

4. Infusions of digitalis were prepared in different ways. In each case the marc was washed and dried, after which it was used for the preparation of tincture, and this tincture was tested on cats in order to determine to what extent the active principles had been extracted during the preparation of the infusion.

5. The official infusion does not represent the drug completely; hence the standardization of the leaf does not insure uniformity in activity of the infusion. The variability of the infusion is at the expense of the more absorbable of the active principles.

6. The infusion prepared according to the simple method described represents the activities of the leaf completely; hence it permits of uniformity when a standardized powder is used for making it. It may be used in place of the tincture in doses just ten times the volume of those of the latter, and it becomes a matter of indifference, so far as therapeutic effects are concerned, which is used.

7. We have been unable to discover any experimental evidence to support the view, still held by many, that there is a necessary qualitative difference between the actions of the tincture and those of the infusion of digitalis, even when the latter is prepared properly.

8. An infusion of digitalis prepared in the manner recommended, and kept in completely filled and hermetically sealed bottles for more than two years and five months, retained its activity unimpaired, as shown by the results of tests on cats and by the therapeutic effects on man.

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## DIAGNOSTICAL ELEMENTS IN DRUG ANATOMY AND THEIR NOMENCLATURE.

BY THEO. HOLM, CLINTON, MARYLAND.

For several years the writer has been engaged in studying the morphology and anatomy in general of our native medicinal plants with the purpose of presenting the results in book form. Owing to the present extraordinarily difficult conditions relative to the publication of such work, involving many illustrations and quotations from similar works in foreign languages, there seems, at present, no possibility of securing a publisher to undertake the publication. Meanwhile, a tenth revision of the Pharmacopoeia of the United States is being prepared, and being well acquainted with the botanical part of the ninth revision, I thought that some suggestions relative to the diagnosis of a few drugs might prove useful to the collaborators.

In dealing with anatomical diagnoses of drugs as presented in the Pharmacopoeia I wish to point out that the distinction between root and root-stock (rhizome) is not always correct, causing erroneous statements as to the internal structure. Moreover, the structure itself is very often so poorly defined that it would be absolutely impossible to identify the drug in question by means of the structure quoted. We must, as a matter of fact, bear in mind that plant anatomy has developed to a remarkable extent during the last decennial; thus, structures formerly considered peculiar to certain genera are known now to be common to many others, besides that several new characteristic structures have been discovered, which *ad interim* are considered peculiar to some few families or genera. In other words, the anatomical characterization offered in the U. S. Pharmacopoeia might be made more helpful to

the student of pharmacognosy if the morphological structure were defined somewhat more precisely, and the anatomy of the drugs were considered from a more modern point of view.

Last, but not least, the botanical terminology used in the Pharmacopoeia is, in several cases, not in conformity with the one recently adopted and so excellently outlined in the comprehensive works of Haberlandt, Schwendener, and Strassburger; for instance:—fibro-vascular bundles, wood-fibers, phloem, xylem, sclerenchyma, bast-fibers, sclerenchymatic fibers, etc.

These various terms were formerly used to designate the elements of the conducting as well as the mechanical system in plants, but somewhat indiscriminately, and not in accordance with physiological botany. It was Nägeli who introduced the term fibro-vascular bundle, and in this way the mechanical and conducting tissues were combined so as to represent one anatomical element, although they are not only physiologically distinct, but, moreover, they often occur as separate tissues, not connected with each other. De Bary proposed the term vascular strand, thus excluding the mechanical tissue, and by this author the terms sclerenchyma, phloem and xylem were adopted, and these terms have been in use for many years. But since then Schwendener and Haberlandt have proposed some other terms, which have been unanimously accepted by the leading authors of works dealing with anatomy and physiology. By Schwendener the terms stereome and stereids were proposed instead of sclerenchyma and sclereids, but he retained collenchyma and libriform (Sanio), the latter applying to internal stereome, located in the stele. Schwendener, moreover, proposed the term mestome, for the phloem and xylem alone. Finally, Haberlandt introduced the terms leptome and hadrome for phloem and xylem, and these terms are now more or less generally accepted, as a review of the publications of recognized botanical anatomists, both in this country and in Europe, indicates. According to Haberlandt a complete mestomestrand thus contains the elements as follows:—leptome = sieve-tubes, companion-cells, cambiform and leptome-parenchyma, and *hadrome* = tracheae, tracheids and hadrome-parenchyma.

The term "endodermis" applies to the innermost stratum of the primary cortex in roots as well as in stems. Oudemans is the author who proposed this term. The pericambium (Nägeli and Leitgeb) is the tissue, mostly of a single stratum, located inside the endodermis in roots; the function of this tissue is to develop lateral roots, as well as cork and secondary cortex. Van Tieghem and Douliot proposed the term pericycle for not only the pericambium in the roots, but also for the more or less complete stereomatic sheath inside the endodermis of the stem. Finally, the term stele has been proposed by Van Tieghem instead of "Central-cylinder," and the term applies only to the tissues inside the cortex, and endodermis in stems as well as in roots.

The terms phellogen, periderm and cork are sometimes used in the Pharmacopoeia, but not always in the proper way. It must be remembered that periderm applies to the superficial protective tissue, which replaces the epidermis in stems, which increase in thickness. This tissue, the periderm, is composed of two elements: the cork and the phellogen; of these the latter represents a kind of meristem from which the cork becomes developed; cork may, however, also be devel-

oped from the pericambium in roots of Dicotyledons and Gymnosperms. When thus the cork arises from a deep-seated phellogen the peripheral tissues necessarily become deprived from conduct of water and dry up, and such dried parenchymatic tissue, belonging to the cortex, is called "Borke" by the Germans. The history and definition of these terms are to be found in various works.<sup>1</sup>

To illustrate these various points the examples which follow may be sufficient:—

*Podophyllum*.—(U. S. Pharmacopoeia p. 329.) The diagnosis reads:—"Under the microscope, a transverse section of the rhizome of *Podophyllum* shows an outer layer of one or two rows of reddish brown cells; parenchyma of cortex and pith with numerous single, spherical, polygonal, or 2 to 6 compound starch grains, or rosette aggregates of calcium oxalate; vascular bundles from 24 to 34, arranged in a circle between cortex and pith."

