagers were introducing from distant countries such important plants as the potato and tobacco, and were exciting interest by their stories of foreign products. A desire to make experiments with these novelties was but natural, and experimental farming received a powerful impetus from the teachings of Francis Bacon, the first exponent of the inductive method. Having, as he wrote, "taken all knowledge to be my province," Bacon was himself an amateur farmer, and if he was not a successful one he was at least intent upon introducing methods of "industrious observation and grounded conclusions." It is to Bacon, I think, that Arthur Young alludes in a passage in which he describes a Lord Chancellor of England as having procured and read every published work on husbandry so that he might learn how to farm, and who, having met with ill-success, collected the offending books and lighted a bonfire! But let us not think lightly of the efforts of this distinguished amateur farmer. The agricultural writers of the succeeding century, indeed, refer to the influence of Bacon in terms that suggest for agricultural science the origin of the phoenix. We may, at least, agree that about the time of Bacon's bonfire this subject first began to attract the notice of scholars.

In spite of the political troubles of the second quarter of the seventeenth century, agriculture continued to secure increased attention, for England had learned that in war or peace the food-supply must be cared for, and the importance of corn-growing increased with the rise in prices. Thus when the Commonwealth was established everything favoured a forward movement. At peace and able to return to country pursuits, the combatants, Cavaliers and Roundheads alike, became active improvers. Engineer agriculturists, like Vermuyden, carried out great drainage-works. Many estates had changed hands, and the new owners, not a few of whom, as Harte remarks, "had risen from the plough," were glad to return to it; others were amateur farmers intent on learning. The books of the old and trusted writers, Fitzherbert and Tusser, had been followed by the works of such authors as Norden, Markham, Plattes, and Hartlib. Bacon's teaching emphasised the need for further study and experiment. Behind the political and economic changes were the powerful, moral influences of the Puritan movement; it was at this time and under these conditions that the spirit of the improver, which had animated Columella, appeared among English agriculturists.

The first practical farmer to plead the cause of the improvement of agriculture was Walter Blith, one of Cromwell's soldiers, who is supposed to have been a Yorkshire landowner, but who for some years, at least, was stationed in Ireland. Blith was an ardent agriculturist, who prefaced his practical book, "The English Improver Improved," by seven epistles designed to attract the attention of all classes of his fellow-countrymen to agriculture. It is in the epistle to the "Honourable Society of the Houses of the Court and Universities" that chief interest lies for us, for here we find an appeal for the systematic study of agriculture in words that recall the classical writers. Blith showed that agriculture required the close study of the learned, and that the societies (*i.e.*, the Colleges) of the Universities might if they wished do much for its advancement. He adds, "You that have the Theorick, may easiest discover the Mysteries of the Practick, and from you have I found most encouragement to this work, and seen most experiences of good husbandry than from any, and from you too I expect

and waite for more discoveries of some thing I scarce know what to name it, which lies yet in obscurity, but I will call it the Improvement of the Improver."

Were we not now concerned with the spirit rather than with the form of the improvement, an interesting parallel might be drawn between the topics which Blith considers of greatest importance and those which to-day are engaging attention. In his epistle to the society, for example, there is an appeal to the learned to give their attention to applied science. Discussing the progress of the Dutch, Blith deplors that policy which Englishmen afterwards termed *laissez faire*. He says: "Our niceness in not nursing the fruits of our own bowells hath given them the opportunity to Improve our native commodities to the advance of their Manufacturidge to our shame, their praise"; then addressing members of the universities he adds, "I speak to wise men whom I would have more publike men. . . . Let me entreat you for the Peoples and your own posterity sake . . . put your shoulders to the work, greater things remaine and larger Improvements are yet to be discovered."

The earnest advocacy of Blith, the essays of "my good friend Mr. Samuall Hartleps," and the energy of landowners like Sir Richard Weston, led to a demand for the records of experiments, and in 1659 there was issued the first series of abstracts of agricultural experiments with which I am acquainted, under the title "Adam out of Eden." The experiments recorded by the author, Ad. Speed, are of considerable interest; but I mention him for another reason. He appears to have made a living by propounding improvements of an imaginary character. He wrote tracts for noblemen and others, containing estimates of the profits to be gained by adopting new methods. Blith scathingly refers to him as "Mr. Speed that superlative Improver," and remarks that so long as his books were private "I could bear it, and suffer wiser than myself to bee fooled because I was not wise enough as to beware of him, but now that they come to be sold in the Stationers' Shops, and spread about the country, to deceive, and beguile the Nation, I cannot forbear." This was written in 1652; as my edition of "Adam out of Eden" is dated 1659, it is clear that the nation continued to be "beguiled" for a considerable period by this particular Adam, the forerunner of a numerous family. Whenever there is a revival of interest in agriculture he flourishes; the new manure, the ravaging insect, the blighting fungus, all serve to bring "Adam out of Eden," and so long as an interested and gullible public exists, "that superlative Improver Mr. Speed" will be found among us. The pamphlet and the stationers' shop have become antiquated; the Adam of to-day has other methods, which I will not venture to particularise. After all, it is a healthy sign. It is only when the public thirst is deep that Adam gets his chance, and, like Blith, we must resign ourselves now and again to "bee fooled," for is it not one of the methods by which the improver is improved?

