

SCIENCE

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THE WORK OF A BOTANICAL LABORATORY IN PHARMACEUTICAL MANUFACTURE.

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BOTANY is constantly growing in economic importance, each year we see some new and valuable practical application of it in industry or science. The many botanical laboratories maintained in connection with agricultural experiment stations testify as to its important work in agriculture. Brewers have seen so much practical value in botanical study of yeast that laboratories for this purpose have in some instances been

established in connection with their plants; while it plays such an important part in the study of disease that many well-equipped hospitals and quarantine stations are provided with facilities for botanical investigation in the line of bacteriology.



GENERAL VIEW IN LABORATORY.

In pharmacy, botany has always occupied an important place, our first drugs were of botanic origin, and each year has added new plant products to drug-lists until now the hundreds of botanic drugs make, at least, a fundamental knowledge of botany a requisite for scientific pharmaceutical work, so that it now forms a part of every thorough course of study in pharmacy.

Though it bears this close relation to pharmacy, many persons, who should be acquainted with the facts, ask what service a botanical laboratory can render a pharmaceutical manufacturing establishment, so this article shall attempt to explain briefly the equipment and work of such a laboratory; as the writer is aware of the existence of but one such in this country, the article is of necessity an account of it.

Facilities for good systematic work are of the highest importance in such a laboratory, and in the one referred to there exists an herbarium of many thousands of species, representing the flora of the United States, and containing numerous forms from Europe and other foreign regions. An essential feature of the laboratory equipment is a jar collection of crude drugs representing nearly all the authenticated botanical products which enter

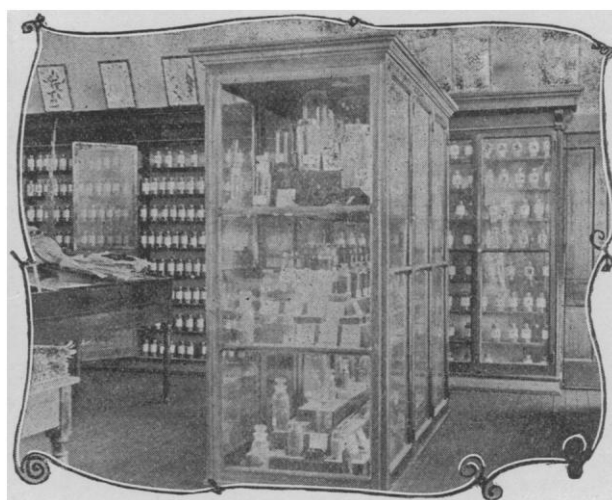
into the manufacture of medicines. In connection with this, a line of crude drug adulterants is being collected.

A dissecting microscope, a good compound microscope with line of eyepieces, objectives, and other accessories provide means for microscopic work. A hand microtome, a large Bausch & Lomb laboratory microtome with reagents, and all necessary materials for staining and mounting sections comprise the outfit for histological work.

In addition to the study of herbarium specimens and cured plants, means are provided for work upon living plants, through the erection, in the laboratory, of a large glass propagating case, in which seeds are germinated and plants grown for study.

The laboratory is supplied with current botanical and microscopical journals, with standard texts and manuals on botany and pharmacy for reference. Briefly, in its equipment, the laboratory is not essentially different from that of any college in which systematic and structural botany are taught, except in point of number of workers for which it is arranged.

The laboratory was founded to provide accurate and scientific means for examining and identifying crude drugs. Many hundreds of botanic products find their way into medicine. These include roots, barks, leaves, flowers, fruits, and, in many instances, entire plants. As the list comprises drugs of widely diverse values



CRUDE DRUG COLLECTION AND MUSEUM CASE.

and effects, and many are liable either to intentional or unintentional adulteration and substitution, it becomes necessary to give each lot of drugs received careful inspection. These examinations are made by the botanist in charge, and, in cases of the least doubt, literature giving the physical appearance of the drug is consulted; the herbarium sheet specimen is used, and, if the material be leaf, flower, fruit, or herb, it is easily proven to be false or true. After identification, the drug is further examined as to its physical condition, compared with the standard jar specimen, and, if found to be in proper condition, labeled and passed into stock.

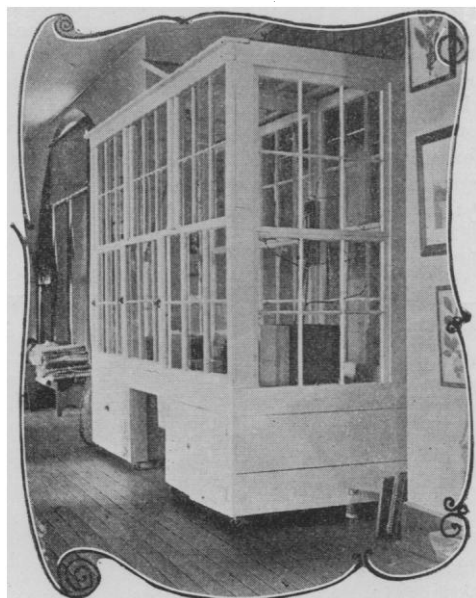
In all this work the herbarium has a constant use and is essential to careful examination of many drugs. It is highly valuable in the detection of substitutions and adulterations, and in many cases is the only means by which the determination of these sophistications is rendered possible. While it is important to know of a substitution or an adulteration, it is almost equally important to know of what it consists. Were the herbarium less general in its character, including only recognized medicinal plants, a great part of its usefulness would be destroyed, as only by careful comparison can some vegetable adulterants be located

in their proper genus or species, the parts being generally too fragmentary for using ordinary methods of determination.

