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THE
BOTANICAL SOCIETY
OF EDINBURGH

1836—1936



EDINBURGH, 1936

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The Botanical Societ
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ADDRESS DELIVERED AT THE CENTENARY
MEETING, JULY 1, 1936,

By Professor F. O. BOWER, Sc.D., LL.D., F.R.S.

WE meet to-day to celebrate the Centenary of the Botanical Society of Edinburgh. The period when it was founded was one of reconstruction and varied initiative. The year 1836, like our own day a century later, fell in a time of recovery after a great international upheaval. War had devastated countries, and depleted exchequers. It had given peoples and individuals alike seriously to think. Not only reviving industries but also quickened mentality then showed nascent qualities, like chilled and super-saturated solutions roughly shaken. But often the reaction, whether in industry or in the arts and sciences, is not sudden like the formation of crystals from an overcharged solvent. Post-war developments are apt to take time in their maturing; the time-lag may even extend to decades before the reaction becomes apparent by results, whether material or mental. But the initiative may have been none the less due to the prior shock.

History yields many instances of new initiative following on the impact of war, and with varying lag of time. The fall of Constantinople in 1453 is reputed to have started the trek of learning from the East through Europe. The Renaissance, reaching the westward seaboard, flowered fully in the glories of Elizabethan literature. In Science it took the form in Britain of Bacon's "Novum Organum" (1620). Later a fresh local stimulus was provided by the disturbances of the Cromwellian period. These were closed by the Restoration and Monk's entry into London in 1660. In 1662 the Royal Society was founded by Charter, realising in some degree Bacon's ideal revealed in the "New Atlantis." Here the time-lag was uncommonly short. In 1681 the Edinburgh College of Physicians came into existence. Passing to the eighteenth century, Quebec fell in 1759, and the Treaty of Paris was signed in 1763, while the surrender of Cornwallis in 1781 closed the American War of Independence. These events were followed by the foundation of the Manchester

Philosophical Society in 1781, of the Royal Society of Edinburgh in 1783, and of the Royal Irish Academy in 1786. A crop of olive branches thus followed close on peace. Soon, however, the French Revolution broke out, with its trail of war culminating at Waterloo in 1815. The more settled times that followed were marked by further scientific developments in northern Britain. Four new Regius Chairs were instituted in Glasgow in 1816, of which that in Botany was one. The Yorkshire Philosophical Society came into existence in 1822; the British Association in 1831, and the Botanical Society of Edinburgh in 1836. Lastly, a similar Society was founded in Glasgow in 1842, though apparently it soon faded out. Such sequences of events can hardly have arisen from mere coincidence. I think we may reasonably believe that a causal relation existed between public disturbances and new beginnings of various orders.

Be this as it may, Sachs opens the fifth chapter of his "History of Botany" with the remark that: "In the years immediately before and after 1840 a new life began to stir in all parts of botanical research: in anatomy, physiology, and morphology." He might well have added inquiry into the nature and classification of species also. The Centenary which we now celebrate recalls that period of change, and the foundation of this Society may be held as a local instance of the nascent state of the Science. In earlier centuries the several branches of Botany were not clearly segregated as separate fields of observation or experiment. The Science was at first generally descriptive, with a view to the identification of food-stuffs, drugs and dyes, timbers and textiles. This was all summed up in the early Herbals, with gradually increasing precision in the grouping. The period culminated in the seventeenth century in such works as those of Bauhin and Gerard. The advance of the Science from a descriptive to a systematic treatment is traced by Sachs to the influence of Cæsalpino early in the seventeenth century; and it was developed later by Morison, Ray, and Tournifort, till Linnæus, in the eighteenth century, gathered up all that had been done before him and, with the aid of his binomial nomenclature, laid out in strict terms the artificial system that goes by his name.

However great the vogue and usefulness of that system proved at the time, Linnæus himself was not satisfied with

it. He constructed a fragment of a natural system based on a wider range of characters; and he declared that the chief task of botanists should be to follow on such lines. The names of De Jussieu and De Candolle are intimately related to its further development. A powerful stimulus was imparted by that golden age of foreign travel which followed in the early decades of the nineteenth century. Robert Brown collected plants with the Flinders expedition (1801-5); Darwin with the *Beagle* (1831-6); Hooker sailed with Ross to the Antarctic (1839-43); these exploits, together with Hooker's later Indian journeys, and Wallace's visits to the Amazon valley and to the Malayan Region, resulted in enormous accessions of fact upon which systematic method worked and developed. The Natural System was by this time fully established, but without any coherent theory of descent to co-ordinate the results. The period when this Society was founded was still pre-evolutionary.

But the year 1836 was also pre-protoplasmic. Though plant-anatomy was already well advanced, with its foundations laid by Hooke and Grew in the seventeenth century, and though their observations had been extended in the eighteenth by the phytotomists of the Continent, it was only the scaffold of cell-walls that they knew: the vital body which those walls enclosed was almost wholly missed. The functional protagonist, the protoplasm itself, was absent. Before 1836 sporadic allusions had already been made to the transparent slimy substance contained within the cell-walls. Interest had been taken in its granules, and suggestions made of vital motion. It was only in 1831 that the nucleus had first been recognised, by Robert Brown, as a body of general occurrence in the cells of plants; while the structural correspondence of the cell-contents with the sarcode of animals was first published by Schwann in 1839. Finally, it was not till 1846 that the word "protoplasm" was introduced by Von Mohl to connote "that viscid fluid of white colour . . . which occupies the cell-cavity." Von Mohl was indeed the founder of the cell-theory for plants; for he was the first who took up the all-important position that fibrous elements and vessels of the wood are formed from cells (1831). Thus the year 1836 fell within that brief nascent period when the cell-unit and the protoplast were emerging from obscurity

towards definite visualisation, making modern physiology for the first time possible.

The branch of plant-physiology had already made advances from the seventeenth century onwards; but at first these were of a macroscopic nature, as seen in the "Static Essays" of Hales, and in the studies of movement by Knight, Von Mohl, and others. Naturally the question of sex was raised early, though it could not be fully resolved till improved microscopic technique led to more exact observation; nevertheless the zoospores and sperms of many Cryptogams had been seen before our Society was founded. In flowering plants, Sprengel's "Entdeckte Geheimniss" of 1793, had established the grosser facts of intercrossing through the agency of insects, though it remained for Darwin and Müller to breathe new life into his data and ideas. Moreover it required Robert Brown's discovery of the pollen tubes in 1831, and the detailed observation of the contents of the embryo-sac from Schleiden to Strasburger, to bring those grosser facts into their true relation to syngamy. The year 1836 fell between the era of surmise and that of demonstration of the actual facts of sex.

On the other hand Nutrition had long before aroused the curiosity of Cæsalpino (1583) and other early botanists; but it offered more exact problems after the discovery of oxygen and carbon-dioxide. This led at the end of the eighteenth century to the recognition by De Saussure of photosynthesis and respiration. The opening of the nineteenth century also saw the study of endosmosis founded by Dutrochet. These and other advances were summed up in the "Physiologie Végétale" of De Candolle in 1832. Real progress, however, in physiology required greater precision of microscopical technique than these writers could command. The defect was remedied by Von Mohl in the earlier decades of the nineteenth century. The book before all others that marked the path of improving technique was his treatise "Die Vegetabilische Zelle" (1851), in which he summed up as a continuous whole the gist of his scattered memoirs of the previous twenty years. From it we learn how fruitful was the period at which this Society was founded in that knowledge which underlies the later advances in Plant-Physiology.

