

**Address at the opening of the medical session in the University of Glasgow
/ delivered by F.O. Bower, M.A., Regius Professor of Botany, October 27,
1885.**

Contributors

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ADDRESS

AT THE

OPENING OF THE MEDICAL SESSION

IN THE

UNIVERSITY OF GLASGOW,

DELIVERED BY

F. O. BOWER, M.A.,

REGIUS PROFESSOR OF BOTANY,

OCTOBER 27, 1885.



GLASGOW:

JAMES MACLEHOSE AND SONS, ST. VINCENT STREET,

Booksellers and Publishers to the University.

1885.

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ADDRESS.

PERHAPS the strongest impression made on my mind by the experience of my first session among Scotch students is, that you are in real earnest: here there is little of that beating about for a profession so often seen among the undergraduates of Oxford and Cambridge: the minds of the majority of you are made up, and your time in the immediate present and future is clearly mapped out. The first object with most of the students who come under my hands is to qualify at this University for medical practice, and they take the course of instruction in Botany as a means to that end.

This clear definition of your aims at an early period in your career at the University, while it is in most cases an advantage to the individual student, is, I venture to think, a decided disadvantage to the University as a seat of purely scientific learning: the result of it is that comparatively few students are found to devote time to pursuing a science further than the passing mark, so that there is thus a tendency to stagnation of all those sciences which do not happen to lead directly to professional or financial success. This is unfortunately the case with Botany: though there

are good positions open to those who can afford to wait, or who possess marked ability, still under present circumstances it is not a science in the pursuit of which a man of average intelligence is likely to earn a livelihood at once, and it must be confessed that the number of students here who pursue it into its higher branches is accordingly small. It is only at a comparatively recent date that the encouragement of a degree in science has been offered to students in this University: as the number of candidates for this degree is increasing in a marked manner, we can hardly form an opinion as yet what the future of our school of pure science may be, or how far it may be strengthened by increased facilities for study. For the benefit of those who prepare to present themselves in Botany, I shall certainly hope to establish an advanced class at the earliest opportunity, on a permanent footing. Now, the success of an elementary class, and even in a higher degree that of an advanced class in Botany, depends largely upon their accommodation in rooms specially adapted for their specific purpose, but in much greater degree upon the near proximity of a well-conducted Botanic Garden, from which an unstinted supply of varied, and often rare material can be obtained. At present, as you know, all our students of Botany, whether elementary or advanced, have here in Glasgow exceptional advantages, in their free access to a Garden, with admirable plant-houses, containing collections equalled by few others in the empire. We are all aware how the very existence of this Garden for the future is at this moment a matter of uncertainty: how the city of Glasgow now has the fate of the Botanic Gardens in its hands: it has now a golden opportunity the like of which, I be-

lieve, no city has ever had before, of taking over houses ready built, and collections ready made: by keeping the Botanic Gardens up on their present footing the city may adopt an enlightened policy of encouragement and support to the most generally popular of the sciences, while at the same time it may join hands with its University and raise from the ruins of the old Botanic Institution an establishment worthy of a great city and of an ancient seat of learning. A single example may be given from among the many possible lines of mutual accommodation and development which such an alliance might foster. The many valuable specimens which come to maturity are at present allowed to rot: with due care and skill these might be preserved, and if necessary dissected, labelled, and described: in course of time a fine museum might thus be constructed at comparatively small cost: the chief requisite is technical knowledge, for which the city might look to its University, while both city and University would reap the benefits.

But, on the other hand, the city may see fit to take a retrograde step; it may, by adopting a contracted, and I might even say a somewhat pharisaical view of its limits and its duties, decide to sell or let the land for other purposes, remove the houses, and disperse the collections. By so doing it would at once lower itself in the eyes of the civilized world, and greatly increase the difficulties of teaching the science of Botany in this University. Were the Town Council, representing one of the greatest centres of industry in the world, to adopt the latter course, its action would indeed be a strange commentary on the address of Sir Lyon Playfair at the recent meeting of the British Association at Aberdeen. He there pointed

out how close the connection is between the active pursuit of science and commercial prosperity, and on this ground called for further encouragement to teaching and research. It is not my province to discuss the financial or municipal aspect of the present crisis, nor would this be the place or time to do so; but I cannot let this opportunity pass without stating my very firm conviction that the maintenance of the Garden as a Botanic Garden is of vital importance to the successful teaching of Botany in this University, and it is only those who have been, or are actively engaged in teaching, who can really appreciate the gravity of the present crisis to us as a school of medicine and of science. Let us hope that those with whom the decision in this important question rests may duly feel the responsibility of the power which they hold, and may realize that other and weightier interests are involved than the mere existence or non-existence of a public pleasure ground.