Walter Blith's appeal for the assistance of the learned did not long remain unanswered. At the time his "English Improver Improved" was published a society of scientific men had already been formed in London, and ten years later this society first received the name Royal Society, at the suggestion of John Evelyn. On October 15, 1662, Evelyn's "Discourse on Forest Trees" was presented to the society. Five years later, when the "Sylva" was published, the author in the preface tells us that the Royal Society was then doing much for husbandry.

John Evelyn was one of the prominent members of the Royal Society, and he seems to have taken a leading part in defending it against the attacks to

which, in the first years of its existence, it was subjected. With much satisfaction he points out, in dedicating the second edition of the "Sylva" to King Charles II., that his essay and the work of the Royal Society have in the past eight years resulted in the planting of more than two million timber trees, and he adds that he has preserved the testimonials he has received with the more care "because they are Testimonials from so many honourable Persons, of the Benefit they have receiv'd from the Endeavours of the Royal Society, which now adayes passes through so many Censures."

With the exception of the "Societies of Learning and Gallantry" of the "Houses of Court and Universities" addressed by Blith, the Royal Society is the earliest to which any influence on agriculture may be traced, and it is certainly the first society which definitely included the improvement of agriculture as coming within its scope. It appears to have depended in no small degree for its early successes on the public interest aroused by the writings of Evelyn and Houghton, and there is evidence that the society gave much attention to agriculture during the second half of the seventeenth century, and that its patronage was much valued.

Evelyn's "Pomona," in which he discourses of fruit trees and cider, gives an interesting glimpse of some of the early activities of the Royal Society, for the work itself is based chiefly on contributions by members of the society to its "well furnish'd Registers, and Cimelia." Evelyn is careful to point out that these contributions were original papers, and that it was not the design of the society to "accumulate repetitions where they can be avoided." These new observations being in the society's esteem "and according to my Lord Bacon's" preferable even when "rude and imperfect draughts" than commonplaces "adorn'd with more pomp." Evelyn himself was not practically acquainted with cider-making, and his own interest in the subject, like that of the majority of his fellow-members, was Baconian—i.e. it consisted in a search for "grounded conclusions and profitable inventions and discoveries."

In other ways the members of the Royal Society encouraged one another in making improvements; thus when in 1666 Evelyn's "worthy friend" Mr. Hake went on a journey, he returned carrying with him—for eight hundred miles—some grafts for Evelyn, together with a "taste of the most superlative perry the world certainly produces." It was by means such as these, and by a policy which approved "plainness and usefulness" rather than "niceness and curiosity," that the newly-formed Royal Society commended itself to the country.

It is indeed probable that agricultural questions occupied much more of the attention of the Royal Society in the earlier years of its existence than the printed records suggest; we are told, for example, by the Scottish improver, "A Lover of his Country," that one of its most illustrious members, Sir Robert Boyle, was an enthusiastic agriculturist; he says: "I had the Honour to be known to that excellent Person and oft in his Company. He was the greatest Lover of Agriculture I ever knew, and I wonder he never wrote of it. I heard him say, it was a pity there was not Seminaries of that, the most useful, and except Pasturage, the most ancient of all Sciences."

Not only were agriculturists attracted by the practical investigations of the Royal Society, but impressed by the value of its methods and organisation, and Worlidge suggests that nothing would more conduce to improving agriculture than the constitution of subordinate provincial societies "whose

principal care and office might be to collect all such Observations, Experiments, and Improvements they find within their Province . . . which of necessity must abundantly improve Science and Art and advance Agriculture and the Manufactures."

The proposal made by Worlidge was unheeded at the time, for not until nearly a century after his suggestion was made did English agricultural societies begin to appear. A retrograde movement set in soon after the Restoration, and although the Government sought to foster improvements and passed several Acts with the object of stimulating farming, Harte tells us that a "total change of things, as well as the very cast and manner of thinking, joined with immoral dissipation, and a false aversion to what had been the object and care of mean despised persons, soon brought the culture of the earth into disrepute with the nobility and gentry."

An insight into the conditions of the last quarter of the seventeenth century and the first quarter of the eighteenth is given us by Lisle, who wrote the introduction to his "Observations on Husbandry" in 1713. He begins by remarking that it is one of the misfortunes of the age that it lacks honourable conceptions of a country life; he directs attention to the fact that in the decadent days of Rome luxury increased and husbandry was neglected. He calls on the landowner to look round him and see how many fine estates are daily mortgaged or sold, "and how many antient and noble families destroyed by the pernicious and almost epidemic turn to idleness and extravagance." He discusses at length the advantages of an agricultural career, and recommends it as a profession for the eldest sons of gentlemen, who might regard it as "a school of profit and education; whereas," he continues, "it is rather looked on as a purgatory for the disobedient, a scene of punishment, to which a son, who answers not his father's expectations, is to be abandoned; or a condition of life of which none would make choice, but such whom fortune has not in other respects favoured. If the country gentlemen therefore frequently consist of persons who are either rusticated by their parents in anger, or who, making a virtue of necessity, settle on their estates with aversion or indifference, it is no wonder the comedians exhibit them on our stage in so despicable and ridiculous a figure; but this is the fault of the persons and not of the art. Were they properly initiated in the study of Agriculture, and pursued it as they ought, it would be so far from excluding them from useful knowledge, and bringing them into contempt, that I may venture to assert they would find it the best school of education, and the fittest to prepare them for the service of their country in the two houses of parliament of Great Britain."