Lastly we come to Morphology, the study of form which, though not always recognised as such, really comprises the

result of all the other branches of botanical inquiry. In the eighteenth century much descriptive detail had become available from earlier writings; but the first general conception of plant-form appeared in the "*Theoria Vegetationis*" of C. F. Wolff (1759), which was naturally at that period based upon comparison of the flowering plants. In restating his phytonic theory in 1766 he said that "he saw nothing ultimately in the plant but leaves and stem, including the root in the stem." After nearly two hundred years we find this statement to accord substantially with the recent Telome Theory of Zimmermann (1930). Then followed the Theory of Metamorphosis of Goethe (1790), and the Spiral Theory of Schimper (1830), restated later by Braun (1835). All of these writers were steeped in the Nature Philosophy of the period. But an antidote to its preconceptions was soon found in the comprehensive textbook of Schleiden ("*Die Botanik als induktive Wissenschaft*," 1842). His primary object was to substitute a spirit of genuine inductive inquiry in place of the preconceptions from which those writers started. In particular, Schleiden gave special prominence to embryology, and insisted upon the history of development as the foundation of all insight into morphology. In this he was followed by Naegeli, who went straight to the application of the laws of induction, maintaining that it is only in this way that facts and observations have any scientific value. Thus two centuries after the publication of the "*Novum Organum*" the principles laid down by Bacon at last found their full application in Botany. Plant Morphology then took its place as a branch of Natural Science on the same footing as Physics and Chemistry (Sachs). This result coincided very nearly with the foundation of the Botanical Society of Edinburgh. Once more we realise the insight of Sachs, when he noted how the years immediately before and after 1840 marked a period of reincarnation of Botanical Science.

Drawing these various aspects of the Science together we can reconstruct in some measure the arena of 1836. Purely descriptive Botany, enriched by the large collections of the golden age of travel, was passing from artificial methods of classification into a gradually moulded Natural System. Even Ecology, though not then known by that name, was being practised in a rudimentary form but on a grand scale by

Darwin and Hooker. Their prescience, combined later with the evolutionary vision shared by Wallace, was opening the question of mutability of species as against their fixed origin by special creation. This had already been glimpsed by Elias Fries in his "*Corpus Florarum*" of 1835, when he found "*quoddam supernaturale*" in the Natural System. So long as the constancy of species was still maintained Systematic Botany would fail to render a scientific account of Nature. But the new wine had already raised a dangerous pressure in the old systematic bottles at the time when this Society was founded. On the other hand, knowledge of Anatomy was deficient in the most essential facts. The protoplast with its nucleus had not been recognised as the physical basis of life and of heredity. Thus far Hamlet had been missing from the stage; but now he was seen just entering through the wings, and the drama of physiology was beginning to unfold upon a new footing of vitality. In Morphology the age of pre-conceptions was drawing to a close, and the inductive method was about to take their place under the influence of Schleiden. His insistence on embryology and development paved the way for the search into life-histories, which marked the next stage of the story. But this could not receive its true comparative meaning under a belief in special creation. The facts remained sterile till the magic touch of evolutionary theory awoke them into life. There was then an atmosphere of expectancy abroad in the leading branches of the Science in 1836, when the Botanical Society of Edinburgh was founded.

However impressive these early advances in botanical thought and achievement may have appeared to the original members of the Society in 1836, their effect was to open the way for still greater results during the period that followed. We may try to restore the picture of further development as it presented itself during the first half century after the incorporation. The greatest event of all was the coming of Evolution, heralded by the famous letter of Darwin to Hooker, in January 1844; within a decade of our foundation. "At last gleams of light have come," he said, "I am almost convinced that species are not immutable." This was probably the first communication by Darwin of his species-theory to any scientific colleague. What followed we all know. As a shaken kaleidoscope makes a new pattern from its fragments

of coloured glass, so the facts derived from living things, hitherto accumulated rather than methodised, found new relations of intelligible beauty. Anatomy, Physiology, and Classification all gained new aspects under the theory of Evolution. But of all the branches of Biology it was Morphology that became the most arresting topic; as Darwin himself said: "It is one of the most interesting departments of Natural History, and may almost be said to be its very soul." As the century progressed the scope of Morphology widened from a mere study of external form and constitution of the adult shoot in the higher plants, and of the construction of the mature flower. Under the influence of Schleiden the *voir venir* became essential in each problem of form. In practice an overruling preference for the earlier stages even led sometimes to a neglect of the adult state. A right balance, however, brought an added knowledge of the whole cycle of development; and this was so not only for the higher vegetation but also in the Archegoniataë and the Thallophytes. The middle of the nineteenth century thus became a period of tracing of "life-histories," and its greatest exponent was Hofmeister himself. It was his masterly synthesis of the facts of the whole life-cycle in Archegoniate plants that gave those facts their real significance; with the result that an underlying scheme was detected for them all, with alternating sexual and neutral phases. While we point to this as a crowning achievement which laid the foundation for Morphology in a new and extended sense, we should not forget that many other workers were taking their part in the completion of life-histories; among Liverworts and Mosses, in various Algæ both marine and of fresh water, and even in Fungi. After a century of such work we now have before us all the essentials of the life-cycle in Thallophytes, Archegoniates, and Seed-Plants; though these still provide material for discussion as to their origin, stability, and significance. Our earliest members will have witnessed the first of these discoveries, and we ourselves have seen the scheme of phases gradually assuming a general application as the phenomenon of "Alternation of Generations."

Meanwhile intensive study of the nucleus and its behaviour during division was following close upon the improvement of lenses, and of microscopic technique. The foundations of

cytology were being laid, and nowhere with such precision as in Bonn, where Strasburger observed and taught. What could be more natural than that the differences of haploid and diploid chromosome-number should be correlated with syngamy and reduction, and a cytological distinction recognised between the normal alternation of gametophyte and sporophyte? The famous statement on Periodic Reduction was made by Strasburger at the meeting of the British Association at Oxford, in 1894. Within three months of its delivery I had the honour of discussing it before this Society in my presidential address of that year. The cytological facts thus threw a new light on the Hofmeisterian cycle; though forty years later, their interpretation remains still open for discussion.

The second half of the century in the history of our Society has witnessed the development of Botany along many divergent branches of specialisation, which, though cognate, are often pursued with a dangerous exclusiveness. Specialist's myopia is a disease that may threaten the scientific balance of any enthusiastic inquirer. The wider the spread of the science in its relation to cognate sciences the greater the danger becomes of pursuing a restricted or an extreme marginal cult, as it were between blinkers. The blinkered horse keeping the straight road does not visualise the countryside he traverses; and so the individual specialist is apt to miss the wider aspects of the science, specific details of which he pursues. It is here that a Society like ours may take an increasingly valuable place in these modern days of high specialisation, and of interests localised but divergent. It will naturally aim at welcoming into its proceedings all branches of the Science upon an equal footing. The general discussions which follow a detailed statement of facts submitted by one who cultivates a limited area would tend to amalgamate those facts into the substance of the whole science; bringing to it, as in an alloy of metals, new qualities of strength, resistance, and stability.