In order to show how deeply the medical school (as apart from the school of pure science) is interested in the fate of the Garden, and at the same time to define in some measure what I take to be my position among you as a teacher in the Medical Faculty, I think I cannot do better than point out as clearly as I can what I consider to be the bearings of the science of Botany as it is now taught upon the education of a medical man. A certain knowledge of Botany has always been expected of those who present themselves for the medical degree in the Scotch Universities, and I hope to be able to show you that though in Botany, as in other things, "the old order changeth, giving place to new," still the advantages to be gained by medical students from an elementary study of Botany

are to-day not less, but rather greater than in the distant past. I am well aware that a different opinion is very widely spread, an opinion which was clearly put in a recent issue of one of the local papers. It is there stated that the Botanic Garden "is frequented at times by medical students, who go under compulsion, cram a few facts for examination, and forget as quickly as possible a study which is of little use in their profession." Such an opinion, if it have any foundation at all, is, I venture to think, based upon ignorance of the facts: either those who hold this opinion have not given the subject their proper attention, or they judge the present by experience of the more or less distant past, having perhaps themselves taken a course of Botany some twenty years ago, or more.

In the old days it was almost exclusively classification and external morphology of the higher plants which were taught to medical students, the idea being, no doubt, that in addition to the advantage of the study as a mental training, a country practitioner should be able to recognize his own "simples," or that a medical man on board ship should be ready to play the part so graphically described in the novels of maritime adventure, when ships are wrecked upon desert islands, and the medical officers recognize at once among the plants growing on the islands such species as will supply all the pressing needs of the shipwrecked crews. In these days of penny postage and parcels post, the supplies of the wholesale dealer have direct access to the most outlying districts, so that a practitioner who does not know *Digitalis* from a turnip can supply himself with all he needs. Probably not one student in 10,000 will ever be wrecked

on a desert island, and, on account of that possible one, it is not to be expected that 9,999 of his fellows should be put through a course of special instruction. Thus the teaching of classificatory Botany to medical students must, at the present day, be justified on other than directly utilitarian grounds. It will be admitted by all who have studied this branch of our science that, where pursued in a proper spirit, it is most valuable in quickening the powers of observation, of apprehension and weighing of facts ; it draws out and strengthens that faculty of diagnosis, which is so indispensable to the medical man. On these grounds classificatory Botany may well retain a place in our curriculum, but not to the exclusion of other branches of the science which are in my opinion more important factors in a medical education.

About twelve years ago British Botanists, who had previously been for the most part calmly contented with their supremacy in classification, suddenly awoke to the fact that in other branches of their science they who had formerly taken the lead were left far behind by their continental colleagues. Anatomy and physiology of the higher plants, and the morphology of the lower forms hardly figured at all at that time in the courses of instruction in this country, and were pursued in private only by very few : in fact, the study of Botany in the laboratory was almost a thing unknown. The awakening was followed by a change little short of a thorough revolution in the style of teaching of our science. Under the new *régime*, instead of the attendance at lectures together with demonstrations of the natural orders being the chief features in a botanical course, the lectures are supplemented largely by laboratory instruction, and it has even been found more useful by

some teachers, where the classes are small, to drop the advanced lectures altogether, and merely to give laboratory direction, together with instructions to the students as to what they shall read. This movement, which started in London, soon spread to the Universities throughout the country, and it is now some six years since my predecessor, Professor Bayley Balfour, established laboratory teaching on a firm basis here in Glasgow. This change in the style of teaching of our science is quite in keeping with the spirit of this age of enquiry. The mere statement of a teacher is hardly sufficient for the true student of to-day: he must needs see for himself, and draw from direct observation the confirmation of what he has been told. At the same time this change in the method of teaching gives Botany an entirely new *raison d'être* in the medical curriculum, which few within our medical schools, and hardly any outside them, have as yet appreciated. We may well devote a short time to the consideration of the new method of teaching, and the special parts of the science which are now brought into prominence. Instead of merely hearing a course of lectures, seeing diagrams, and observing the outsides of plants, the student is now invited (though here in Glasgow he is not compelled) to see and investigate for himself in detail in the laboratory those points of structure, development, and, to a certain extent, of function which are described in the lectures. It will be my object, while making the course of lectures sufficiently independent of the work in the laboratory, to be intelligible without it, so to construct the theoretical and practical courses that they may run parallel with one another, and together form one whole. Supposing that this complete course be taken, we may now proceed to consider