Such were the dispiriting social conditions with which the successors of Evelyn in the Royal Society had to contend. The agricultural experiments of the society therefore attracted but little attention outside the ranks of the curious. Houghton, a contemporary of Evelyn's, started a periodical publication, *Houghton's Letters*, but it soon ceased. A generation later, and about the period to which Lisle refers in the above quotation, a work on husbandry was written by a fellow, John Mortimer. It is dedicated to the society, "to whose encouragement, inquiries, and direction it owes its birth." Special thanks are given to another fellow, Dr. Sloane, who assisted the author, and "has greatly contributed to the advancement of useful knowledge."

Testimony to the activity of the Royal Society at this period is also to be found in a work on "Curiosities of Nature and Art in Agriculture and Gardening,"

a translation from the French of the Abbot de Vallemont by Bishop William Fleetwood, published anonymously in 1707; this work contains the passage: "The Royal Society of England who are so zealous for the Perfection of Agriculture and Gardening, have apply'd themselves with great Care to find out the true way to make Salt-petre, which they likewise allow to be the chief Promoter of the Vegetation of Plants."

About this time botanical questions of much interest to agriculturists were occupying the attention of the Royal Society. Robert Ball and Samuel Moreland were investigating reproduction in plants, and a few years later Richard Bradley, another fellow, professor of botany at Cambridge, but more of an agriculturist than a botanist, was explaining how, by cross-breeding, "such rare kinds of plants as have not yet been heard of" may be produced. He refers specifically to a cross between a carnation and a sweet-william, but by inference to Burgoyne's Fife and the other things "not yet heard of" that are associated with agriculture and botany in the Cambridge of to-day.

Various causes, among which the influence of fellows of the Royal Society must be given an important place, led the landowners and the educated classes of England again to turn their attention to agriculture about the beginning of George II.'s reign. The revival was associated with and followed, as it has in recent time, a development in gardening. William and Mary were patrons of horticulture, they greatly improved the Royal gardens, and the nobility, in imitation, laid out parks and *parterres*.

A writer on agriculture and gardening of this period, the Rev. John Laurence, of Bishop Weresmouth, Durham, attributes the revival, not merely to progress in the art of gardening, fostered by nobles and statesmen, but to the Royal Society—of which he says that its *Philosophical Transactions* "are standing Memoirs of the Zeal and Activity of many Persons of Quality and Learning;" whose "Discourses and Experiments" have "advanced much Light in the Art of Husbandry."

Although for seventy years after its formation, and throughout a period during which agriculture was neglected by the landed classes, the Royal Society did much to keep alive the spirit of the improver, the unfortunate apathy of the agriculturist prevented that progress which appeared to be imminent when John Evelyn wrote his "Pomona." It was not possible for a learned society in London to investigate agricultural questions in the absence of the scientific agriculturist himself; subjects of agricultural interest were therefore discussed chiefly from a theoretical point of view, and, neglecting the teachings of Bacon and the example of Evelyn, there arose that use of the deductive method which in the past two centuries has done so much to hinder the progress of agricultural science.

The first to show up the fallacy of the deductive method in studying this subject was Jethro Tull, who, though he himself fell into the errors which he condemned, was, in his understanding of the true relationships of science and practice, far ahead of any of his contemporaries. A lawyer by training, he probably took to agriculture because of his poor health. He worked at it for twenty years before he was induced to set out his views in writing, and it was years after he began farming before he read anything on the subject. Dissatisfied with the practice of his times, he set himself to reason out new methods and to make experiments. He got suggestions from foreign travel; he tells us, for example, that the first hint of the value of horse-hoeing husbandry was derived from the

ploughed vineyards of France; but he was careful to submit his ideas to the test of experiment before he adopted them in farm practice. His temper, which, if one may judge from his references to his labourers, was far from serene, was much tried by his controversies with *Equivocus*, and his criticisms of the writers and scientific men of the preceding half-century are severe. He remarks, for example, on the superficial knowledge of agriculture shown by "Mr. Laurence, a divine; Mr. Bradley, an academic; Dr. Woodward, a Physician; Mr. Houghton, an Apothecary; these for want of practice could not have the true theory; and the writers who are acquainted with the common practice, as Mr. Mortimer (whether for want of leisure, or not being qualified, I do not know) have said very little of any theory." He freely criticised the writings even of "Mr. Boyle" and of that "miracle of a man Sir Isaac Newton," and in a characteristic sentence he remarks: "From Sir Isaac's transmutation arguments we may learn that a man never ought to depend entirely upon his own for support of his own hypothesis." An admirable sentiment which I am afraid that Tull himself, and many another agriculturist since his time, failed to lay to heart.

Jethro Tull's great work was published two generations after Walter Blith first endeavoured to awaken the spirit of the improver in English farmers. Throughout this period not much progress had been made, but a change was at hand. When in 1730 Turnip Townshend left politics and went down to Norfolk to farm his estate, the tide had turned, and henceforward throughout the eighteenth century there was a rapid improvement in the practice of English agriculture. Of these developments no small share may be attributed to the influence exercised by the Royal Society during the first seventy years of its existence.