It is a good thing for any one from time to time to review his position, not only in respect of his own branch of science, but in relation to Science as a whole. He should take time to consider whether or not his enthusiasm or his limitations may require correction, so as to maintain a just poise. But

if this is wise for the individual, how much more may such a review have its value when applied collectively to the votaries of a science, or even to its balance among the related sciences. It is here that the meetings and discussions of societies such as ours have a still wider value. Those who cast their eyes abroad in this way will perceive that the progress whether of an individual adherent of a particular science, or collectively of the representatives of that science is not equable. Advances are apt to be made, in either case, by fits and starts. Sometimes they are dictated by important discoveries of fact, or by syntheses which give new aspects to facts already known. The herd-sense may thus be aroused, and a general tendency be developed to follow lines of least resistance by multiplying instances of what has been already demonstrated. Such results easily convert themselves into what is little more than a temporary fashion. Certain sciences, or certain aspects of a single science may thus come prominently before the public eye, and enjoy a vogue; but this is liable to wear out so soon as difficulties of further observation, dearth of facts, or exhaustion of the new vision make resistance to progress again a positive deterrent. The fashion then fades, or dies of inanition. This is no fancy sketch. Anyone who follows the history of scientific progress can readily find instances on a larger or a lesser scale. The meetings of the British Association serve as a mirror reflecting how certain subjects come to the middle of the stage, or fall back. For instance, in the sixties of last century there was an on-coming wave of biological enthusiasm following on the Theory of Evolution. Now the pendulum has swung to cosmic questions, under the influence of discoveries from the atom to the nebula. The biological sciences meanwhile tend to pass under a temporary eclipse.

It is the same with any individual science as it differentiates into distinct branches; as Botany has done in recent years. An ebb and flow of interest follows in the pursuit of each of these. New syntheses, or new facts guide the stream of research, and now one branch now another starts into prominence, becoming for a time a popular field of inquiry. For instance Von Mohl's visualisation of protoplasm founded the physiological renaissance of Sachs and his school. Schleiden's insistence on the history of development as the foundation

of all insight into morphology led to Hofmeister's great synthesis, and paved the way for the Organography of Von Goebel. De Bary's Comparative Anatomy preluded the stele-theory of Van Tieghem, and the physiological anatomy of Haberlandt; while his fungal researches provided the initial steps of infective pathology. Strasburger's nuclear researches laid the foundation for modern cytology and genetics. Bornet and Thuret in their "*Études Phycologiques*" led up to the Algology of Oltmanns and Svedelius. The French Palæophytologists were the natural precursors of Williamson and Scott; while the Rörägen Flora of Halle heralded the discovery of many new plants of early Devonian Time. These and other lines of specialisation, particularly those on the borderline of physics and chemistry, characterise modern botanical research, and all should find a common meeting ground in such a Society as ours.

Few can expect to follow to-day a plurality of these lines to the fringe of present knowledge. The day of the specialist is upon us, with its choice of lines for detailed study. In this, as we have seen, fashion and opportunity are determining influences. At the moment Cytology, Genetics, and Palæophytology, together with Physiological Chemistry and Physics are in the ascendant, while the old fundamental branches are more static. This was specially noted by Von Goebel in respect of Morphology. In his last letter, written to me a few months before his death, he expressed disappointment that enthusiasm for Morphology was not more widely spread at the present time. "Nowadays (he wrote) small attention is bestowed on anything but genetics and experimental physiology." Nevertheless he added the hopeful words, "*aber die Zeit wird kommen.*" They give me a text for my concluding paragraphs.

In the ardour of their pursuit of special branches of research, few of those thus engaged take the larger view of relating their results to the whole evolutionary problem. Each demonstration may be, and commonly is, pursued as an end in itself, while the scope of the whole problem is not fully realised; which is, to ascertain, so far as is possible causally, how plants as we see them came to be such as they now are. This modern aspect of Morphology must be built up by co-ordination of the results of all investigations that affect form. This

is a very different thing from that idealistic study for which the name of Morphology was introduced by Goethe. It accords more nearly with the broader vision of Schleiden, which was based upon induction from observed facts. But it is far enough still from realisation. Nevertheless it is from such sources that a truly scientific morphology may gradually emerge. Hitherto semi-poetic guess-work, largely based upon preconceptions, has been too much in evidence, passing under the guise of morphology. But if the embryo from the moment of definition of its polarity be visualised as a plastic shoot-unit, with its apex defined as an inherited feature in relation to a substratum, then an approach is made to a starting point for the treatment of the adult shoot based upon observed fact. The future of such a scientific morphology of cormophytic plants as this does not lie in the details of the adult form; it is to be sought rather in a renewed examination of the growing point of the shoot-unit, and of the continued embryology that is centred there. Having made a lifelong study of primary meristems, dating from attendance in Sachs' laboratory in 1877, I may venture to suggest to those who will carry on such work an aspect of the apical cone that offers a high degree of freedom from preconceptions. It is now generally agreed that segmentation in the apical region and the genesis of appendages are two separate propositions. The results may sometimes correspond; as for instance when each apical segment forms a leaf, as in Mosses and in some Ferns. But this is only an occasional event. Such correspondence is in fact optional for certain types of plants; it is not obligatory for all. If this be admitted the whole apical region may be regarded as a septate and encysted plasmodium, capable of forming outgrowths independently of cell-cleavages. In a sense its behaviour would be amœboid, though under the restriction of encystment, which rules out retraction of an outgrowth once initiated. The lobes thus formed would possess from the first a stability such as the pseudopodia of *Amœba* have not, and such stability would be liable to persist as an inherited character. As to the number and relative position of those lobes or appendages Von Goebel definitely refers their origin to conditions of growth and symmetry that arise in the growing point, which plays not a passive but an active part in their determination. On the

other hand, it has been reasonably suggested that a localisation of hormones in the apical region is a precedent condition for the outgrowth of appendages. Probably the same will also hold for the inner tissue-tracts. Such localisation may be referred to an inner heritable initiative of the apical region itself.

This is not the time or the place for detailed discussion of such broad questions as these, nor are the necessary measurements yet available for founding a settled opinion as to the place which the size-relation of parts composing the shoot-unit may take: for instance, in the problems of phyllotaxy, or the definition of elaborately moulded conducting tracts. But an occasion like the present seems to be propitious for suggesting this "amoeboid" point of view of the embryonic unit acting as a whole which, so far as the features are inherited, would be initially independent of the impress of external conditions. In doing this I think I shall be realising at this Centenary Meeting, one of the primary functions of a Society such as ours. It should not be a mere receiver for results contributed by members with a view to their publication, however important this function actually is. It should also be held as an arena for criticism; but most important of all it should supply the stimulating effect of contact of one mind with another in relation to nascent questions.

I have not attempted in this address to trace any continuous thread of the history and achievements of the Society itself. This is embodied in the following pages from authors better informed for that purpose than I could possibly be. My object has been to place the century of its existence, the completion of which we now celebrate, in its relation to the progressive stream of the Science of Botany at large. Who can tell what the future may hold for those who come after us? But looking back we cannot fail to see that the century now closed has witnessed wonderful advances not only of fact but also of vision. To other forward movements as they arise this Society will be as fully alive in the years to come as it has been in the past.

LIST OF PRESIDENTS.

