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STRUCTURE OF OUR CHERRY BARKS.

BY EDSON S. BASTIN,

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The knowledge that the barks of two or more of our native species of cherry were occasionally, at least, substituted for the official species has led to the studies set forth in this paper.

The species of cherry growing wild within the limits of the United States are the following: *Prunus Pennsylvanica*, Linne filius; *Prunus Virginiana*, Linne; *Prunus serotina*, Ehrhart; *Prunus demissa*, Walpers; *Prunus Avium*, Linne ; *Prunus Cerasus*, Linne; *Prunus Mahaleb*, Linne; *Prunus Caroliniana*, Aiton; *Prunus sphaerocarpa*, Swartz; *Prunus emarginata*, Walpers, var. *mollis*. Brewer; and *Prunus ilicifolia*, Walpers.

This list excludes the closely related plums and those species of cherry which do not attain dimensions greater than those of a small shrub.

Of the species listed the barks of the following have been studied and are here described and figured: *P. serotina*, *P. Avium*, *P. Mahaleb*, *P. Virginiana* and *P. Pennsylvania*. Efforts were made to procure the barks of *P. Caroliniana*, and of the Pacific Coast species, *P. demissa*, *P. emarginata*, and *P. ilicifolia*, but so far without success.

Prunus serotina, commonly called the Black cherry, is a tree of large size, common in the forest regions of the United States, from Minnesota, eastern Nebraska, and Louisiana, eastward to the Atlantic. It also occurs in southern Canada and Nova Scotia. It does not occur in the Rocky Mountains or west of them, except as cultivated in San Francisco and vicinity, and perhaps in the vicinity of some other cities of the Pacific Coast. It seems to attain its fullest development in the valley of the Ohio, where it sometimes attains the height of 100 feet and its trunk a diameter of 4 feet. Ordinarily, however, it is smaller, with a trunk 18

inches in diameter and a height of 50 or 60 feet. Its close-grained heartwood which is capable of taking a high polish, and which has a light red color, deepening with age, is highly valued for cabinet and ornamental work.

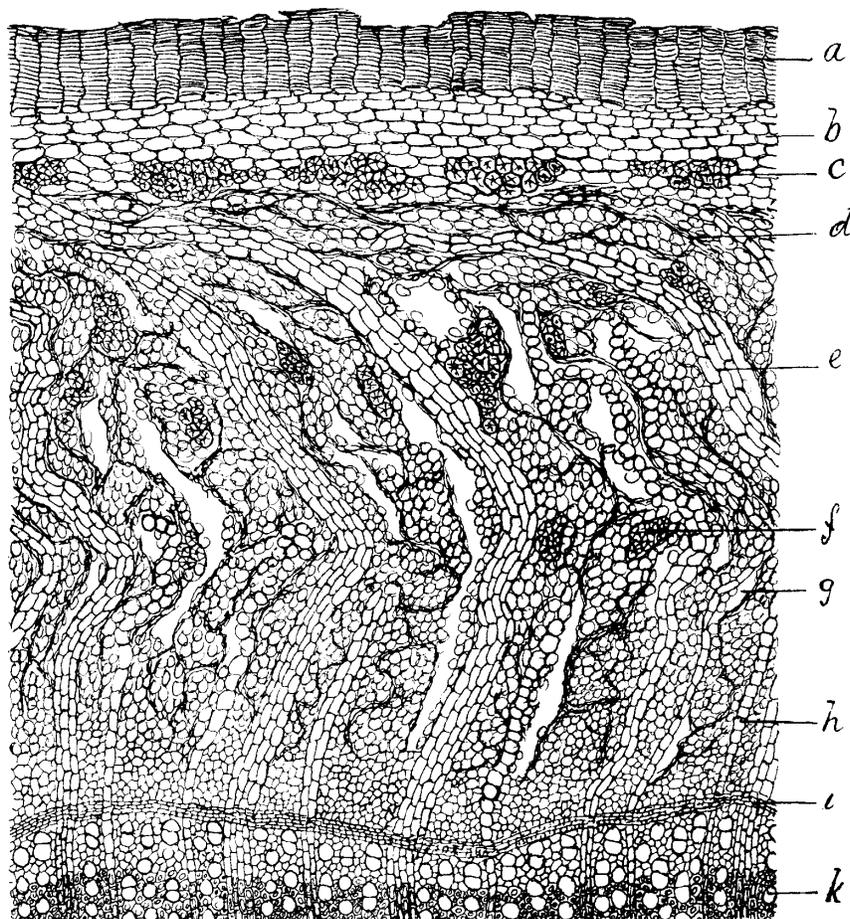


FIG. 1.—Transverse section of the stem bark of *Prunus serotina*.

The bark of the trunk is blackish-brown and rough exteriorly, the exterior corky layers exfoliating transversely in thickish but rather narrow pieces. The bark of the twigs, however, is smooth or even glossy, dark reddish-brown, thickly punctate with small whitish lenticels, and the corky layer may be readily peeled off transversely in a thin, papery layer, exposing the deep green middle bark beneath. The corky layer of the root, which is somewhat lighter colored, begins to fissure and exfoliate much earlier, and when the cork is removed it exposes a middle layer which is at first white, but, on exposure, soon turns ochreous brown. The leaves are short-petiolate, with thin, lanceolate, toothed, deciduous stipules, and elliptical, oblong, or oblong-lanceolate, taper-

pointed, appressed-serrulate leaves, which are usually obtuse, but sometimes acute at the base, and commonly have a pair of glands on the petiole near the insertion of the blade. They are smooth on both surfaces, thickish, and deep and somewhat glossy green on the upper, and much lighter green on the lower surface.