There is not a single point in this diagnosis which conveys to the reader the somewhat singular structure of the rhizome of this plant. The diagnosis should be written as follows:

"Under the microscope, a transverse section of the rhizome of *Podophyllum* shows a thin-walled cork of a brownish color, a thick-walled cortex with starch of large and small grains; endodermis and pericyclic stereome absent; mestome-strands about 30, collateral, arranged in an almost circular band, with the large hadrome V-shaped; some few mestome-strands near the periphery of the rhizome containing mostly leptome and cambium; pith large, thin-walled, with aggregated crystals of calcium oxalate."

So long as the drug often contains some roots, the structure of these in connection with the rhizome may be helpful to the identification, *viz.*:

"Secondary roots strong, but increase in thickness confined to the stele, most often pentarchic; cortex and pith broad, endodermis thin walled."

*Cimicifuga*.—(U. S. Pharmacopoeia, p. 111.) The diagnosis in the Pharmacopoeia of the rhizome does not give the essential structural points, as for instance: "the absence of endodermis and pericycle, the very deep rays of hadrome, destitute of libriform." And with regard to the roots, these show a most characteristic structure by the 4 to 6 mestome strands alternating with the very distinct 4 to 6 groups of proto-hadrome vessels, and separated from each other by a very broad secondary cortex. Moreover, it is characteristic of the structure that the increase in thickness does not involve the throwing off of the epidermis or the primary cortex; endodermis with numerous radial cell-divisions. By comparing the rhizomes with the roots of *Podophyllum*, *Jeffersonia* and *Caulophyllum* with *Cimicifuga*, *Cimicifuga* may be distinguished at once by the roots containing a secondary cortex. None of these points are brought out in the Pharmacopoeia.

*Hydrastis*.—(U. S. Pharmacopoeia p. 224.) There is no real diagnosis of the rhizome, which exhibits quite a peculiar structure, notably on account of the col-

<sup>1</sup>S. Schwendener, "Das mechanische Princip in anatomischen Bau der Monocotylen," Leipzig, 1874. G. Haberlandt, "Physiologische Pflanzen-anatomie," Leipzig, 1896. (2nd Edition). J. C. Schoute, "Die Stelärtheorie." Groningen, 1913. H. Solereder, "Systematische Anatomie der Dicotyledonen," Stuttgart, 1899.

lateral mestome-strands being arranged in a single circular band, with deep rays of secondary hadrome, embedded in a large, thin-walled parenchyma, but with neither endodermis, pericycle, nor interfascicular cambium.

*Aristolochia Serpentaria*.—(U. S. Pharmacopoeia p. 374.) The diagnosis in the Pharmacopoeia is so incomplete that it does not show the structure of a rhizome at all. There is a cortex, of which the hypodermal stratum is collenchymatic, and the cells contain chlorophyll and oil. The stele consists of a thin-walled endodermis, and a stereomatic pericycle surrounding about 10 collateral mestome-strands separated from each other by very broad rays of parenchyma, and connected with each other by strata of interfascicular cambium; the pith is excentric.

*Stillingia*.—(U. S. Pharmacopoeia p. 410.) The following, and most important characters, are not mentioned in the Pharmacopoeia:

“Laticiferous ducts abound in the secondary cortex: Stereids is present in the primary leptome; thickness of the roots depending on the numerous layers of cork, secondary cortex and secondary hadrome.”

*Gelsemium*.—(U. S. Pharmacopoeia p. 201.) The remarkable structure of the cortex being divided into two zones by the endodermis and pericycle, as well as several other points, are not mentioned in the official diagnosis.

*Sassafras*.—(U. S. Pharmacopoeia p. 379.) In describing the bark no mention is made of the sclerotic cells forming longitudinal rows in the cortex nor of the large mucilage-cells, oil-cells, etc.

Finally, the diagnosis of *Sarsaparilla* (p. 369) seems to apply to a rhizome rather than to a root. What is meant by “a porous central-cylinder” in the root of *Veratrum* (p. 486) is very uncertain. Under *Taraxacum* (p. 438) mention is made of “laticiferous vessels and sieve-tubes alternating with parenchyma,” which statement could be improved by replacing the words “vessel” with “ducts” and “alternating” with “separated by.”

As the drugs are described in the United States Pharmacopoeia, their identification by structure alone is hardly possible, for in too many cases the structure has not been given so as to show the most essential points, besides the botanical terms have not always been applied in the proper manner. It would be a great help to the students of pharmacognosy if the Pharmacopoeia contained some glossary of botanical terms explained in a few words, and some figures illustrating the most important features of the drugs in question, especially the anatomical structure.

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## DRUG TOPICS.\*

BY J. A. BAKER.

### No. 4. Bleached Coriander.<sup>1</sup>

At the request of Dr. R. H. True, at that time in charge of the investigations of drugs and medicinal plants for the Bureau of Plant Industry, the study of bleach-

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\* From the Laboratory of Edward Kremers.

<sup>1</sup> Extracts from J. A. Baker, “The Bleaching of Drugs,” Thesis, University of Wisconsin, 1911.