The agriculture of Scotland had not shared in the revival due to the work and writings of the English improvers, and was in a very backward state in the middle of the seventeenth century. Its condition is indicated by John Ray, who, in 1661, some months before the Royal Society received its charter, set out from Cambridge to spend the Long Vacation in a Scottish tour. He crossed the Tweed on August 16, and proceeded from Berwick, via Dunbar, to Edinburgh. His first day's journal gives us his impressions of what is now, and probably was then, one of the foremost agricultural districts in Scotland. "The ground in the valleys and plains bears good corn," he says, but "the people seem to be very lazy, at least the men." Scottish women, he writes, "are not very cleanly in their houses, and but sluttish in dressing their meat." "They have neither good bread, cheese, or drink. They cannot make them, nor will they learn. Their butter is indifferent, and one would wonder how they contrive to make it so bad."

After the Union Scotchmen in increasing numbers took the high road to London, and at first with much less profit to themselves than those acquainted with the Scot in modern times might suppose. As a result of social intercourse, the upper classes began to copy the manners and customs of their rich English neighbours, and prices and the cost of living rose rapidly. These economic changes, as in England a century before, turned the attention of landowners to the improvement of their estates; but as the Scottish laird of the beginning of the eighteenth century did not take readily to farming, a few of the more enlightened men among them saw that if improvements were to be made special measures were necessary. Impressed by the usefulness of the Royal Society, these reformers conceived the idea of establishing an Agricultural Society in Scotland. This society, which met

for the first time in Edinburgh on June 8, 1723, and adopted the name of "The Honourable the Society of Improvers in the Knowledge of Agriculture in Scotland," was the first association to be formed for the express purpose of promoting agriculture. Some account of its work is given in its Transactions, published twenty years later, but for a contemporary view of the problems which engaged the society's attention we must go to a book published in Edinburgh in 1729, under the title of "An Essay on Ways and Means for Inclosing, Fallowing, Planting, &c., Scotland, and that in Sixteen Years at farthest, by a Lover of his Country."

Of all old books on agriculture this is, to me, the most interesting. The anonymous writer is believed to have been Brigadier-General Mackintosh of Borlum, one of the rebel leaders of 1715, who fell into the hands of the English at Preston, was imprisoned in Newgate, and sentenced to death. But this Highlander was not to be held by English gaolers. With some of his comrades he overpowered the prison guard and made good his escape; recaptured in 1719, he spent the rest of his life in prison. The essay was written, its author informs us, in "my Hermitage"—a cell in Edinburgh Castle—and the writer remarks that he can give no better reason for his work "than other Enthusiasts do, the Spirit moves me."

The prisoner employed his enforced leisure to great advantage. He displays more familiarity with the classical authors than any of his predecessors, or for that matter than any of his successors, except Harte and Adam Dickson, and he had obviously studied all the more important works published in England in the previous century. He argues that since the Union, Scotland had not made progress, and that, while extravagance had spread and necessities greatly increased in cost, no attempt had been made to learn good rural economy from the English. He points out that until they improve their estates Scottish lairds cannot hope to emulate English landowners. He counsels fallowing and inclosing, and recommends that skilled English labourers should be brought to teach English methods. He indicates where the best workmen might be obtained. Men from Devonshire for denshiring (paring and burning); men from Cambridgeshire for draining; men from Hertfordshire for ploughing; from Hereford for fruit planting; and from Shropshire for hedging. He estimates that six hundred and forty men would be required for Scotland. A "regimental number," he facetiously remarks, but a welcome regiment, for they would be armed only with spade and shovel! He would apportion a group of these men to every county in Scotland and place them under the guidance of county supervisors. "And if I might have my wish," he says, "we should not go on by Halfs, and all Europe should be quickly disabused of the Reproach they load us with of *Idleness and Poverty*." In another passage he prophesies that "Scotland from one of the poorest, ugliest, and most barren Countries of Europe, is, in a very few Years, become one of the richest, most beautiful and fertile Nations of it," and who would now assert that the old rebel's prophecy has not been fulfilled?

As already mentioned, the Society of Improvers was constituted at a meeting held on June 8, 1723. A council of twenty-five members was elected, the council was divided up into subcommittees, each of which was charged with the care of a special branch of agriculture; the rules set out that the members of committees were to "chuse different subjects in Agriculture and mark down their thoughts thereon in writing." They were also to correspond with the most intelligent agriculturists all over the country and to endeavour to get small local societies formed. The

chief duty of each subcommittee was, however, to give advice on the means of carrying out improvements. Members were asked to send in an exact statement of their difficulties, and answers were forwarded by the society. If the suggestions proved useful, the recipient of advice was expected to report the result for the benefit of his fellow-members.

The volume of "Select Transactions," published in 1743, contains a number of specimens of the questions sent in and the answers supplied. Such subjects as the draining of boggy land, the use of marl and lime, the effects of seaweed as manure, the cultivation of potatoes, hops, sainfoin, and flax; the feeding of cattle and the employment of steepes for corn were dealt with. Most of the correspondence is with Scotchmen, but occasionally letters from others occur, including an interesting communication from Jethro Tull in which he says that "twenty years ago there was much the same way of tillage in England as is now in Scotland, but it has since been exploded by experience, and the farmers have enriched both the land and themselves by plowing it more than they were wont." Directions for lime-burning are contributed by Mr. Lummis, "who came from England and made the Rotheran Plough." The Transactions have an advertisement of this plough, from which it appears that the Earl of Stair had sent one of his men to be taught by "the best Plough and Wheel-Carriage wrights in England," and that Rotheran ploughs of very superior workmanship were being made at Newliston, West Lothian. The Earl of Stair further laid agriculturists under obligation by introducing turnips, cabbages, and carrots as field crops, and he bred very good Galloway cattle. Another notable man among these early improvers was the Earl of Islay, who gave special attention to the cultivation of peaty soils and succeeded in producing good corn and grass on land previously thought to be of little value. He also planted extensively, and, according to Maxwell, introduced the larch, among other trees, to Scottish foresters.