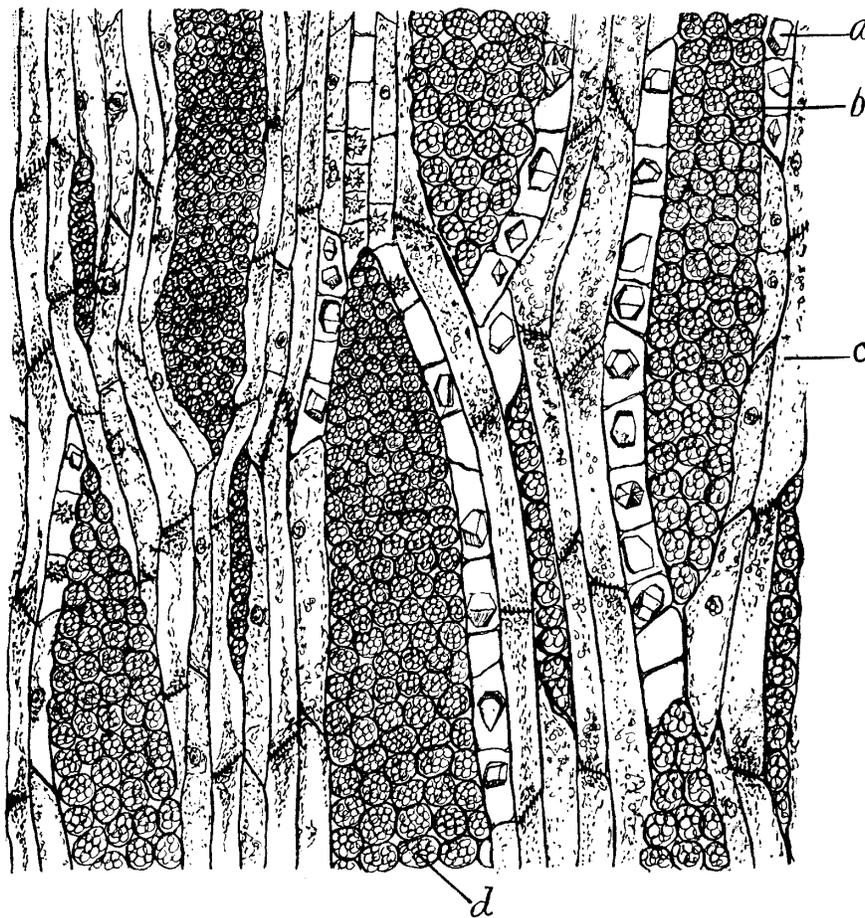


FIG. 2.—Longitudinal tangential section of inner bark of *Prunus serotina*.

The flowers occur in late spring, after the leaves, in simple racemes at the ends of small leafy branches. They are small, white and with a decided but not very agreeable odor. The drupes are small, round, about the size of peas, blackish-purple, destitute of a bloom, bitterish, but not decidedly astringent to the taste, and containing a roundish-ovate, marginless pit.

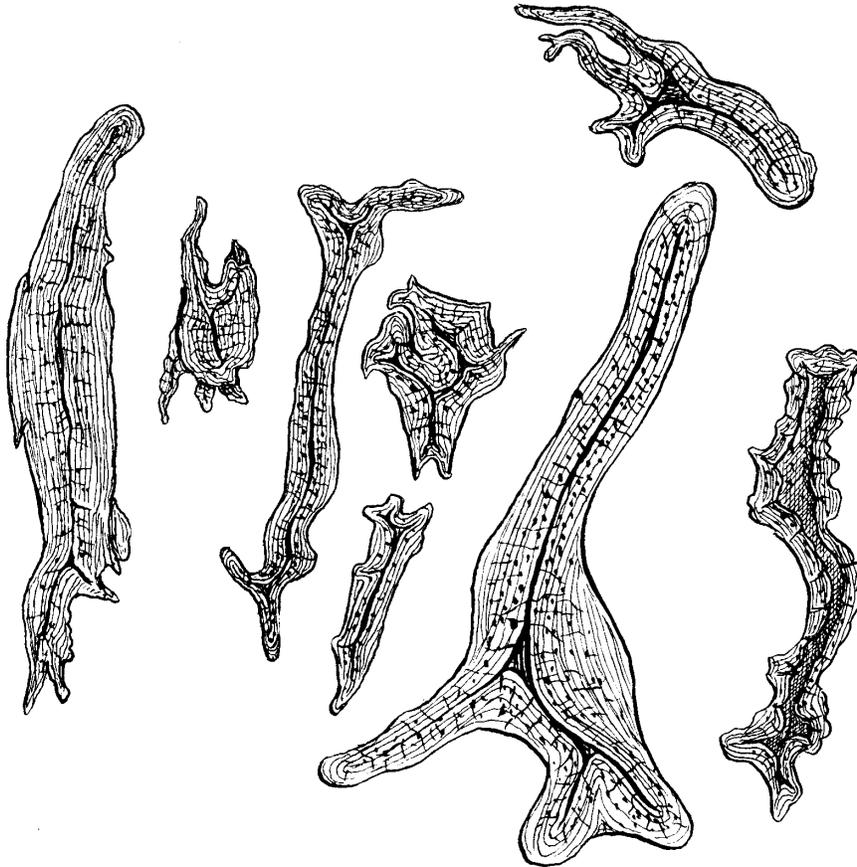


FIG. 3.—Sclerenchyma from bark of *Prunus serotina*.

Structurally the barks of the different species of cherries examined resemble one another in the following particulars:

- (1) The phellogen begins its formation in the first layer of collenchyma cells beneath the epidermis, and no considerable development of the phelloderm layer beneath takes place.
- (2) They all resemble one another in the facility with which the periderm layers are separated transversely into thin sheets.
- (3) The medullary rays in all the species are several rows of cells thick, though the number of cells differs somewhat in different species.
- (4) In all the barks examined the medullary rays are more or less wavy in their course, though less so in some species than in others.
- (5) All the barks show a strong tendency to fissure between the medullary rays and adjacent bast tissues.

(6) All of the barks, especially of the trunk and older branches, are rich in oxalate of calcium crystals, some of them containing it in such quantities as to make sectioning difficult.

(7) All of the barks possess a bitter, astringent and more or less aromatic taste, but the bitterness is much less marked in some than in others, and the aromatic quality is very decided in some, but barely perceptible in others.

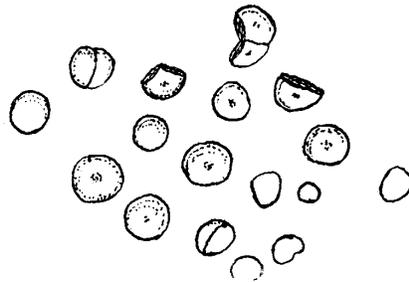


FIG. 4.—Starch from stem bark of *Prunus serotina*.

The most prominent structural differences are in the number, arrangement and character of the sclerenchymatous elements. These and other differences will be noticed in the descriptions of the barks of the different species.

Bark of the Stem of Prunus serotina.—The periderm or corky layer separates readily in transverse bands from the rather thin layer or cortex beneath. The latter contains numerous clusters of short sclerenchymatous cells or stone cells, which form an interrupted zone in this layer of bark. Just underneath this layer the medullary rays, whose course from the cambium zone outward is more or less wavy, terminate very obliquely. The rays in their thickest part are from four to six cells broad, and between them lie the bast masses which, except near the cambium zone, consist of crumpled sieve sometimes stellately clustered, but more commonly are single and are most abundant in the cells adjacent to the medullary rays.

The medullary rays contain usually an abundance of very finegrained starch. The granules of starch are usually spheroidal and simple, with an inconspicuous central or sub-central hilum, and no other recognizable markings. Some double and treble grains, however, are

observable.