Many drugs are received, the physical appearance of which alone is not a safe criterion for verification; barks, leaves, stems, and roots often arrive in a crushed and broken condition, which renders it very hard to tell whether or not they are what they purport to be. In such cases the appeal is to the microscope, and here an outfit for histological work has its use. Sections are prepared; the cell-structure and arrangement of tissues almost unerringly reveal the identity of the material. A set of slides of the official parts of plants has been commenced and will form a valuable part of the laboratory's equipment.

In the examination of powdered drugs, the compound microscope is indispensable; crystals, starch granules, and fragments of cells often betray adulterations at a small outlay of labor. In addition to the use of the microscope in drug inspection, it is a necessity in investigation along the line of pharmaceutical botany.

Interesting and practical results are expected from the cultivation of medicinal plants in the propagating case. Medicinal plants are grown from the seed with the purpose of learning more about their life history; seeds of adulterants are germinated



PROPAGATING CASE.

in hope of ascertaining the origin of the adulteration, and other work of similar nature, relating to pharmacy, is in progress.

Correspondence relating to botanical origin of drugs and plants, which arises in connection with business, is attended to by the botanist in charge, and in this work the laboratory is of much service.

Daily practical demonstrations are seen of the use of a botanical laboratory in connection with the trade. As an aid in the examination of drugs alone the laboratory finds its existence justified. As a means for investigation, it has great value, and through such means alone can some things, very important to the trade, be worked out.

The discoveries and determinations of adulterations of jalap, cubebs, Arnica flowers, Calendula flowers, and many other important drugs was only possible because botanists worked upon them; it cannot be said to have been otherwise, as pharmacists who have made these discoveries have had botanical training, used botanical methods, and succeeded in so far as they were good botanists.

The laboratory referred to in this article was founded primarily to provide accurate and scientific means for determining plant products used in manufacture; the acquisition of an herbarium which includes representatives of families and genera not medicinal, the provision for plant culture, histology, and microscopy is in recognition of the fact that botany in a broad sense has a direct and practical bearing on pharmacy.

ON THE EMERGENCE OF A SHAM BIOLOGY IN AMERICA.

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THOSE whose attention, during the past fifteen or twenty years, has been directed towards the various phenomena attendant upon the establishment and modification of university *curricula* will scarcely have failed to notice, in certain quarters, an interesting eruption of courses in biology. Upon even a casual examination these courses, in almost every case, turn out not to be courses in biology at all, but courses in zoölogy masquerading under an attractive but deceptive name. Chairs of biology occupied by men practically ignorant of one-half of the content of the science they profess to teach are not unknown in institutions otherwise altogether reputable. This ignorance of theirs is not merely the normal failure to push beyond the beach-line of the great unknown ocean of truth, but is a failure to comprehend or admit that the ocean extends away equally in both of two directions rather than in one alone. When one remembers how intolerant are most men of liberal education when they discern through the thin veil of pretence the deformity which it tries to hide, it seems remarkable that more vigorous protests have not already arisen against the sham biologist and the sham biology. It is because the writer believes that opportunities for a development of the true biology are lost, sometimes, through the mistaken acceptance of the sham, that he ventures upon the unpleasant task of pointing out what, after careful examination, seem to him the places where the healing cautery should be applied.

First of all, it is important to note what should be the proper limitation of the term "biology." Historically and etymologically it is still to be defined as by Lamarek and Treviranus—both distinguished botanists—who invented it. It is indeed the science of living things; it is that vast mass of knowledge bearing upon the organized world of plants and animals. Biological science is therefore to be set over against physical science in the broadest sense, and is to be considered as a generic name, under which are grouped the specific sciences of botany, zoölogy, and doubtless also psychology, if that is to be considered as co ordinate with zoölogy rather than as one of its subdivisions. Here, then, is the proper definition: "Biology is the science of living things." These are the two groups of subject matter: Plants and animals.

In Germany, and sparingly elsewhere in Europe, a limited and secondary meaning is imparted to the word "biology." Of this use an excellent example is furnished by Wiesner,¹ who groups together the various phenomena of inter-relation between plant and environment under the name of *Pflanzenbiologie*. To this restricted use of the term, Strasburger² very properly objects, characterizing it as "fälschlich bezeichnet." This employment of the term, as if it were synonymous with Ecology, does not, however, seem to be prevalent in America, where is to be found the third and most misleading use of the word— as generally exclusive of botany and sometimes also of zoölogy. For example, at Columbia College their exist together departments of botany and biology,³ and, upon examination of the courses offered in "biology," it appears that they are almost purely courses in animal biology, and indeed this modified term is quietly brought forward in a foot-note. At Columbia College, then, it is apparent that the subject of botany, since it stands by itself under its own organization, is supposed, at least by the "biologists" of that institution, to be quite without the pale of their own science. And a further examination of the circular shows that the biological work is in the hands of zoölogists, both the professor-in-charge and the adjunct-professor being known to the scientific world only through zoölogical research and not through botanical.

The department of biology, then, at Columbia College seems to the writer to have false colors flying at the mast-head.

It is concerning the false use of the word "biology" in some American institutions that I wish particularly to speak. I have

¹ *Biologie der Pflanzen*, Wien (1889).

² *Bau und Verrichtungen der Leitungsbahnen*, vorwort viii., Jena (1891).

³ Columbia College Circular of Information, Pt. IV., pp 44-45 (1892-93).