The society did not confine its attention exclusively to agriculture. It noted a natural connection between the agricultural and fishing industries, and did much to promote the latter, thus establishing an early precedent for the association of agriculture with fisheries for administrative purposes. Manufacturers, too, were encouraged, and in this connection there stands out the name of the Duke of Hamilton, who moved the following "Overture": "That all of you and all under your Influence, should, for Examples to others, buy no foreign Linen for Shirting, Bed-linen, or any other Household-furniture; and that you should propagate to the utmost of your power the wearing of home-made stamped Linen." The consequence, we are informed, was that "even at Publick Assemblies of Persons of the greatest Distinction, the whole Company appeared dressed in Linen of our own Manufacture." The Duke's success with linen led him next to propose a resolution against the drinking of foreign spirits, so that the great sum annually sent to France for brandy might be kept at home! The consequences were not so immediately noticeable as in the case of linen, for the local records of the east of Scotland show that the smuggling of French brandy was a very profitable trade throughout the eighteenth century. It is, however, the case that at a later date the Duke's advice was followed, for not only linen but liquor of native manufacture came to be appreciated, "even at Publick Assemblies of persons of the greatest Distinction"; at assemblies, moreover, on both sides of the Tweed!

During the twenty-two years of its existence the Honourable Society of Improvers became a powerful and important body. Its influence, it should be noted,

was obtained by educational methods, for its funds were small, it had no State subsidy, as had the Irish Society, it offered no premiums, but it drew together in the cause of agricultural improvement many of the most prominent Scotchmen of the period, and it undoubtedly laid the foundations of that successful agriculture for which Scotland has ever since been noted. In 1743 the society had 299 members, and an examination of the list reveals many well-known names representing all sections of the educated classes of Scotland, with the notable exception of the clergy.

Of all the members, those who best deserve our notice are Thomas Hope of Rankeilor, president, and Robert Maxwell of Arkland, editor of the Transactions. Mackintosh refers to Hope as a man who had taught improved agriculture to hundreds of his fellow-countrymen. He studied the subject, not only in England, but in France, Flanders, Holland, and other Continental countries, and Maxwell says of him "that it has been much owing to Mr. Hope of Rankeilor your Preses, that this Society was entered into and that the Spirit of it rose so high," and adds that he "has been instructing others in the Knowledge of it and been preaching up the publick and private Advantages arising from it for a continued Tract of more than Twenty Years' Time." Of the spirit which animated Robert Maxwell himself we have ample evidence in the dedication of the "Select Transactions." Reviewing what has been done by the society and considering that which might still be done, Maxwell writes, "since the Case stands thus, how much doth it concern the Publick and every Individual that Agriculture be encouraged and that the *Knowledge* of it, the efficient Cause of all those inestimable Benefits, should be taught to all who are willing to learn the Principles of this the most useful of all Sciences; to all who desire to know the secret Causes why some plants enrich, and others impoverish the Ground in which they grow; why different Methods of Husbandry produce different Effects; and in general to all who incline to study the Reasons for and against, the different Methods practised? They that do not study Agriculture as a Science do right only by chance, and that rarely happens. Why then should Reason be so little exercised, as generally it is, in this Matter of the greatest Importance?" He then refers to the opinions of Virgil, and to the views expressed by Columella on the subject of teaching agriculture, and he urges the society to take steps to found a professorship.

Maxwell proposed that the society should address a memorial to the King on the subject of a professorship. "You are," he wrote, "a great Body of loyal Subjects and generally of great Distinction, and I humbly think upon a proper Application to his Majesty, you could not fail to have sufficient Influence to get such a Professor or Inspector named or both."

But, alas! neither professor nor inspector did Maxwell see, for within two years Prince Charles Edward had landed in Scotland, the Marquis of Tullibardine was rallying the Highlanders to the Stuart flag, and the loyalty of the Honourable Society was subjected to a strain which it could not withstand. Most of the members took the advice of Duncan Forbes and held out for the King, but others, like the Duke of Perth and Lords Cromatie, Balmerino, and Lovat, followed Prince Charlie. When peace was restored, the Honourable Society, and not a few of its members, had ceased to exist; but the purpose for which it was founded had been achieved, and the spirit of the improver lived on.

One of the objects of the Honourable Society of Improvers was to develop local societies. Two of these may be traced in Scotland before 1745, one in

Buchan, the other in East Lothian. The former appears to have been started about 1730 by James Ferguson of Pitfour among his Buchan tenantry. Ferguson was a friend of Thomas Hope's and believed in his methods of "preaching improvements." He supplied the members of the Buchan Society with books, and he himself attended their meetings. In 1735 this society published a small volume which had been drawn up by the members at their meetings, entitled "A True Method of Treating Light Hazely Ground; or, an Exact Relation of the Practice of Farmers in Buchan containing Rules for Infields, Outfields, Haughs, and Laighs." In many respects this is a remarkable little work. It relates exclusively to local farming, and while the inspiration may have come from Edinburgh, the book itself bears no evidence of outside influence. Their independence is indeed a noteworthy characteristic of the members of this Buchan Society. From certain references which appear in their Proceedings it may be surmised that they were well acquainted with agricultural writers. But instead of recounting the opinions of others, and speculating as to their value for Buchan, this society of tenant-farmers adopted the true scientific method, they described their practices in detail, discussed them fully, and, being satisfied that they were applicable to local conditions, they reduced their methods to rules. In matters too deep for them, their philosophy rested on a firm basis. Here, for example, is an explanation of the early fruiting of wild oats. This pestilent weed they urge all farmers to destroy by "cropping the wild oats how soon they come out of the hose, who appear always about eight days before the tame. Thus is Providence so kind as to tack that to their nature which is the means of their own destruction."