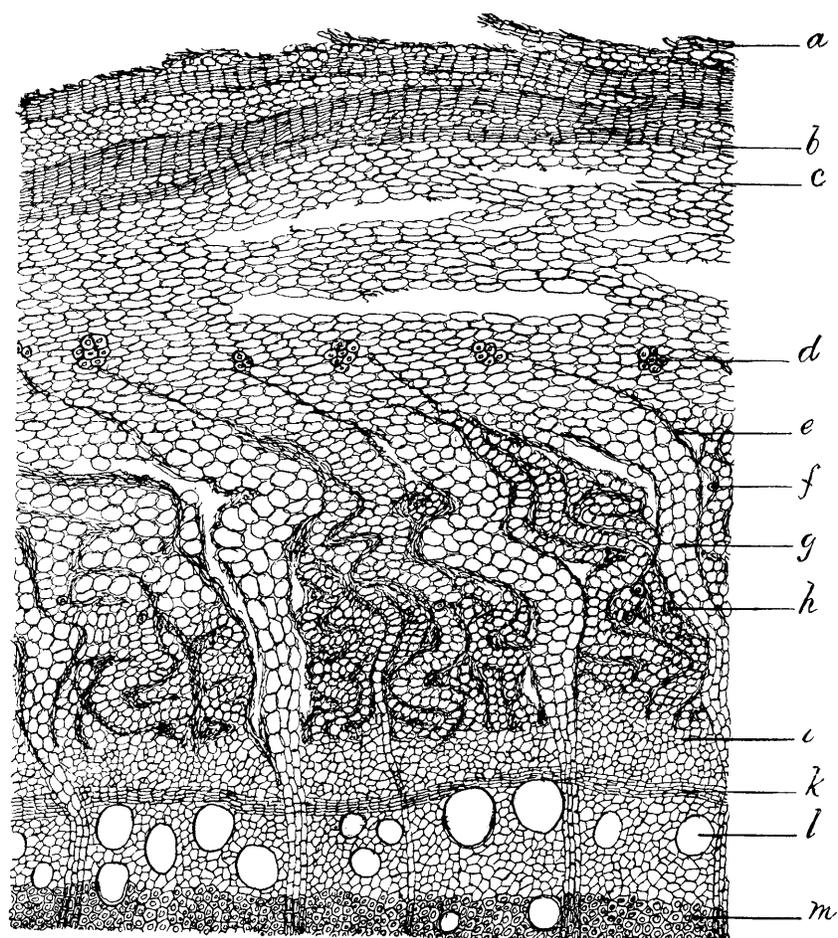


FIG. 5.—Cross section of stem bark of *Prunus Mahaleb*.

The root bark of this species bears a close resemblance to that of the stem, but it is lighter exteriorly and the corky layer earlier begins to fissure. The clusters of sclerenchyma cells are less numerous, and the bast fibres somewhat better differentiated. They are still few in number, however, as compared with the stone cells, and they occur chiefly in association with the latter, though sometimes they are isolated or in separate clusters of few fibres.

Both root and stem bark are decidedly bitter and aromatic, and somewhat astringent to the taste. The aromatic or bitter almond odor and taste in fresh specimens are more pronounced in the root bark. This would lead to the inference that the latter is the more valuable of the two for medicinal purposes.

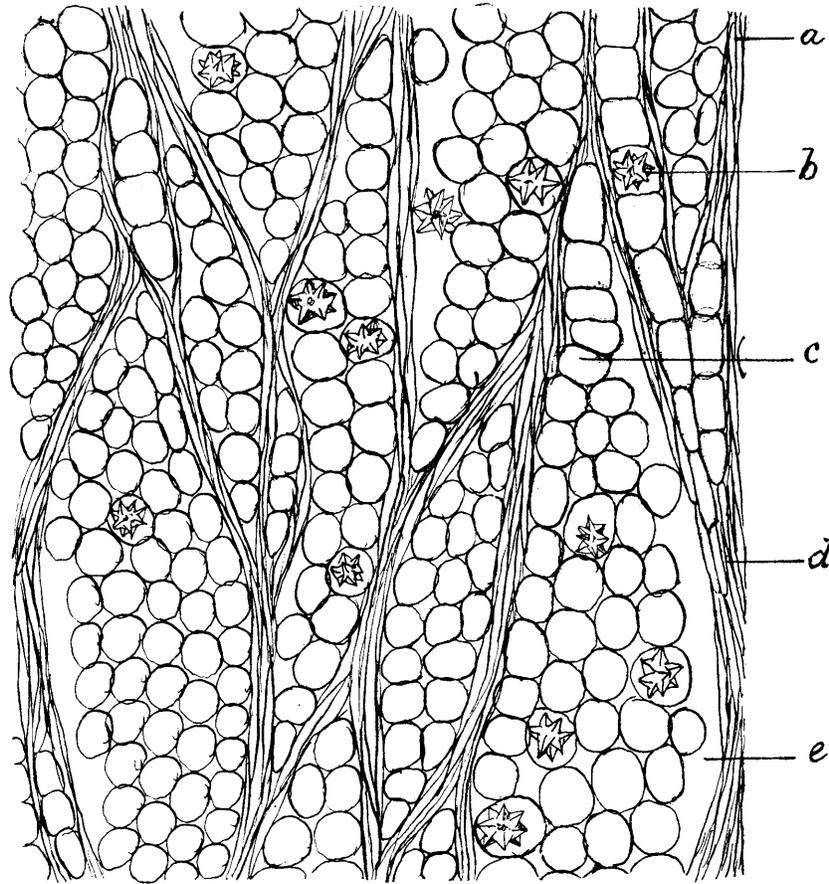


FIG. 6.—Longitudinal section of inner bark of *Prunus Mahaleb*.

The Stem Bark of Prunus Mahaleb.—The bark on the old stem is dark gray and fissured, though less strongly so than that on the trunk of *Prunus serotina*, There appears to be a greater development of secondary cortex in this species than in *Prunus serotina*, and a corresponding difference in the cork formation. Some of the later-formed bands of secondary cork not merely invade the inner cortex, but in the older bark cut even into the outer portion of the bast layer.

The sclerenchymatous elements are less abundant than in *Prunus serotina*, and consist mostly of small clusters of bast fibres, stone-cells being wholly or nearly absent. The medullary rays are quite similar to those of *P. serotina*, and the intervening sieve elements are, in the older bast areas, likewise much crushed and fissured. Crystals of calcium oxalate are abundant, but much less so than in *P. serotina*, and are seldom single in the cells, but in stellate clusters. Probably owing to the season of the year when the bark was gathered, namely, in June, no starch grains were recognized.