1836-1839 Prof. Robert Graham.	1872-1873 James McNab.
1839-1840 Robert K. Greville, LL.D.	1873-1877 Sir Robert Christison, Bart.
1840-1841 David Falconar.	1877-1879 Thomas Alexander Goldie Balfour, M.D.
1841-1842 Prof. Robert Christison, M.D.	1879-1880 William Gorrie.
1842-1843 Patrick Neill, LL.D.	1880-1882 Prof. Isaac Bayley Balfour.
1843-1844 Prof. Robert Graham, M.D.	1882-1884 William B. Boyd.
1844-1845 Andrew Douglas MacLagan, M.D.	1884-1887 Prof. Alexander Dickson.
1845-1846 Prof. John Hutton Balfour, M.D.	1887-1889 William Craig.
1846-1847 Robert K. Greville, LL.D.	1889-1891 Robert Lindsay.
1847-1848 Rev. Prof. John Fleming, D.D.	1891-1893 David Christison, M.D.
1848-1849 Prof. J. H. Balfour, M.D.	1893-1895 Prof. Frederick Orpen Bower.
1849-1850 Rev. Prof. John Fleming, D.D.	1895-1897 Andrew P. Aitken, D.Sc.
1850-1851 Prof. J. H. Balfour, M.D.	1897-1899 William Watson, M.D.
1851-1852 William Seller, M.D.	1899-1901 Rev. David Paul.
1852-1855 Prof. J. H. Balfour, M.D.	1901-1902 Col. Fred Bailey, R.E.
1855-1856 Lt.-Col. Edward Madden.	1902-1904 Prof. J. W. H. Trail.
1856-1857 Rev. Prof. John Fleming, D.D.	1904-1906 Prof. I. B. Balfour.
1857-1858 William Seller, M.D.	1906-1908 J. Rutherford Hill, Ph.C.
1858-1859 Andrew Murray, W.S.	1908-1910 T. Bennet Clark, C.A.
1859-1860 Prof. George James All- man, M.D.	1910-1912 A. W. Borthwick, D.Sc.
1860-1861 Wm. H. Lowe, M.D.	1912-1913 Sir Archibald Buchan- Hepburn, Bart.
1861-1862 Thos. C. Archer.	1913-1915 R. Stewart MacDougall, D.Sc.
1862-1863 Prof. Andrew Douglas MacLagan, M.D.	1915-1917 R. A. Robertson, M.A., B.Sc.
1863-1864 Prof. J. H. Balfour.	1917-1920 James Whytock.
1864-1865 Alexander Dickson, M.D.	1920-1922 Wm. G. Smith, Ph.D.
1865-1866 Robert K. Greville, LL.D.	1922-1925 Prof. Wm. Wright Smith.
1866-1867 Isaac Anderson-Henry.	1925-1927 Prof. J. Montagu Drum- mond.
1867-1868 Charles Jenner.	1927-1929 Col. John Sutherland, C.B.E., LL.D.
1868-1869 Hugh F. C. Cleghorn, M.D.	1929-1931 J. Rutherford Hill, Ph.C.
1869-1870 Sir Walter Elliot, K.S.I.	1931-1933 William Young.
1870-1871 Alexander Buchan, M.A.	1933-1935 Malcolm Wilson, D.Sc.
1871-1872 Prof. Wyville Thomson, LL.D.	1935-19 Prof. Sir Wm. Wright Smith.

A SURVEY OF THE ACTIVITIES OF THE BOTANICAL SOCIETY OF EDINBURGH.

1. SYSTEMATIC WORK (Phanerogams and Vascular Cryptogams).

INSTITUTED on the 17th of March 1836, the Botanical Society of Edinburgh issued a Prospectus of its Laws and intended activities at its first open meeting, held on the 14th of April following. From this Prospectus it is clear that the formation of an Herbarium and the exchange of dried specimens of plants were at that time the Society's main objects.

"The operations of the Society," we there read, "will for some time be confined principally to the holding of Periodical Meetings,—to Correspondence,—to the formation of an Herbarium,—and to the establishment of a Medium of Inter-course for the exchange of Specimens between Botanists at home and abroad. . . . The value of an authentic Herbarium, especially to the resident Botanist, must be obvious; and this will, therefore, receive particular attention. The peculiar feature, however, in the constitution of the Society, is the provision made for the interchange of Specimens. . . . The Flora of Edinburgh, which is particularly rich, will afford a constant supply of valuable duplicates, and many rare species will be annually obtained from the mountainous parts of Scotland."

That the exchange of specimens was contemplated on a large scale may be seen from the Laws of the Society. To enable him to participate in the distribution of specimens, a Resident Member was required to contribute yearly "not less than fifty species of Plants, with as many duplicate specimens of each for distribution as possible"; while a Foreign Member's obligation amounted to "500 specimens (including at least 100 species)," at the time of his election, and "300 specimens, including at least 50 species," annually thereafter.

Under the enthusiastic guidance of such men as Professor Graham, Dr. R. K. Greville, Dr. Hutton Balfour, Dr. Patrick Neill, and James McNab, the Herbarium thus started grew so rapidly that it soon became a burden to the Society. In

1839, after only three years, it contained no less than 150,000 specimens, and its accommodation was an acute problem. Arrangements were then made, by courtesy of the Senators and Patrons, to have it housed within the walls of Edinburgh University, under the designation "University Herbarium"; but with the Botanical Society still as curators. To it was added, at the same time, the "College Herbarium," dating from the days of Dr. John Hope (1761-1786), but fallen into neglect, which contained some 1100 species. By 1842 this joint Herbarium was regarded as "nearly complete"; but thereafter the failing health of Professor Graham, and the scattering of those most keenly interested, caused a great decline in activity, which never again reached its first fervour.

While this decline in enthusiasm may be regretted in some ways, it can only be regarded as fortunate in others. It is on record that, in 1838, the Society had from Robert Gardiner of Dundee alone some 3000 specimens collected by him in the Perthshire mountains. Many others were equally busy, and the almost ruthless gathering of the rarer alpine and even local plants rapidly began to have its inevitable effect. After an excursion in Perthshire during August 1839, Professor Graham was constrained to write as follows: "The usual Ben Lawers plants were found at the top and on the west side, but in much smaller quantity than formerly, and the specimens of *Myosotis alpestris* were generally miserably small. The mountain has for some years been too frequently visited by collectors, and the plants too carefully gleaned." At the same time he remarks, of an adjacent locality: "I feel quite certain that this is untrodden ground, for no collector could have left such specimens as we gathered of *Draba rupestris*; specimens many times larger than I ever saw before. . . ."

One cannot but feel glad that the student of Botany to-day has an altered outlook, compared with his predecessor of one hundred years ago, and has largely lost the collector's covetousness of specimens, rare or fine, merely as such.

By 1853 the "University Herbarium" had so increased in extent that only the British section of it could be conveniently housed at the University, and at that date the foreign collections were removed to "a commodious room in the new

Museum" at the Royal Botanic Garden. In 1863 the Society lost the use of the "Herbarium Rooms" at the University, which were needed for other purposes, and shortly thereafter the two sections were reunited at the Botanic Garden. There they still remain, and have formed the nucleus around which has been built up, under successive Regius Keepers of the Garden, the present very extensive Herbarium of that Department, housed and cared for by Government, and comprising upwards of a million and a half sheets of specimens. Rich in material from most areas, this Herbarium is unique in the full representation it possesses of the flora of Western China, that being largely due to the magnificent work done there during many years by the late Mr. George Forrest, an Associate of this Society.

Amongst the numerous acquisitions of value in the earlier days only a few can be mentioned here. In 1837 Christina, Countess of Dalhousie, presented her entire East Indian collection; about 1840 the Hon. East India Company sent a fairly complete series of Dr. Wallich's material; while in 1860 there was given a set of Hooker and Thomson's Himalayan specimens. After his death, in 1866, the entire phanerogamic herbarium of Dr. R. K. Greville was acquired: while from South America came over 6000 of Dr. Spruce's plants of the Amazon and Andes, between 1852 and 1857; and shortly afterwards a set from Peru and Brazil gathered by Dr. Jameson.