what advantage a medical student may derive from it. Having heard in the lectures a detailed description of the external form and the minute structure of the organs of a typical plant, he will by the help of the microscope set about their practical analysis in the laboratory; thus in the first place he will become accustomed to the use of the microscope and ordinary microscopic methods, so that when he proceeds to the physiological laboratory he will be able to give his undivided attention to his histological work, instead of being hampered by difficulties in the use of the instrument. It is of the very first importance while introducing the student to the use of the compound microscope, whether on animal or vegetable tissues, to give him clear ideas on two points, otherwise his microscopic work will be of little use to him. Firstly, he must be led to realize the relation of size of the objects seen under the microscope to those visible with the naked eye, and the microscopic study of a vascular bundle, which he can easily see without the instrument, will make this plain to the beginner. Secondly, he must gain a clear conception of the exact position which any section he cuts bears to the whole organ from which it is taken. Now, the organs of plants are so frequently of simple cylindrical form, and the tissues are so often arranged with almost diagrammatic regularity that they are peculiarly fitted for assisting the student to overcome this difficulty. In the next place, he will acquire some skill in cutting sections, and it is with the express object of cultivating dexterity of manipulation, which is so important to the surgeon, that I avoid ready-made preparations, and encourage students to prepare and mount their sections themselves. Thirdly, he will gain facility in the interpre-

tation of what he sees under the microscope ; and it is here that the study of vegetable tissues is of peculiar value. Anyone who has compared the minute structure of animal and vegetable tissues will, I think, admit that the latter are the better suited to the beginner: the firmness of the tissues, often making previous preparation by hardening unnecessary, the clearly-marked cell-walls, and the definite and easily recognized forms of many of the elements, together with their often regular arrangement in clearly limited groups, all mark vegetable tissues as peculiarly well suited for early essays in microscopic work. Further, if sections be cut in certain definite directions from a cylindrical organ (for instance, transverse, tangential, and radial) it is comparatively easy to translate the results of observations in these several planes into an idea of the whole organ as a solid body. If in this way the idea of the structure of the cylindrical organ, *e.g.*, the stem of the Elm or Pine, be built up synthetically from the results of its microscopic analysis, I can hardly conceive of any better training for the beginner in microscopy. Any intelligent man can do it, and once it is done he acquires a surprising increase of power. I well remember in my own case the benefit derived from my first complete study of a thickened stem.

But the new method of teaching is not limited to the mere description and observation of the forms and modifications of cells, however great the educative value of this may be. We proceed farther to the detailed observation of the protoplasmic body of the cell, and of the various bodies included in it, such as plastids, starch granules, aleurone grains, fats and oils, sugars, crystals, etc. These having been described in the lectures, and their place in the economy of the

plant explained, they are demonstrated in the laboratory, and by means of micro-chemical reactions their actual nature is as far as possible illustrated. This part of our subject has more than a mere theoretical or generally educative value for the medical student. If he acquire an adequate knowledge of the chief plastic substances of the plant-body, he will be in a position to form an opinion as to the specific value of the various vegetable food-stuffs in common use, and of their adaptation severally to the varied requirements which arise in a general practice. It is my intention in my future teaching among you to lay much more stress upon this part of our subject, and to devote a considerable portion of the time allotted to Botany to the investigation of the constituents of the common vegetable foods, so that the student passing from this University into practice may be in a better position to diet his patients, not merely by a rule of thumb, but may bring some clear knowledge to bear upon his advice.

This part of our subject will lead on naturally to a discussion of the dependence of the animal on the vegetable kingdom—a dependence which throws into the greatest prominence the importance of the process of assimilation or amylo-genesis in green plants. A man who gains a clear conception of the main points in this process, and sees how its first products are the starting point for the elaboration of the varied organic substances of plants and animals, gains a breadth of view which cannot be otherwise attained; he looks upon the organic world in a new light—in point of physiological interdependence all the organic world is for him a connected whole. Then proceeding from this assimilating process as the starting point, we may

trace how, directly or indirectly, those stores of nourishment are laid up by the plant for its future use, which man has diverted for his own purposes as food. We may investigate their mode of transfer from point to point, and finally see how they are used up by the plant in the processes of growth. So the student will be led by gradual steps to a general idea of the physiology of plants. It is but a step from the physiology to the morphology of plants. The two branches of the science are so closely connected and interwoven that neither can be adequately studied without the other, while they mutually throw light one upon another. It is our object in teaching at the present day as far as possible to trace and accentuate this connection, so that since the first principles of vegetable physiology have their importance in the medical curriculum, the study of external form, as well as of internal structure, follows as a natural corollary. For the illustration of this connection between external form and function a liberal supply of varied specimens is required, such as can only be obtained from a well-established Botanic Garden. Without such a supply these branches of our science would resolve themselves into mere paper work and barren description. If the Botanic Gardens were closed, and our supplies thus cut off, there would then be some excuse for students resorting to a system of senseless cramming, from which we are not even now entirely free.