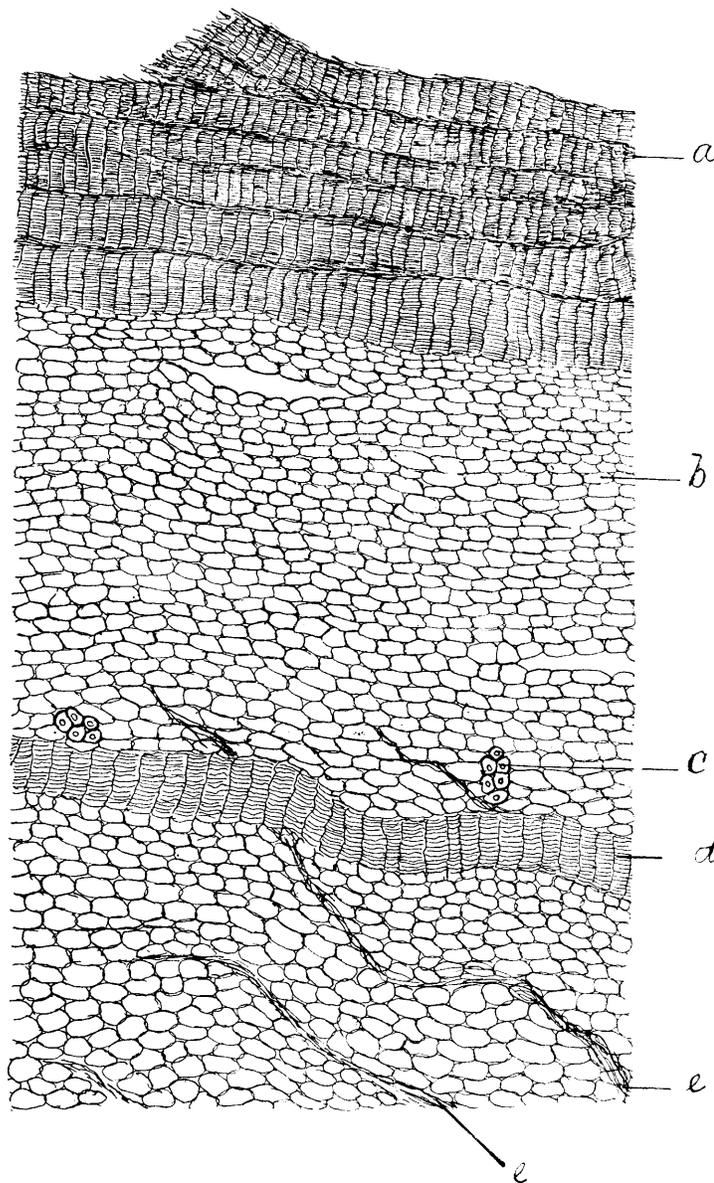


FIG. 7.—Cross section of bark of *Prunus Mahaleb*, including outer, middle and outer portion of inner bark.

The bark has the bitterness and astringency of the official species, but much less of the aromatic quality.

Often the portions of the wood adhering to a medicinal bark afford characters which aid in identification. Between the wood of *Prunus Mahaleb* and that of the official species there are marked structural differences. The ducts of the former are much larger and also less evenly distributed, being most abundant and largest adjacent to and on the

exterior side of the ring of growth, so that the rings of growth are rendered much more conspicuous to the eye.

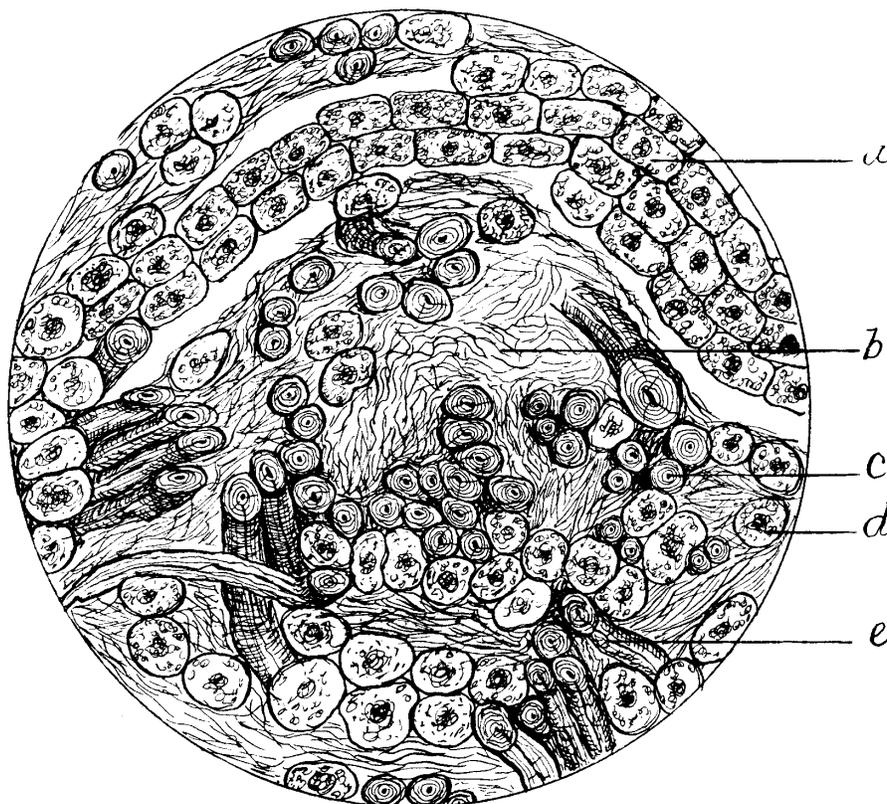


FIG. 8.—Small portion of cross section of inner bark of *Prunus Avium*.

The Stem Bark of *Prunus Avium*.—The bark of this species is smoother and lighter colored, being reddish-brown on the twigs of the second or third year, and deep gray or reddish-gray on the trunk. The lenticels on the twigs are much fewer than in the official species, but they are still present and enormously increased in size in trunks 6 inches or more in diameter. They appear as lenticular, transversely elongated, corky patches, often 2 inches or more in length. The outer bark may be easily stripped off transversely in broad bands, exposing the deep green middle bark, and the corky layer, in turn, may be easily split into thin lamellae, corresponding to the concentric stratification lines seen in the cross-section.

The inner bark shows the wavy medullary rays, terminating very obliquely at the exterior, the wavy bands of compressed sieve tissue in the older portions, and the fissuring between the medullary rays and the bast masses, which are shown in most species of cherry; but it differs from the official species and from some others in the decidedly fibrous

character of the bast layer.