A special interest in the cultivation of unusual plants led Mr. Charles Jenner to propose, in March 1868, the formation of an "Alpine Botanists' Club," with the object of financing and sending out annually "two competent young botanists to some desirable districts of limited area in the Scottish Highlands" to obtain for subscribers specimens, living or dried, of "new or rare cryptogamic and phanerogamic plants." A committee was formed to consider the proposal, but nothing further was done. Two years later, however, worthier expression was given to that delight in the mountains of Scotland and their flora, characteristic then as now of so many of the Society's members, by the formation of the "Scottish Alpine Botanical Club." This inner circle of the Botanical Society of Edinburgh was instituted on the 10th of August 1870 at Bridge of Lochay Hotel, Perthshire, during a week's

botanical exploration of the neighbouring peaks; among the ten original members were Professors Dickson and Hutton Balfour, John Sadler and Isaac Bayley Balfour. Membership was—and still is, for the Club continues to flourish—confined to those “who are in the habit of visiting alpine districts of Scotland for the practical study of science, and who have proved themselves to be pleasant *compagnons de voyage*.” In addition, no one was to be admitted “who had not proved that he had ascended on foot to the summits of three Scottish mountains, not less than 3300 feet above the level of the sea.” Throughout its long life the Club has annually carried through at least one excursion programme of several days’ duration, and the annual Reports dealing with these are printed in the *Transactions* of the Society. The activities of the Club have added not a little to our knowledge of Scottish botany. During the excursion of August 1874 *Salix Sadleri* Syme (*S. herbacea* \times *lanata*) was discovered; while in 1883 the remarkable and still somewhat obscure *Sagina Boydii* F. B. White was found. Additional stations for many Scottish rarities, for instance *Thlaspi alpestre* L., *Saxifraga rivularis* L., *S. caespitosa* L., and *Gentiana nivalis* L. have been recorded; while old and doubtful records, such as those of *Carex atrofusca* Schkuhr and *Cystopteris montana* Link from Ben Lawers, have been re-established by its members.

An examination of the pages of the *Transactions* of the Society shows how continuous and close has been the relationship between the Society and students attending the Classes of Botany at Edinburgh University. In connection with these classes it has always been the practice to hold frequent excursions for the study of plants in the field, and records of the species observed on such occasions will be found scattered throughout vols. i to xiii, along with many lists of plants met with by former students during their vacations at home and abroad. Not a few, after graduating, became attached as medical men to expeditions of importance and communicated regularly with the Society while so engaged. Some idea of the extent and value of this to the Society may be had from the fact that, at the Meeting held on 8th July 1858, letters were read from Drs. Balfour Baikie, John Kirk, and James (later Sir James) Hector, then attached respectively

to the Niger Expedition, the Livingstone Expedition in Central Africa, and Pallisier's North American Expedition.

Again, the pages of the Society's *Transactions* show how closely its members have kept in touch with current advances in knowledge of the British Flora. In his time, Professor C. C. Babington contributed many papers, some of considerable importance. His "Monograph of the British Atriplicae" will be found in vol. i, and his "Synopsis of the British Rubi," with Supplements, in vols. ii and iii; while there are treatises by him on such critical genera as *Fumaria*, *Viola*, *Saxifraga*, *Oenanthe*, *Epilobium*, *Arctium*, and *Statice* in these and subsequent volumes. From 1885 to 1925 very numerous papers and notes on similar subjects appear under the name of Arthur Bennett. Other contributors well known in connection with British Botany are R. K. Greville, H. C. Watson, T. Bell Salter, John Bell, T. Townsend, John T. Syme, J. Hutton Balfour, F. Buchanan White, Lauder Lindsay, E. F. Linton, G. C. Druce, A. Scott Elliot, and many more. In vol. ii the Rev. W. H. Coleman first separated and diagnosed *Oenanthe fluviatilis*, till then confused with *Oe. aquatica* Poir.; and in vol. xiii appeared the first description of *Hieracium Dewari* Boswell.

Foreign systematic botany has frequently occupied the attention of the Society, in particular during the years 1905 to 1925, covered by vols. xxiii-xxix, when the rich collections made in Western China by Mr. George Forrest were being worked out. It is impossible to cite even a portion of the papers on this aspect of botany published during these years, but, taking vols. xxvi and xxvii alone, the following important contributions were made to the Botanical Society by Sir Isaac Bayley Balfour:—"The Primulas of the Bullatae Section"; "Primula obconica and its Microforms"; "The Saxifrages of the Diptera Section"; "Rhododendron trichocladum and its Allies"; "Rhododendrons of the Irroratum Series"; "Some late-flowering Gentians"; and "The Genus *Nomocharis*." In the same two volumes appeared numerous papers by other authorities on various groups: by Sir William Wright Smith on *Rhododendron*, *Primula*, *Compositae*, and many scattered genera; by Professor J. Small on *Compositae*; by Dr. Schindler on *Leguminosae*; and by Dr. R. Ll. Praeger on *Sedum*. In addition to numerous new species and varieties

in existing genera, no less than eight new genera were described in the Society's *Transactions* during the period under consideration, namely: *Borthwickia* W. W. Sm. (*Capparidaceae*), *Cavea* W. W. Sm. et J. Small (*Compositae*), *Craigia* W. W. Sm. et W. E. Ev. (*Sterculiaceae*), *Formania* W. W. Sm. et J. Small (*Compositae*), *Parasyringa* W. W. Sm. (*Oleaceae*), *Parasenecio* W. W. Sm. et J. Small (*Compositae*), *Wardaster* J. Small (*Compositae*), and *Whytockia* W. W. Sm. (*Gesneraceae*). In vol. xxviii, it should finally be mentioned, appeared Sir Wm. Wright Smith's "Notes on Chinese Lilies."

W. E. EVANS.

2. CRYPTOGRAMS (non-vascular).

In the first publications of the Society—the Annual Reports 1836–1846—only scattered references to cryptogams occur. Among them, however, are references to the discovery of *Phycomyces nitens* and *Buxbaumia aphylla* in Scotland, and these probably constitute first records. In the early years, indeed, the members were interested chiefly in flowering plants, as is well indicated by the fact that of 402,000 specimens received for the Herbarium in 1839 only 1200 were cryptogams.

In the earlier years a considerable number of papers appeared on the Algae. These for the most part deal with the marine algae, and include papers on new species of *Sargassum* by R. K. Greville in 1849, the distribution of Marine Algae in the Forth by Rattray in 1885, the Marine Algae of the Dunbar Coast by G. W. Trail in 1885, and the Marine Algae of the Orkney Islands in 1886 by the same author. More recently W. and G. S. West communicated an account of the Freshwater Algae of Orkney and Shetland in 1905.

Papers on the Diatomaceae and Desmidiaceae have appeared by Dickie, Ralfs, Greville, and others, one of the most important being that by Ralfs on the British Desmidiaceae in 1844. In fact the last paper published in the *Transactions* by R. K. Greville, in 1866, was on a number of New and Rare Diatoms from the Tropics. An important account of the British species of *Chara* published by C. C. Babington in 1853 may also be mentioned here.