The second of the local Scottish societies, existing before 1745, was that established by an enlightened landowner, John Cockburn of Ormiston, in East Lothian. Robertson, in his "Rural Recollections," gives July 18, 1736, as the date of its formation. With Cockburn were associated Sir John Dalrymple and other country gentlemen. From a reference made to their meetings by Henry Home, it would appear that in this society we have the origin of the "farmers' dinner." Home counsels landlords to "convene" tenants once a year to a "hearty meal," at which they were to be instructed in new methods of husbandry. "It was by such means," he adds, "that the late John Cockburn of Ormiston promoted emulation and industry among his people." But Cockburn did not confine himself to an annual dinner. Monthly meetings were held for the discussion of agricultural improvements, and these were much appreciated not only by Cockburn's tenants, but by neighbouring landowners like the Earl of Stair and the Duke of Perth, who attended regularly. Even the '45 did not suppress these monthly meetings, and after Preston Pans the Duke of Perth was mindful enough of Ormiston to send troops to protect the members, so that they might quietly continue their criticisms of Tull and their appreciations of turnips.

Maxwell tells us that the Dublin Society (established 1731) was formed in imitation of the Society of Improvers. It is clear when Arthur Young wrote that to the Dublin Society "belongs the undisputed merit of being the father of all similar societies now existing in Europe" he meant that it was the oldest of existing agricultural societies, and not the first society of its kind. The Dublin Society soon after its formation received a Government grant and could therefore spend much more on its work than its Scottish prototype. Time will not permit of a reference to the work of this society, but mention may be made of the experimental farm established by the unfortunate John

Wynn Baker, under its auspices. The farm was started in 1764 and continued until about 1770. Schemes were drawn up by Baker in consultation with the society, and an annual grant of 200*l.* was made in support of the experiments; two volumes giving the results were issued.

In 1754 the Royal Society of Arts was established, and almost immediately afterwards it began to give attention to agriculture. A record of its valuable work written by Sir Henry Truman Wood has recently been published in the society's Journal.

The same year that saw the formation of the Royal Society of Arts brought together in Edinburgh a small group of distinguished men who formed themselves into the Select Society. The purposes were the discussion of philosophical questions and practice in public speaking. The idea came from Allan Ramsay, an artist and son of the poet. Alexander Wedderburn was elected chairman (as Lord Loughborough, the first Scottish Lord Chancellor of England, he affixed the seal that gave Sir John Sinclair his Board of Agriculture), and among the members were Adam Smith, David Hume, Henry Home (later Lord Kames), and William Robertson (afterwards Principal of Edinburgh University). This society soon attracted all Edinburgh residents who were in any way distinguished. But in one respect it was a failure; certain members, we are informed, always talked, and the wisdom of others was in danger of being suppressed and unavailing. It is said, for example, that Adam Smith and David Hume never opened their lips! It appears, therefore, to have been decided that the society's genius should be turned to practical objects, and within the Select Society a new organisation, the Edinburgh Society, was formed in 1755, "for the encouragement of Arts, Sciences, Manufactures and Agriculture"—*i.e.* for the same purposes as the Society of Arts had been established in London a few months earlier.

An account of the Edinburgh Society is given by Ramsay in his "History of the Highland and Agricultural Society of Scotland," from which it appears that the methods of this society—the offering of premiums for live-stock and implements—were those which have since been everywhere adopted. In 1759, for example, we read that at the show of horses nine stallions were exhibited, "all very good." But the goodness of the stallions and of the objects did not bring prosperity to the Edinburgh Society; talent was more abundant than money in Edinburgh in the middle of the eighteenth century, subscriptions remained unpaid, the premium list had to be reduced, and finally the Select and the Edinburgh Societies disappeared together in 1765.

Before concluding these notes on early associations let me ask your attention very briefly to some of the evidences of their influence on the agriculture of a later period.

The chief aims of the early societies were to impress upon landowners in the first place the interest afforded by the study of agriculture and in the second the duty of providing an increased supply of food for the nation. Nothing is more marked in the writings of such improvers as Blith, Worlidge, Lisle, Laurence, and Mackintosh than their insistence on the importance of agriculture as a subject of study. Until the educated among their fellow-countrymen could be interested in the principles of agriculture, it was clear to these far-seeing men that progress could not be made.