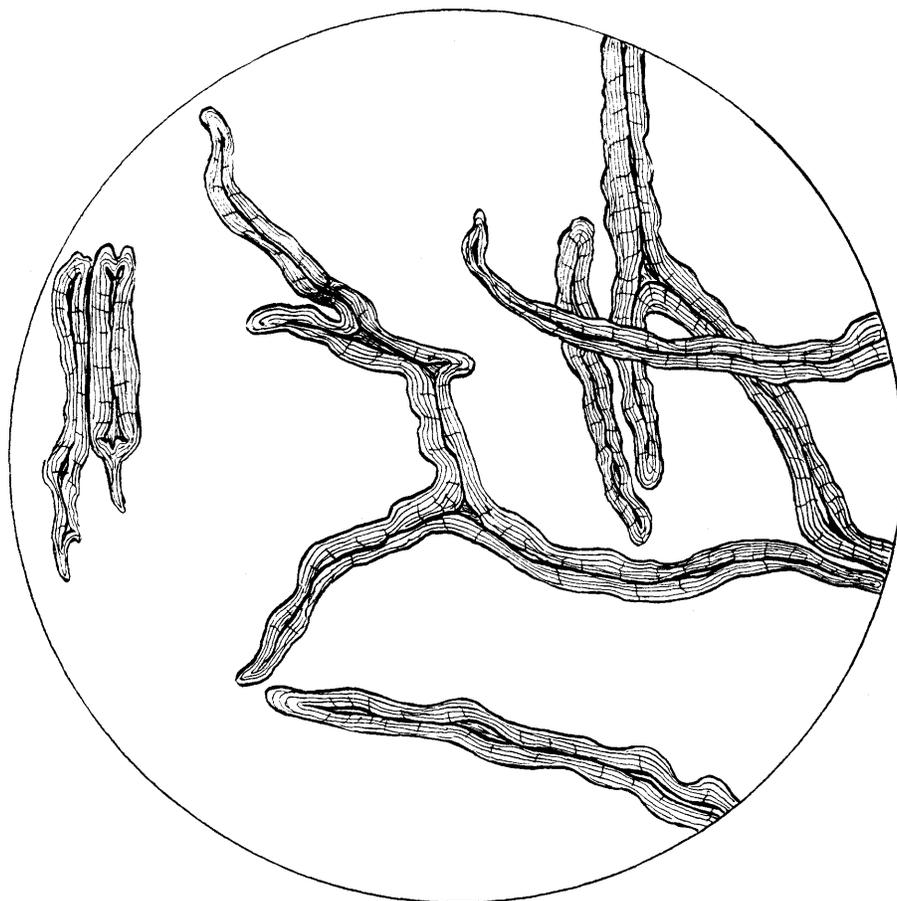


FIG. 9.—Sclerenchyma fibres from *Prunus Avium* as they appeared *in situ* in a longitudinal section.

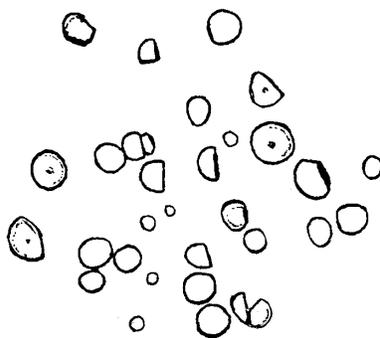


FIG. 10.—Starch from stem bark of *Prunus Avium*.

There are not only scattered and very tortuous lignified fibres in its outer portions, or even extending into the middle bark, but clusters and isolated fibres occur abundantly throughout the bast. Many of the fibres, especially those occurring in bundles, are long and slender, and run quite regularly lengthwise of the bark ; but others, especially the

isolated ones, are very irregular in form, tortuous in their course, and often branching.

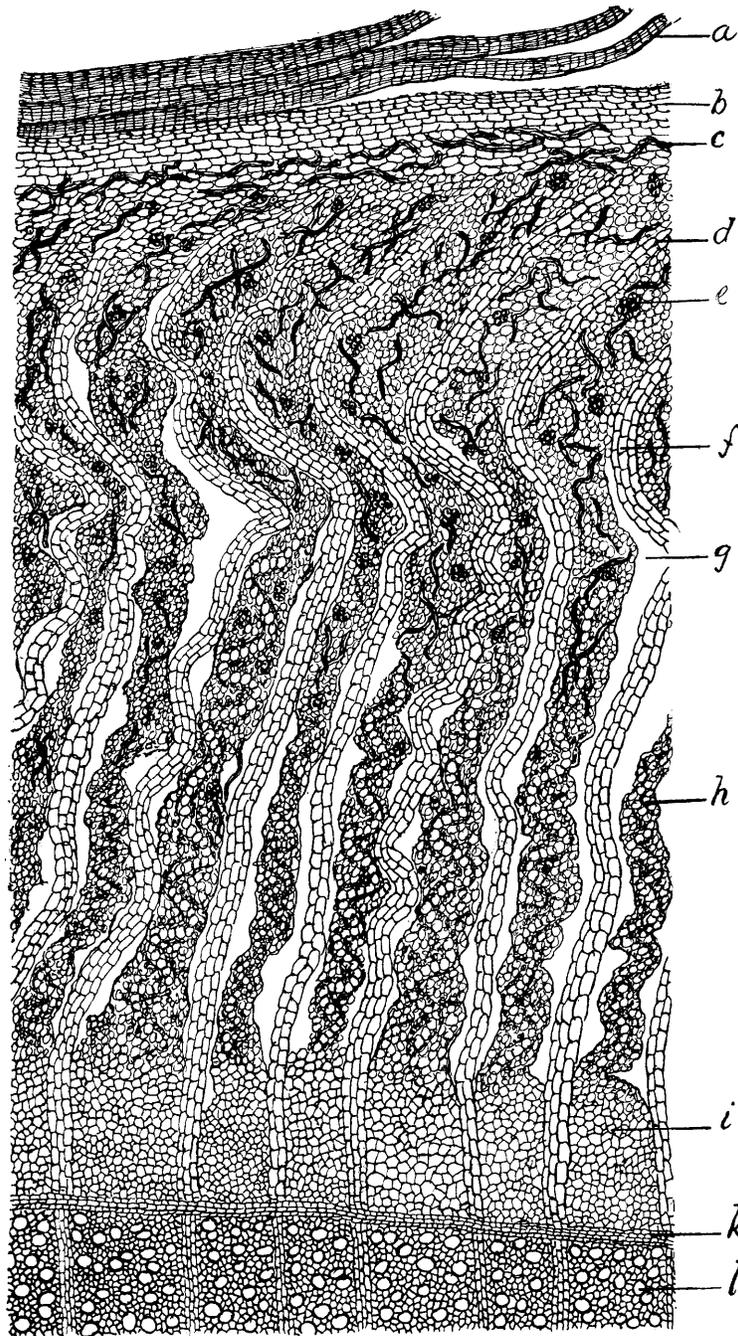


FIG. 11.—Cross section of stem bark of *Prunus Pennsylvanica*.