Only comparatively few contributions dealing with the fungi are found in the *Transactions*. An interesting early account of the potato disease was published by Goodsir in 1846, in which he referred "to the opinion generally gaining ground that certain epidemics owe their existence to the growth of fungi" and considered that "we are bound not to overlook the fungi which exist in the diseased tubers." Other early contributors of papers on fungi are J. Hutton Balfour and John Lowe. In 1857 S. J. Meintjes gave an account of an epidemic of *Oidium Tuckeri* at the Cape and its control by the application of sulphur.

Between 1870 and 1880 M. C. Cooke undertook the re-organisation of the fungus herbarium at the Royal Botanic Garden and contributed a number of mycological papers, the most important being an enumeration of the species of *Polyporus*. In 1888 an important paper on the fungi collected in Hardanger by J. W. H. Trail was published, in which many new species were described. During the same year the author also gave an account of the plant galls of Norway. In 1898 R. A. Robertson described the witches' brooms of various trees, and A. W. Borthwick contributed a paper on the same subject in 1899. The latter author at later dates also contributed various papers on fungal diseases, especially those of forest trees.

In 1934 appeared a long paper giving the distribution of the Uredineae in Scotland by M. Wilson.

A series of papers by W. Lauder Lindsay was published between 1862-1869 dealing with the cryptogamic flora of various countries, and especially with the lichens, the more important of these being the flora of Iceland (1862), of Otago, New Zealand (1886), and Greenland (1869). He also contributed the following papers on lichens:—"The Lichen-Flora of Druidical Stones in Scotland" (1867) and "Arctic Cladoniae" (1867). Carrington, Stirton, and others, have also published contributions on this group.

The taxonomy and distribution of the Bryophyta is a subject on which papers have appeared throughout the whole period. During the earlier years contributions on this subject were made by Dickie, T. Taylor, and Greville, and later on by Howie and Schimper, Stirton, Buchanan White, Ferguson, Bell and Sadler, W. Evans, Carrington, H. N.

Dixon, and others. Although the majority of these were concerned with Scotland, papers on the distribution in several other countries were also published, *e.g.* "The Musci and Hepaticae of the Pyrenees," by Spruce in 1849, and those of Spitzbergen by J. Hagem in 1908. The most important contributions dealing with this subject were "The Hepaticae of South America," by R. Spruce in 1885, which occupies the whole of volume xv and contains descriptions of many new genera and species, and "The Distribution of the Hepaticae in Scotland," by S. M. Macvicar, published in 1910, which occupies the whole of volume xxv.

In a consideration of the papers published on cryptogamic plants it is of interest to note that although the majority are concerned with distribution they are not by any means confined to a consideration of Scotland, but deal with regions as far removed as Australia, New Zealand, South America, and Greenland.

Papers on morphology and physiology are less numerous, and were for the most part published during the present century, although some are found throughout the whole period.

While work on all the classes is represented, perhaps the most numerous and important contributions deal with the Bryophyta, especially the Hepaticae.

Our amalgamation with the Cryptogamic Society of Scotland last year will doubtless increase the interest of the Society in this branch of botany.

M. WILSON.

ANATOMY AND HISTOLOGY.

So far as anatomy and histology are dealt with in the thirty-one published volumes of the *Transactions* certain very different trends of investigation can be discerned. At first attention was focussed on the cell itself. Subsequently the chief interest was transferred to investigations concerned with the destiny of the homogeneous cells as they differentiate in the establishment of the tissue systems of the plant. Still later these formal or morphological studies were applied to taxonomic and phylogenetic problems, and also to problems of physiology.

In the second volume of the *Transactions* Dr. (later Professor) George Dickie contributes a paper (1845) on "Fecundation in Plants." He reviews in this connection the work of Brown, Amici, Brongniart, Mirbel, and Schleiden. The last-named author had in 1837 announced that the extremity of the pollen tube is itself actually converted into the embryo. Dickie's contribution to the problem is the description of "ovule tubes" in *Narthecium* whose function he suggests is to secure the effect of the pollen upon the ovule. The difficulty of securing this effect is attributed to the large number of ovules and the awkward position of the "exotome." In 1848, in the third volume of the *Transactions*, the same author contributes a paper on the ovule of *Euphrasia officinalis*. His position has undergone a change, and "admitting that the pollen tube reaches the ovule" the action of the pollen in regard to the origin and the subsequent development of the embryo are considered. The paper contains much speculation in regard to the nature of the suspensor. Two years later, in 1850, John Scott Sandeman furnishes an account of the embryogeny of *Hippuris vulgaris*. Reference is made to the splendid contemporaneous researches of Hofmeister, Unger, and Tulasne, and the development described for *Hippuris* is claimed as typical of the higher plants. In 1855 Charles Jenner contributes a "Comparative View of the more important Stages of Development of some of the higher Cryptogamia and the Phanerogamia," in which he refers to Hofmeister's "Vergleichende Untersuchungen höherer Kryptogamen," which appeared between 1849-1851, but were not translated until 1862. This illustrates a recurring feature of the work of the Society where a member in touch with important botanical investigations abroad keeps his fellow-members abreast of such progress.

Excepting for a paper on "The Embryogeny of *Tropaeolum majus*" by Dr. Alexander Dickson (then in Aberdeen) in 1862 there is a break of twenty-four years before a further reference to histology occurs. By 1880 Strasburger had described the division of the nucleus, and its importance in cell division had come to be recognised. In 1881 Dr. (now Professor Emeritus) J. M. Macfarlane attacked the problem of the nucleus in a paper on the "Structure and Division of the Vegetable Cell." Special reference is made to the

nucleolo-nucleus, and detailed descriptions are given of the nucleus of *Spirogyra* and of *Equisetum limosum*. Allan E. Grant in 1883 dealt with the multinucleated conditions seen in a large number of flowering plants. This paper was one of two competitive papers for the Society's Student Prize of £10—a prize, one ventures to suggest, which might well be revived to mark our Centenary year. The break in anatomical contributions from 1855 to 1881 is indeed surprising, as J. Hutton Balfour came from Glasgow in 1845, and to Hutton Balfour Edinburgh owes the introduction of practical teaching of vegetable anatomy and histology.

The years following mark important advances in cellular study. In 1886 G. F. Scott Elliot presents a paper on the vegetable cell, reviewing the work of Schmitz (1880) and Strasburger (1882), and in 1891 and in 1892 Gustav Mann presents two papers. The second paper, "An Account of the Embryo-Sac of *Myosurus minimus*," covers seventy-seven pages, and is outstanding for its wealth of detailed observation and also for the extensive superstructure of speculation which still characterises much of the work of this period. However, in 1894, Professor F. O. Bower in his presidential address discusses the discoveries of Strasburger, who had formulated the generalisation that while the number of chromosomes was constant for each plant that number was halved at spore production and reassumed on the fusion of the gametes.

Another important forward step, the use of anatomy as an aid in taxonomy, finds early expression in the *Transactions*. In 1854 George Lawson contributes a paper on "The Cinchonaceous Glands in Galiaceae." In the succeeding volume the same writer contributes a paper on "The Microscopical Analysis of Tobacco." Descriptive papers are interspersed in the volumes until 1872, when Dr. Wm. Ramsay McNab contributes a paper on "The Organisation of Equisetums and Calamites." This contribution introduces Professor Williamson's work to the Society, though it denies that author's discovery of secondary thickening in the Calamite stem. In 1878 Isaac Bayley Balfour contributes an important paper on "The Genus *Halophila*," in which the aid of anatomy to taxonomy is well shown. Amongst the contributions of 1879 is one on "The Envelope of the Plumule of the Grass Embryo," by A. Stephen Wilson. This marks a stage in the

controversy over the homology of this structure which was cleared up only in 1931 in the remarkable paper on the Monocotylous Seedling by Dr. Lucy Boyd. In the years between 1879 and the present there have appeared numerous anatomical papers which though mainly descriptive yet have a bearing on taxonomy and on developmental anatomy. The most popular family for study is the Rubiaceae, while the *Potentillae* and other individual genera, e.g. *Banksia*, *Ruscus*, and *Mesembryanthemum*, were dealt with by R. A. Robertson and other workers.