The change in the attitude of the educated classes to agriculture that took place within a century of the formation of the Royal Society is indicated in all the works published after 1750. Hirtzel, of Berne, *e.g.* in

"The Rural Socrates" (second edition, 1764) remarks: "It is no longer a controvertible point whether the science of Agriculture merits the distinguished attention of philosophical minds, and is the proper study of the most enlightened understanding; since the proof is beyond contradiction, that a judicious rural economy is one of the chief supports of the prosperity of a State." In Henry Home's dedication of "The Gentleman Farmer" to the president of the Royal Society (1776), we find this passage: "Agriculture justly claims to be the chief of arts, it enjoys beside the signal pre-eminence of combining deep philosophy with useful practice"; and in the preface to the same work he says: "Our gentlemen who live in the country have become active and industrious. They embellish their fields, improve their lands, and give bread to thousands." He contrasts these pursuits with those which formerly occupied the country gentleman: "His train of ideas was confined to dogs, horses, hares, foxes; not a rational idea entered the train, not a spark of patriotism, nothing done for the public."

How unlike the state of affairs described by Home were the conditions in a country resembling Britain, but in which the spirit of the improver had not been awakened, may be indicated by a quotation from a report on the farming of Holstein and Mecklenburg sent to Sir John Sinclair in 1794. The writer, M. Voght, states that the agriculture of North Germany was fifty years behind that of England, and explains its depressed state by saying: "Our noblemen are no farmers, and our farmers no gentlemen; our authors on agriculture possess no cultivated land, and those few who could give to the public the precious results of long experience and labour would starve their printer for want of readers."

The landowner of North Germany, towards the end of the eighteenth century, was, indeed, in very much the same state as the landowner of Britain in the first quarter; and it is when we compare the conditions described by Lisle, Mackintosh, Home, and Voght that we begin to appreciate how much British farming owes to such associations as the Royal Society of England and the Honourable Society of Improvers of Scotland. Had not the interest of landowners, and of the educated classes generally, been secured, there is no reason to suppose that the agriculture of Britain in 1794 would have been markedly in advance of that of Germany.

Both in England and Scotland the first impetus towards progress was economic in its character, and throughout the seventeenth and eighteenth centuries economic causes were constantly accelerating the improvement of agriculture; but we must not make the mistake of supposing that a rise in prices necessarily brings about improvements in husbandry. A motive for improvement is provided and more labour may be drawn to agriculture, but it does not follow that there will be a real advance, and that there will be more food produced for the use of workers in other industries. Without changes of system, *i.e.* without improvements based on new discoveries, the effect of a rise of prices in a self-supporting country would merely be to alter the proportion of the population engaged in agriculture, and to form congested districts. This was the danger that threatened England early in the seventeenth and Scotland early in the eighteenth centuries; but fortunately for each country an intellectual revival followed close on the rise in prices, and attention was directed not only to the necessity for more food, but to the need for improvements which would afford a surplus for the support of the industrial classes.

Within recent years the improvers of the eighteenth and early nineteenth centuries have been much criti-

cised for their land policy, their enclosures, and their treatment of labourers; but one thing at least the agriculturists of 1760-1815 saw more clearly than their modern critics—they recognised that if their country was to become a great manufacturing nation, more food must be grown; and to this task they applied themselves so successfully that, as Porter points out the land of Great Britain, which in 1760 supported about eight million inhabitants, in 1831 supported sixteen millions. When we reflect that the implements of husbandry were rude, that thorough drainage had not been introduced, that artificial manures (except crushed bones) were scarcely known, that oilcake were scarce, that grain was too valuable to be given freely to cattle, that in bad seasons live-stock had to be starved so that men might be fed, that in good seasons prices fell rapidly, and with them farmers' profits, and that credit was difficult to obtain at an interest high, those of us who know something about the ordinary work of the farmer can realise the strenuous efforts that must have been necessary to wring from land a sufficiency to feed this rapidly growing nation and to maintain it in health and comparative comfort. Even as late as 1836 Porter shows that it would have been impossible to feed a considerable part of the people on imported food. "To supply the United Kingdom with the single article of wheat," he says, "would call for the employment of more than twice the amount of shipping which now annually enters our ports."

Part of the additional food-supply was obtained by enclosing about seven million acres of land between 1760 and 1814; but as more than three times the area must already have been enclosed, as much of the land enclosed after 1760 was of poor quality, and all of it had formerly contributed in some degree to the food-supply of the country, it is obvious that between 1760 and 1834 the rate of production per acre must have been largely increased.

Improvements in the art of agriculture cannot be rapidly introduced; there is first of all an experimental stage, and when improved methods have been learned they pass but slowly from district to district. Before any marked advance in the art can take place, there must therefore occur a period during which a foundation is being laid. It was about 1760 that our population began to increase rapidly, and it was then that agriculturists were called upon to produce more food. As we have seen, they were able to double the food-supply in seventy years. It cannot be doubted that this marvellous feat was rendered possible by the pioneer societies of the preceding century, or that it was the spirit of the improver, which the early associations had fostered, that animated the men from whom Arthur Young and Sir John Sinclair learned. If, in place of those enterprising agriculturists whose improvements are described in the reports of the first Board of Agriculture, our shires had been occupied by the dull-witted country gentlemen referred to by Lisle, or the "upstart sparks" condemned by Mackintosh, the history of this country must have been very different. Behind the military and naval victories which made Britain a great Power, was a commissariat supported by the agricultural classes. For the great industrial army which the genius of Arkwright, Watt, and other inventors provided with employment there was raised an ever-increasing food-supply. Political and industrial development alike depended on the rate of increase of the population, and this again on the rate at which the means of subsistence could be raised from British soil.