The masses of bast fibres are never very large, and are not arranged with any apparent order.

Crystals of calcium oxalate in the specimens examined were much less abundant than in *P. serotina*, and they were nearly always in stellate masses.

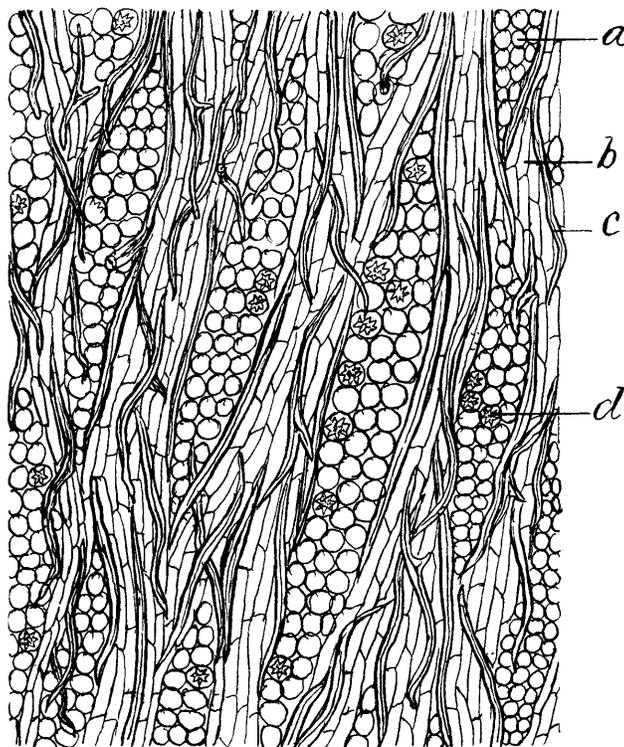


FIG. 12.—From longitudinal tangential section of inner bark of *Prunus Pennsylvanica*.

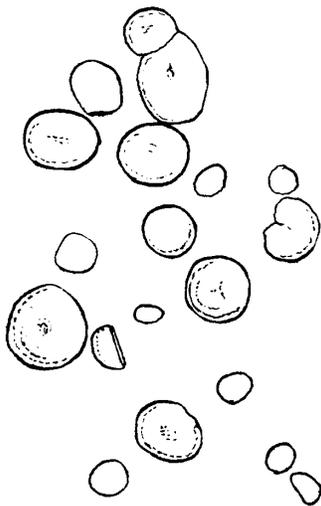


FIG. 13.—Starch from stem bark of *Prunus Pennsylvanica*.

The specimens studied were gathered in June and July, and in these, starch, though present in the medullary ray-cells, was not abundant. It was also very fine grained; the grains were often rounded and simple,

but also frequently double or triple. The faintly distinguishable hilum is nearly central. The taste of this bark is decidedly bitter and astringent, but the aromatic or bitter almond odor and taste are usually scarcely perceptible.

The Stem Bark of Prunus Pennsylvanica.—This tree, when not in fruit or flower, might be mistaken for a small specimen of *P. serotina*, for the habit is similar, and the bark of the trunk, though usually lighter colored and smoother than that of the official species, is occasionally, in the old specimens, quite dark and rough enough to resemble that of young and thrifty specimens of *P. serotina* of similar size. The lenticels on the twigs, however, perceptible also even on the older trunks, are much less numerous. Of course, there would be no difficulty in distinguishing this species when in flower, for its flowers occur in umbel-like clusters instead of racemes; in early instead of late spring; and from separate, lateral scaly buds instead of on the ends of lateral leafy branches. The fruits also are red, on long pedicels, and with a thinner, more acid and not a bitter taste.

The lenticels on the trunk are not so large as those of *P. Avium*, seldom attaining a length transversely of more than half an inch. The corky layer, however, separates from the sub-lying green tissue in a very similar manner, and in cross-section this layer shows a similar, though finer, stratification. When the brown or blackish scurf is rubbed from the surface of the periderm, a fine red-brown or mahogany color is exposed.

In this species, as in *P. Avium*, there appears to be but a slight development of the secondary cortex. Similarly, the medullary rays of the inner bark are oblique and wavy. They are, however, narrower, being seldom more than three cells broad. The fissuring

and the collapsed sieve tissue are also similar. The older portions of the inner bark abound in tortuous and strongly lignified scleren-chyma fibres, similar to those of *P. Avium*, but the clusters of more typical bast fibres are considerably less numerous.

The taste of this bark resembles that of *P. Avium*, being decidedly bitter, somewhat astringent, but scarcely at all aromatic.

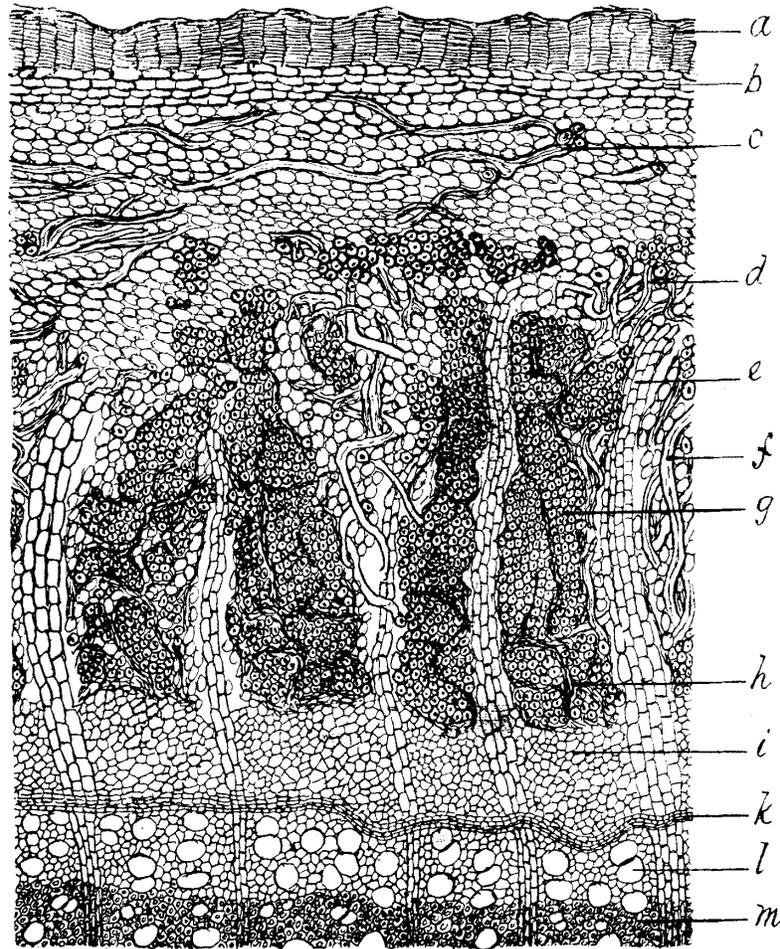


FIG. 14.—Cross section of stem bark of *Prunus Virginiana*.