The work of Haberlandt was introduced to the Society by G. F. Scott Elliot in 1885.

Among the papers in the early days of the present century occur two which are of considerable historical interest. In 1900 James Terras described the relation between the lenticels and adventitious roots of *Solanum Dulcamara*, thus antedating by twenty-five years the work of van der Lek and others on preformed roots. In 1909 James Waterston, in a paper on "The Morphological Changes induced in the Roots of Bromeliaceae by Attacks of *Heterodera*," describes the wound reactions that occur in plant tissues, and it is interesting to note that the endodermis is specifically mentioned. In 1915 Sophie J. Wilkie presents a paper on "The Influence of Different Media on the Histology of Roots." From 1922 onwards there occur two important series of papers. The first series deals with problems of regeneration in plants, and starts most appropriately with a paper by L. B. Stewart on "Juvenile Characters in *Acanthus montanus*." The histological changes occurring in regeneration are dealt with in numerous papers contributed by workers at or associated with the Edinburgh University Department of Botany. The second series of papers, with which the St. Andrews University Department of Botany is associated, starts in 1925. The investigations are concerned with ecological anatomy, and the publications cover the strand plants and the saltmarsh plants in the neighbourhood of St. Andrews. In vols. xxix to xxxi of the Society *Transactions* more anatomical papers are to be found than in the whole of the other volumes of the Society. These papers come mainly from the Edinburgh and the St. Andrews departments. The activity displayed in this field during the last decade of the century under

review augurs well for the immediate future, as a sound training in anatomy lies at the foundation of botanical training and investigation.

Notice must also be taken of the publication of papers dealing with methods of value to workers in plant anatomy and in histology. In 1868 William Ramsay McNab details the use of stains such as acetate of mauvine and Beal's carmine, while in 1881 Dr. J. M. Macfarlane gives methods for the use of aniline dyes, emeraldine, heliocin, and naphthaline. Gustav Mann in 1890 describes a method of embedding plant material in paraffin with chloroform as the intermediate solvent. In 1897 R. A. Robertson communicated a paper on the "Photomicrography of Opaque Stems," and he also applied this method of recording anatomical structure to fossil stems, which was indeed pioneer work at the close of last century.

R. J. D. GRAHAM.

4. PLANT PHYSIOLOGY.

In the earliest publications of the Society the interest of the members, as shown by the printed records, was wide, and embraced all aspects of Botany more or less equally. No section of the science was left without some notice. The position of botanical science at the time of the initiation of the Society is evidenced by the presidential address delivered by Dr. Greville and printed in the first volume of the *Transactions*. The literature cited by Dr. Greville on that occasion shows twenty-six papers classed as "descriptive and critical"; twenty-one on "Floras"; fourteen as "illustrated works"; eighteen miscellaneous—chiefly on collecting and exploration; five on Vegetable Chemistry, and four on Physiology. Truly a wide cast of the net.

The predominance of "descriptive and critical" papers taken in conjunction with the high number of Floras and works dealing with collecting and exploration indicates that the Society commenced its life at the period when the "philosophic phase" of biological science was weakening and the glorious era of collection and identification of the world's plants was marching towards its fulfilment.

An interesting fact in this connection is that one of the

papers on plant physiology cited by Dr. Greville is the publication which describes Ward's case devised for the safe transit of living plants over long distances—the Wardian case of to-day. How much of the glory of our gardens and our wealth of knowledge is due to this change of phase and the men who made the expansion possible?

Turning now to a somewhat more detailed examination of the papers of physiological interest actually communicated to the Society we find that not only were the members reporting on physiological phenomena observed by themselves, but certain members were noting publications in other journals and drawing the attention of the Society to new knowledge of importance obtained elsewhere. Vol. i of the *Transactions* shows this, for we find a paper by Herbert Giraud directing attention to the nitrogen problem in the nutrition of plants and dealing at length with the work of Boussingault. That the Society was ever concerned with the general position of the nitrogen problem is evidenced right through the publications, for we find in 1896 the presidential address of A. P. Aitken entitled "The Nitrogenous Food of Plants," and again in 1897 we find a paper by William Somerville discussing experiments with Nitrogin, and in the same year a paper by R. Stewart MacDougall on the bacteria of the soil emphasising the nitrogen problem.

Other trends of the special interests of members of the Society will emerge later in this review, but in the meantime some of the individual papers may be noted.

In vol. i a paper dealing with the natural plant dyes used for colouring wool in the Shetland Islands is of interest, as is another on the mucilage in the bark of *Tilia*.

In vol. iii is published a paper by a young German scholar visiting Edinburgh, Dr. A. Voelcker, of Frankfort, Germany, and the same worker has a paper in vol. iv, but now he is described as of the Royal Agricultural College, Cirencester. The first paper dealt with the chemical composition of the fluid in the ascidia of *Nepenthes*, while the second reports on the analysis of the watery secretion of the leaves of *Mesembryanthemum*. These two papers, particularly the first, mark a point in the development of plant science in this country, for the young German visitor was to become the man who took a major part in the development of scientific

agriculture in Britain for many years, and whose work on the theory of manuring still stands. Other papers by Voelcker appear in later volumes, but none after vol. vi, by which time he had no doubt found a wider field of interest.

A paper of more than passing interest is that by Stevenson Macadam in vol. iv, dealing with the presence of iodine in various plants, with some remarks on its general distribution. The paper directs attention to the relationship between plant composition and the appearance of goitre in the human subject.

In 1885 Dr. Gilchrist discusses the relationship between the growth of rare alpine plants and the chemical composition of the rocks underlying them.

Other ecological papers still of interest are scattered throughout the earlier *Transactions*, such as those recording detailed observations made on plants after years of peculiar or extreme weather. As an example may be cited that by Dr. G. Dickie published in 1885, recording the damage done to plants in various situations in the Aberdeen district by a frost of the previous year. He notes amongst other things that all grafted plants were killed while members of the same species on their own roots survived. A long series of papers by the curator of the Royal Botanic Garden record the time of flowering of the different species in the Garden, and the various deviations are related to weather phenomena.

In 1856 an idea still fashionable was suggested in a paper by the Rev. J. Wardrop. He develops the idea of phylogenetic relationship being evidenced by chemical similarity of the species, and insists that the "naturalness" of a grouping based on morphological criteria may be checked by chemical methods.

On occasion a touch of humour enters into the otherwise sedate pronouncements of these earlier savants—possibly unconscious humour—as in a paper in 1857 dealing with analyses of certain newly received Australian wines. The report praises the quality of the samples but deplores their smallness! That the spirit of prophecy was also present is shown by the statement in this same paper that the cultivation of the vine and the manufacture of wine "will no doubt be carried on extensively in Australia."