As I have already stated, the teaching of Botany in the old times was almost entirely confined to the higher plants. At the present day the limits of the vegetable kingdom are the only limits to our scope. This change is due in great measure to the advance of our knowledge, in the first instance by the re-

searches of the great Hofmeister, in whose hands comparative morphology of the Vascular Cryptogams first took a definite shape. He and his successors, deriving new impulses from the Darwinian hypothesis, have now indicated roughly, if not definitely, the probable lines of affinity. Our knowledge of the lowest forms still leaves much to be desired, but from the whole series it is easy to select representative types, of which our knowledge is relatively complete, and which illustrate the more prominent characteristics of the group to which they belong. The life-histories of such types are described in the lectures, and, as far as possible, their successive stages are traced in the laboratory. Passing by gradations to the lowest forms, the student has thus placed before him a series of types which may indicate to him the probable line of development from the lowest to the more elaborate forms. At the lowest limit he sees those organisms over the possession of which the zoologists and botanists still quarrel, which is in itself sufficient indication of the difficulty, I may say the impossibility, of placing a barrier between the two kingdoms. Thus, putting together the results of his work in Zoology and Botany, the practical student will gain, by actual personal observation, that broad view of the two organic kingdoms, as two divergent series, starting from a common point, and terminating in the one case in the Gamopetalous Dicotyledons, in the other case in himself.

But beyond the advantage gained by breadth of view, the study of certain of the lower organisms has its direct bearing upon the study of medicine, while others attract more than ordinary interest, since they affect the success of some of our most important crops.

Under the first of these heads may be placed the Ergot of Rye, and Bacteria; under the second the Potato disease, with its direful results on that most important crop, and *Puccinia*, the Rust of Wheat.

In what I have now said it must not be thought that I intend an apology for the retention of the subject of Botany in the medical curriculum. In my opinion no such apology is needed, since the change in the method of teaching. My object has been rather to indicate to you the difference between the old style of teaching and the new method, the introduction of which amongst us here we owe to the energy of Dr. Balfour. Further, it has been my object to point out some of the bearings of the subject, as it is now taught, upon the medical education; and the general conclusion to be drawn is this, that it is practical work (either at home or in the laboratory) joined with lectures, rather than the lectures alone, which give the science its true *raison d'être* in the medical course. Without personal observation, there is perhaps no science which is in greater danger than ours of degenerating into barren and senseless book-work. This may be prevented partly by practical laboratory work, partly by the establishment of a student's series of museum specimens properly dissected and described. The pressing need of some such museum has been amply illustrated by my experience of the recent examinations, and I feel confident that, if students were assisted in their work by easy access to suitably prepared specimens, the results of our examinations would be very much better than they are. The importance of laboratory work has been clearly recognized by at least two of our great Universities—Cambridge and London. In both

these institutions a practical examination in general Biology, which is in fact under the new schedules tantamount to practical examinations in Botany and Zoology, is obligatory on those aspiring to the medical degree. This regulation is in both Universities of comparatively recent date. Now, we know that such changes in the regulations of the University of London are the result of the deliberations of the Senate, a body including some of the leading men of the day in medicine and science ; and hence we may trace in this imposition of a practical test of the knowledge of Biology possessed by candidates for the medical degree the verdict of those leading men that a practical knowledge of the subject is of sufficient value in the medical training to justify the necessary time being spent upon it. I do not say that such a verdict is to be swallowed whole by the Scotch Medical Schools ; but, nevertheless, such an expression of opinion is worthy of careful consideration.

My second object, and perhaps at the present juncture the more important of the two, has been, while showing that Botany is a useful factor in the medical course, to express in the most unqualified way my opinion, that the science cannot be satisfactorily taught without a Botanic Garden. Some may think that in laboratory teaching a garden is less necessary than it was in former times, but this is not so : the material necessary for our work in the laboratory must often be carefully watched, and taken exactly at a certain period. Two examples will suffice to illustrate this : when it is desired to study the fully developed contents of the embryo sac, the flowers in question must be taken as a rule exactly at the period of pollination, otherwise the results would be compli-

cated by earlier or later stages of development, which would sadly confuse the elementary student. Secondly, when it is desired to study the process of nuclear and cell-division, the material should be fixed at once, not even a short interval should be allowed to elapse between cutting the organ in question and placing it in the hardening re-agent. Now, the want of a Botanic Garden would place serious difficulties in the way of demonstrating either of these important points to students.