Crystals of calcium oxalate abound, and they are mostly in stellate masses.

The starch grains are similar in shape to those of *P. Avium*, but they average of larger size, and compound forms appear to be somewhat less numerous.

Stem Bark of Prunus Virginiana.—This tree, commonly called Choke Cherry, on account of its very astringent fruit, is undoubtedly often confounded with the Black Cherry. This is not only because it is often, in general appearance, similar to that of a small black cherry tree, but because its flowers and fruits are similar in size, color and arrangement, being borne in both cases in racemes. Our pharmaceutical nomenclature

also adds to the danger of confusion, the name *Prunus Virginiana* being still absurdly retained as the pharmacal name of the drug obtained from *P. serotina*.

There is no real reason, however, why any one tolerably familiar with the botanical characters of the two species should confound them, for there are marked differences. *P. Virginiana* is, in the first place, a much smaller tree, in fact, usually more a shrub than a tree, though sometimes its stem attains a diameter of two or three inches. Its branches and trunk are not so dark, being rather grayish than blackish, and the lenticels are much less numerous. Its leaves are thin, oval-oblong or ovate, abruptly pointed, and sharply serrate, with slender, projecting teeth, while those of the black cherry are thickish, oblong-lanceolate or oblong and taper-pointed, but less abruptly so than in the other species, and the margins are serrate with incurved, short and callous teeth. The serrations on the leaves of Choke Cherry are also often double, which is not the fact with those of the Black Cherry. The petals of the Choke Cherry are more rounded than those of the Black Cherry.

The microscope, however, reveals the most decided differences in the structure of the barks. The medullary rays in *P. Virginiana*, which are three or four cells wide, are less flexuous than in *P. serotina*, or in any other species examined. Proper stone cells, so abundant in the bark of the Black Cherry, are almost wholly absent from the bark of the Choke Cherry, but the tortuous sclerenchyma fibres, similar to those in *P. Avium* and *P. Pennsylvania*, not only abound in the inner bark, but in the cortex. Bast fibres of the ordinary form also occur in large and irregular masses in all the mature portions of the inner bark. By reason, perhaps, of the abundance of bast fibres, the radial fissuring, so observable in all the other species studied, is much less conspicuous in this.

Owing, probably, to the fact that the specimens studied were gathered in the season of active growth, namely, about June 1st, no starch was found in the sections examined.

Oxalate of calcium crystals in stellate masses are abundant in the species.

In aromatic quality and in bitterness, this species is inferior to the Black

Cherry, though the bitter almond odor and taste are much more evident than in any of the other species thus far studied.

Another cherry bark, samples of which were sent by Professor Henry G. Greenish, of London, has been examined by the writer, and found to resemble, in most of its structural characteristics, that of our *P. Pennsylvanica*. It differs from the bark of this species, markedly, however, in some particulars, and was probably derived from one of the unstudied Pacific Coast species. The sample was very bitter, somewhat astringent, and slightly aromatic. Professor Greenish states that the sample was taken from a quantity which had been sent to the London market as Wild Cherry Bark.

This outline of the studies thus far made by the writer in this genus must be considered merely as preliminary to a more complete account which he expects to publish at a future time. In the meantime, it is hoped that the descriptions and illustrations here given may be of service to our profession, and aid in emphasizing the importance of the study of the histological structure of drugs.

The writer's thanks are due to Mr. Henry L. Clarke, of the University of Chicago, for securing for him authentic specimens of the bark of *Prunus Virginiana*.

DESCRIPTION OF FIGURES.

Fig. 1.—Transverse section of bark of *Prunus serotina* magnified 75 diameters. The specimen was from a stem only five or six years old. *a*, cork, probably secondary periderm; *b*, middle or green layer of bark; *c*, clusters of stone cells in inner portion of middle bark; *d*, compressed sieve tissue in the outer portion of bast layer; *e*, a medullary ray; *f*, mass of stone cells; *g*, fissure between medullary ray and bast; *h*, medullary ray; *i*, cambium zone; *k*, duct in mature wood.

Fig. 2.—Small portion of longitudinal section made well toward the cambium zone and parallel to it. Magnification about 75 diameters, *a*, crystal of calcium oxalate; *b*, a medullary ray cell containing starch; *c*, sieve tube; *d*, medullary cell.

Fig- 3—Some of the sclerenchymatous elements from the same species, magnified 230 times; the longer of these cells, perhaps, to be regarded

as bast fibres, or as transition forms between stone cells and bast fibres.

Fig. 4.—Starch grains from bark of *Prunus serotina*, magnified 1,200 diameters.

Fig. 5.—Cross-section of bark of *Prunus Mahaleb* magnified about 75 diameters, *a*, cork exfoliating from exterior surface; *b*, secondary cork formation farther interior; *c*, fissure in cortex; *d*, primary bast fibres in outer portion of bast layer; *e*, compressed sieve tissue; *f*, single bast fibre. (A few scattered bast fibres occur in the secondary bast in this species.) *g*, medullary ray; *h* compressed sieve tissue; *i*, newly formed bast; *k*, cambium zone; *l*, large duct in newly formed wood; *m*, wood of previous season.

Fig. 6.—Tangential section through bast layer of *Prunus Mahaleb*, showing medullary rays and compressed sieve tissue. Magnification about 230 diameters.

a, compressed sieve tissue; *b*, crystal cell; *c*, ordinary parenchyma cell of medullary ray; *d*, compressed sieve tissue; *e*, fissure between medullary ray and sieve tissue.

Fig. 7.—Cross-section of outer part of bark of *Prunus Mahaleb*, showing mode of cork formation, *a*, outer layers of cork exfoliating at the surface and showing stratification lines. (The cork readily splits along these lines.) *b*, cortex or middle bark; *c*, cluster of primary bast fibres; *d*, secondary cork forming interior to the clusters of primary bast fibres; *e*, compressed sieve tissues. Magnification about 75 diameters.

Fig. 8.—Small portion of cross section of inner layer of stem bark of *Prunus Avium*, magnified about 230 diameters, showing arrangement of bast fibres. *a*, portion of medullary ray, well toward the outside of the bast layer; *b*, compressed sieve tissues; *c*, bast fibre; *d*, parenchyma cell; *e*, bast fibre, in oblique view.

Fig. 9.—Some of the sclereuchyma fibres as they appeared in situ in a longitudinal tangential section of the bark of *Prunus Avium*. Magnification, about 230 diameters. The more regular, slender and elongated fibres usually occur in masses.