W. Lauder Lindsay, M.D., in 1856 reports that a high

incidence of plant disease always seems to occur in India when a cholera epidemic breaks out, and suggests that the cholera patient exhales some influence detrimental to plants. The observation is of value if it is confirmed, though to-day identity of causation of cholera and plant disease in so far as environmental factors such as temperature and humidity are concerned would be looked for.

The question of electricity and the plant from time to time exercised the minds of the Fellows. The effects of lightning are mentioned many times, and insistence placed on the report that birch and beech trees seem to be immune to lightning, while other trees are killed. As early as 1856 H. F. Baxter reports the existence of electrical potential differences between different parts of living plants.

Another paper with a modern flavour is that read by Professor Balfour in 1857. The paper had been written by Professor Gregory just before his death, and discusses aspects of base exchange and adsorption in soil not far removed from the theories current to-day.

In the *Transactions* for 1859 we find proof that members of the Society were actively interested in practical problems in a paper summarising the technical evidence offered in a then recent law case on the effect of noxious gases on plants. Work on a somewhat related subject—the effect of anaesthetics on plants—is published from the pen of William Coldstream. Coldstream had been Prizeman in the Professor's class, and the report he submits consists of the essay which had gained him the special honour. He had experimented with the sensitive plant (*Mimosa pudica*), stamens of *Berberis* and *Helianthemum*, and the column of *Stytidium*.

An aspect of the Society's earlier publications which gives freshness and interest to-day was the publication of personal letters from members, and friends of members, overseas to members at home. Intimate touches on very diversified topics amongst the more formal papers lighten the subject-matter at many points. How valuable these communications may be is evidenced by a long series of letters from many correspondents all dealing with the introduction and establishment of cinchona into India. This series commences about 1864.

A number of papers of considerable interest to anyone

specially interested in water relations of plants occur in 1869 and 1870. The first is by Mr. McNab on results obtained from cutting and transplanting a plaited hornbeam hedge located in the Royal Botanic Garden. Another paper is by W. R. McNab, a brother of the last-mentioned author, describing experiments on the transpiration of watery fluids by plants. This paper gives very detailed figures, and is of special interest in that the spectroscope was used to trace the various fluids in the plant. By means of spectroscopic analysis McNab provides thirty significant figures for water relationships, and includes such as the absorption of water from the atmosphere by the leaf and other figures usually ignored nowadays.

In vol. xi, 1871-1873, Sir John Don Wauchope, Bart., gives a detailed report of "bleeding" in a hornbeam tree. The term exudation pressure might be used to-day, but would be no more descriptive of the phenomenon reported. A branch of hornbeam, $1\frac{1}{2}$ inches in girth, during nine hours exuded 1 gallon 3 gills of sap, and bled at about this rate for three days, when at last the branch was successfully plugged.

Physiological studies in seed germination commenced in about 1873, for in vol. xii, of 1876, an experiment with turnip seed by A. Stephen Wilson is reported, followed by a long paper in vol. xiii, 1879. The author was interested in the speed of germination and subsequent success of embryos and plants raised from large seeds as compared with the same from small seeds. This author digresses to allude to the then neglect of agricultural botany in favour of agricultural chemistry. In this regard he says: "Provided plenty of manure is put into soil the intimate laws and habits of seeds and plants to be grown may be ignored, the result will be proportional to the manure. Pap of all sorts has been manufactured regardless of cost; feeding-bottles of the most attractive design have been presented, but whether the child, Flora's little pale sprawling embryo, should have its head or its heels uppermost has mostly been regarded as immaterial." To such pioneers, it may be supposed, the present proud position of Agricultural Botany, with its seed-testing stations, its plant-breeding stations, and so on, must be ascribed.

Indeed the next paper on record to deal with seeds is one by A. N. MacAlpine, who in 1891 described an invention of his own designed specifically for the testing of agricultural

seeds. A. N. MacAlpine, later to become the Professor of Botany in the new West of Scotland College of Agriculture, did much to develop and foster the modern science of Agricultural Botany.

In 1893, 1894, and 1896 Mr. Cuthbert Day offered meticulous reports on detailed experiments regarding germination of barley and wheat.

In 1889 Professor I. Bayley Balfour devoted his presidential address to an exhaustive review of the literature dealing with chlorophyll.

Comparing the first President's address with this one some fifty years later we realise the change which had taken place in botanical study. The first President was able to review the work of the whole science easily within the compass of a short paper. The President of fifty years later devoted more space and time to a comparatively small portion of plant physiology.

In June 1891 appeared a paper describing the work of the Pilcomayo Expedition, written by the young naturalist who accompanied the party. The vegetation is described in general terms, and in a later paper formal descriptions of new species are submitted. It may be wondered whether Botany did not lose too much, to the great gain of her sister science Zoology, when T. Graham Kerr, the young man in question, elected to specialise on animals rather than plants.

With the advent of the twentieth century we see evidence of a further change of phase in the character of the publications. The description and elucidation of naturally occurring phenomena tend to give way to reports of deliberately planned laboratory experiments, with all the environmental factors controlled. Papers appear written by L. B. Stewart and R. J. D. Graham, working either separately or together, on propagation; papers by E. Philip Smith on plant pigments and propagation, and individual papers by other workers on subjects such as light reception by *Mesembryanthemum* and germination in seeds.

A. NELSON.

5. OTHER BRANCHES.

Arboriculture in its various aspects has occupied the attention of the Society continuously throughout the whole

period under review. During the century there have been numerous introductions of exotic trees and shrubs, and the histories of these with their behaviour in cultivation have been invariably recorded. At intervals there have been contributions of special note, as for example those by Lt.-Col. Barclay and Sir Robert Christison. The latter will be remembered for his precise and laborious researches resulting in a series of articles (1878-1881) on the "Exact Measurement of Trees and its Application," a distinct and unusual contribution to tree science.

Another notable contribution was that of our distinguished Fellow, J. E. T. Aitchison, who as a result of his work with the Afghan Delimitation Commission contributed in 1890 the valuable paper on the "Products of Western Afghanistan and of North-East Persia" which occupies over two hundred pages of vol. xviii of the *Transactions*.

Turning to Palaeobotany we find in the earlier contributions to the Society the influence of the numerous publications, about 1820, of Sternberg and Brongniart. The first paper on this subject appearing in the *Transactions* was by Robert Paterson, who in 1840 described *Pothocites Grantonii* from casts showing no internal structure. It is significant of the state of knowledge at the time that the fossil was then regarded as a "monocotyledonous inflorescence." It is also significant of the slow and cautious development of the science that this erroneous deduction remained uncorrected until 1885, when Kidston referred the fossil to *Archaeocalamites*. Paterson's effort was succeeded by a long series of notable contributions to palaeobotany by such eminent enthusiasts as J. H. Balfour, Carruthers, C. W. Peach, Dawson, Etheridge, Christison, Kidston, and Gordon; of whom the most prolific was C. W. Peach, regarded by his contemporaries as "one of the most active and zealous of palaeontologists." In more recent times palaeontology is poorly represented, since it is now dealt with mainly by geologists.

Such then, in brief outline, have been the main activities of the Society. It is hoped that this account may convey some idea of the work of past and present members, and of the trend of botanical investigation during the last hundred years. Throughout the century the Society has maintained its position in two ways: firstly through the original work and

personal investigations of its Fellows, and secondly through the communication of each important advance made outwith the Society to the Fellows by those of their number who had familiarised themselves with such new developments. For the future, what better can be hoped for than that the same spirit will keep the Society ever abreast of the scientific developments of its time?