I would earnestly recommend these facts to the consideration of those who have influence in connection with the fate of the Garden. Putting on one side the importance of retaining the Garden as an open space of public resort, let them ask themselves, Is Glasgow smaller or poorer than in 1818, when the Royal Botanic Institution received its charter? Is the public interest in science any less? Is the number of students in the University smaller, or the medical profession less worthy of consideration? and lastly, is it creditable that, when other towns are establishing Botanical or Zoological Gardens, the rich and intelligent city of Glasgow should calmly discuss the demolition of its fine collection? * There is no one, I think, who can honestly answer any of these questions except in the negative; and, moreover, as I feel sure that the large majority of the community must be in favour of keeping up the Gardens, I can hardly believe that the present crisis can have any other than a satisfactory issue.

But while the final decision is pending, one of the

* "Arrangements are being made for the establishment of a Zoological Garden in Christiania."—*Nature*, Oct. 8, 1885. A circular has recently been sent to Botanists and others, announcing that it is intended to establish a Botanic Garden in Montreal.

valuable assets of the old institution is being seriously depreciated. It happens that in the balance sheet of the Royal Botanic Institution the collections themselves are "not valued"; but for that reason it must not be thought that they are without a market value. Such specimens as our Tree Ferns, Cycads, Palms, and Orchids command high prices. Already the fact that the Gardens are underhanded (owing to a diminution of the staff in order to reduce expenditure) is only too plainly visible to the experienced eye: a botanical collection is a very delicate thing, which immediately suffers from want of due attention. Seeing the present starved condition of the institution, I confess I view with dismay the prospect of eighteen months more of living on narrow means. We gain, it is true, the convenience of a breathing space, but it is gained at the cost of the collections themselves, which are, as I have said, a valuable asset. Still more do I fear the result of making up any deficiency in the accounts by sale of plants, etc. In our endeavours to save the more valuable specimens, still more of the time of the staff will have to be devoted to the propagation of less important plants, and still more will the former have to be neglected. Further, it is to be remarked that, if the present admirable collections be even partially lost to us by want of due attention, the difficulties of ever filling them up again would be greater than those under which they were originally made. By reason of its continued and increased sales of plants the Garden will have lost the confidence not only of the dealers with whom it would thus compete, but also of similar public institutions, from which, as well as from the dealers, a great portion of our collection was derived on an understanding, tacit, if not

explicit, that sales of plants should not be continued or resumed. It can hardly be considered creditable to a wealthy community like the city of Glasgow that an indigent society, founded for its pleasure and profit, should be forced to act in a manner which in a private individual would never be tolerated among commercial men. I know that I am not alone in protesting against this breach of faith with the dealers and with those public institutions to which we owe so large a portion of our present stock. But whether our revenue for the coming eighteen months be derived from the City, from special subscription, or from these ill-advised sales of plants, it is clear that if it is intended ultimately to keep up the Gardens on their present footing of efficiency, every effort must be made to prevent the loss of any important item in our present collection, and with this object in view a staff equal to that at present employed must be maintained throughout the period of uncertainty, so that the directors may be able to hand over the establishment in good condition to its new owners.

If we allow ourselves to look forward to the possible, I may almost say the probable future, when the City shall have undertaken the care of the Gardens on their present footing, we may see various ways in which their usefulness might be greatly extended. Not only may the University obtain the supplies upon which it is dependent both for elementary and advanced students, but also the citizens of Glasgow would be able to acquire a considerable knowledge of plants gratis. Further, by the construction of a suitable museum, which, as I have stated, requires constant and skilled attention rather than large expenditure, the educative value of the Garden might be greatly

increased. If such a museum were formed, it might well be housed in a building which should serve as a lecture room. In this the University lectures might be given, as was the custom of old, until the accommodation became insufficient: it was indeed obligatory on the Botanic Institution to supply accommodation for the lectures of the Professor of Botany in the Garden, in respect of the subscription of £2000 by the University. In addition to University lectures, however, popular lectures might also be given for the general public. For my own part, I should be disposed strongly to support such a movement for the popularization of our science. If a lecture room be established with this double object in view, laboratories, and a herbarium, so useful in controlling the nomenclature in a Botanic Garden, might be grouped around it, and so we might ultimately obtain in Glasgow an establishment worthy of so great a city, in which, as in those of Edinburgh and Oxford, all the accommodation necessary for the pursuit of the science would be found within the Garden itself. If this very desirable end be ever attained, I see no reason why Glasgow should not become one of the most important centres of Botanical learning in Europe.