Although the economic position has undergone a revolution there is still work for the improver; no longer indeed do our industrial classes depend for sub-

sistence on the surplus products of the British farmer, but after a long period of forgetfulness, once again it has been recognised that a progressive agriculture is essential to the well-being of the nation. This is not the time to discuss the nature of the questions which press upon us to-day; but let us not forget that they are our questions. To this newly-formed section of the British Association has descended the task of the early associations; it is the privilege of its members to preserve, and to hand down to their successors, that spirit of the improver which animated alike the ancient writers of Greece and Rome and the British societies of the seventeenth and eighteenth centuries; and to-day we may take to ourselves the exhortation of Walter Blith, for his words apply to Section M as they did to its predecessors, "from you, too, I expect and wait for more discoveries of some thing, I scarce know what to name it, which lies yet in obscurity, but I will call it the Improvement of the Improver."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The electors to the Isaac Newton studentships give notice that in accordance with the regulations an election to a studentship will be held in the Lent term, 1913. These studentships are for the encouragement of study and research in astronomy (especially gravitational astronomy, but including other branches of astronomy and astronomical physics) and physical optics. The persons eligible are members of the University who have been admitted to the degree of Bachelor of Arts and are under the age of twenty-five years on the first day of January, 1913. The studentship will be tenable for the term of three years from April 15, 1913. The emolument of the student will be 200*l.* per annum. Candidates for the studentship are invited to send in their applications to the Vice-Chancellor between January 16 and 26, 1913, together with testimonials and such other evidence as to their qualifications and their proposed course of study or research as they may think fit.

The Arnold Gerstenberg studentship has been awarded to A. E. Heath, of Trinity College. The Gedge prize has been awarded to A. V. Hill, of Trinity College, for his essay entitled "The heat production of amphibian muscle and of cold-blooded animals."

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, August 23.—F. W. Aston: The influence of the nature of the kathode on the length of the Crookes dark space. (1) The relations between the values of pressure, voltage, current, and the length of the dark space are determined for plane kathodes of many different materials, and found to satisfy the same form of equations as those previously given for aluminium, the constants varying considerably. (2) Roughness of the kathode surface does not appear to affect the discharge, if the dimensions of the irregularities are small compared with the length of the dark space. (3) The length of the dark space is shown, in the cases examined, to be greatest for silver and least for magnesium, the metals following the same order as in the case of the kathode fall. (4) The rate of change of length of the dark space with change of current density at the surface of the kathode seems much the same for all kathodes. (5) Difficulties in the way of arriving at a satisfactory explanation of these and other data connected with the dark space are indicated and shortly dis-

cussed.—F. W. Aston: The discharge between concentric cylinders in gases at low pressures. (1) The relations between pressure, voltage, and the length of the Crookes dark space in the discharge between concentric cylinders take much the same form as those in the discharge between parallel planes. (2) Curvature of the surface of the kathode appears to have no influence upon the rate of alteration of the length of the dark space with change of current density, *so long as the latter is measured at the surface of the kathode.* (3) *Ceteris paribus*, the length of the dark space is greater for a convex cylindrical surface than a plane, and for a plane than a concave one.

MANCHESTER.

Literary and Philosophical Society, October 1.—Prof. F. E. Weiss, president, in the chair.—Prof. G. Elliot Smith, F.R.S.: Ancient stone monuments. There is, stated the author, no longer any room for doubt that the monuments known as "megalithic," which are to be found along the coast-lines of Europe, North Africa, and Asia, ranging from the Atlantic to the Pacific, embody the same general idea which has been elaborated in various ways amongst the different peoples. The repetition of apparently insignificant details in these monuments in countries as far apart as France and India, and Ireland and Japan, makes it quite certain that no theory of independent evolution of the idea of erecting these curious monuments can be entertained. All the evidence we possess tends to prove quite definitely and conclusively that the farther away from the eastern Mediterranean, whether east or west, north or south, the more recent the date of their construction. Thus, there can be no doubt that the idea of erecting such monuments originated somewhere in the region of the eastern Mediterranean. Now, so far as we know, the art of building in stone was cultivated in Lower Egypt at an earlier period than elsewhere. It is also known that every stage in the evolution of the burial customs associated with stone mausolea and every phase of the gradual development of the craft of stone-working have been preserved in Egypt. Further, in Egypt, the people were making a variety of stone tombs and mortuary chapels, which are obviously the prototypes of every kind of megalithic monument, long before any such monument is known to have been erected elsewhere. The conclusion is that the idea of building such monuments originated in Egypt.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), parts 5 and 6 for 1912, contain the following memoirs communicated to the society:—

May 18.—P. Hertz: A proof by Boltzmann of the second law of thermodynamics.—W. Voigt: Electric and magnetic double-refraction (i.), with an appendix by P. Langevin. Th. Brandes: Plesiosaurus (*Thaumatosaurus*) aff. *megeocephalo* Stutchbury from the lower Lias of Halberstadt.—W. Blaschke: Proof of the undeformability of closed convex inextensible surfaces.—K. Försterling: The theory of the Zeemann effect in any direction.—E. Landau: The number of integer-points in certain regions (i.e. the number of points with integral coordinates included within given regions of any number of dimensions).

July 20, 1912.—P. von Liebermann and G. Révész: Binaural combination of tones.—J. Thomae: The convergence of a Fourier's series.

The business communications (part 1 for 1912) contain the prize-subjects proposed by the society, the eleventh report of the Samoa Observatory for 1911-12, and a memoir of Sir Joseph Dalton Hooker by A. Peter.