Fig. 10.—Starch grains of *P. Avium* magnified 1,200 diameters.

Fig. 11.—Cross-section of the stem bark of *Prunus Pennsylvania*, magnified about 75 diameters, *a*, cork in layers, represented as separating from the middle bark, *b*; *c*, irregular or tortuous sclerenchyma fibres; *d*, medullary ray; *g*, fissure between medullary ray and bast; *h*, compressed sieve tissue; *i*, young bast tissues near cambium; *k*, cambium zone; *l*, a duct in the wood.

Fig. 12.—Portion of longitudinal tangential section of inner bark of *P. Pennsylvania* magnified about 75 diameters, *a*, medullary ray; *b*, soft bast cell; *c*, bast fibre; *d*, crystal cell.

Fig. 13.—Starch from bark of *Prunus Pennsylvania* magnified 1,200 diameters.

Fig. 14.—Cross section of stem bark of *P. Virginiana*, magnified about 75 diameters, *a*, periderm; *b*, outer cortex (collenchyma); *c*, *d*, tortuous sclerenchyma fibres; *e*, medullary ray; *f*, sclerenchyma fibre; *g*, large mass of secondary bast fibres; *h*, compressed sieve tissues separating masses of bast fibres; *i*, younger bast; *k*, cambium zone; *l*, duct in newly formed wood; *m*, mature wood.

TARAXACUM ROOT AND TARAXACIN.

BY L. E. SAYRE.

Presented to the Amer. Pharm. Assoc., Denver Meeting, 1895.

As a continuation of the investigation mapped out for myself a few years ago in connection with taraxacum, and reported upon in 1893 and 1894, I desire at this time to present the results of further work during the past winter in the same direction. It may be remembered that an effort has been made to determine the variation in the root at different seasons of the year, and to determine whether the valuable constituents are to any great extent altered by the application of a low heat, such as might be used in drying the fresh drug.

During the past year an effort has been made to determine the nature and characteristics of the so-called bitter principle—taraxacin—and to this end my investigations have been chiefly directed. The first difficulty

in isolating the active principle lay in the separation of it from the extraneous matter with which it is always contaminated when its colorless aqueous solution is evaporated. This extraneous matter was referred to in a former paper (Proceedings of A. Ph. A., 1893, p. 78), when it was stated that all attempts to obtain the bitter principle in a crystalline form, free from admixture of brownish-red extractive, had been unsuccessful, and what was reported as taraxacin in the analysis was this crude bitter principle containing this extractive.

It seemed impossible to separate the small, needle-like crystals from the resin-like globules of other uncrystallizable material seen under the microscope, and whether these uncrystallizable, amorphous globules of extractive, or the crystals, were actually the bitter principle, it was almost impossible to tell. My efforts have been directed towards this particular problem—how to obtain the taraxacin in the pure state. If it be a crystalline body, how can this body be separated from the above-mentioned amorphous substance or substances? For help in the work I am indebted to Mr. A. B. Clarke, a student in the School of Pharmacy of the University of Kansas.

A record of the work will show, probably, that a separation of the bitter principle has been accomplished, and in the present paper an attempt will be made, not only to show this, but to make clear the various steps in the process, so that others may be able to take up the subject, or follow the ground gone over, and thus be able to verify or disprove the statements made herewith. At the same time, an attempt will be made to offer a process for the separation of the acrid principle which exists in the root.

In the work during the year, the various preparations of the drug were used as starting-points, viz.: the chloroformic extract, the extract and the fluid extract. It is unnecessary to take up each one of these divisions in detail and refer to the many failures and the causes of them. Reference will be made to such parts of the work as yielded results which I desire to record for the benefit of those who will, at a future time, wish to verify it.

Coloring Matter.—A point worthy of note has been hinted at in a former paper, namely, that the root, at a certain time in the late fall, seems charged with a coloring matter almost entirely absent at other seasons. On going over this part of the work again this year, I found that the

October root was of a much higher color, and contained this peculiar coloring principle, which was entirely absent in the root collected in September. This coloring principle was obtained nearly pure by dissolving it from the chloroformic extract with alkaline water, and precipitating it from the alkaline solution with an acid. It is very sensitive to acids and alkalis; with the former yellow, and with the latter a deep red color is produced.

Acrid Principle.—One ounce of the extract was mixed with clean white sand, and dried in an oven at a temperature of 65° C., and powdered. This powdered extract was very hygroscopic, taking up water and becoming caked together when allowed to stand in the air but a short time. The powdered extract was placed in a continuous extracting apparatus and treated with chloroform for ten hours. The chloroformic extract was nearly colorless. The heat used in the manufacture of the extract seemed to have rendered most of the coloring matter insoluble in chloroform. There was, however, a small amount in solution, which became visible upon concentration, and on complete evaporation a yellow mass, of pasty consistency, remained, having an acrid and very bitter taste. The residue was dissolved in water, and one-third of the yellow solution placed in a vacuum desiccator and allowed to evaporate. This gave no crystals, but the residue was highly colored, and had an odor resembling caramel. This was again dissolved in water, and shaken with absolute ether. The ether was then drawn off, and, on evaporation, left a residue which was not crystalline, but had an intensely sharp, acrid taste—not bitter.

Taraxacin —Four ounces of a fluid extract, prepared by repercolation, were diluted with an equal bulk of water, and a dilute solution of subacetate of lead added, until no further precipitation was produced. The precipitate was mixed with water, and hydrogen sulphide passed through the mixture, until the lead was all deposited in the form of sulphide. The mixture was then filtered, and the filtrate evaporated to dryness on a water bath. The residue showed no signs of bitterness, making it evident that the bitter principle had not been precipitated by the subacetate of lead.

The first filtrate from the precipitate formed by the subacetate of lead was then taken and freed from lead by passing hydrogen sulphide through the solution and filtering out the lead sulphide formed. The filtrate was then evaporated to dryness, leaving behind a yellow, pasty

mass of intensely bitter and acrid taste. The mass was mixed with sand and dried in an oven at 55° C. for three days, but the residue did not dry sufficiently to be powdered. It was divided into small particles and macerated in chloroform. The chloroformic extract, on being evaporated, left a large crop of crystals nearly free from foreign matter. The residue was very bitter.

This bitter residue gave glucosidal reactions, but when the drug was treated by the lime process for the separation of glucosides— viz.: the powdered drug mixed with freshly prepared milk of lime and evaporated to dryness on a water bath and the residue extracted with alcohol—no evidence of the bitter principle could be found in the residue after evaporating the alcohol.

Of the processes employed in separating the taraxacin thus far, the one using the solution after precipitating with subacetate of lead is by far the most satisfactory; but in any of the processes it is necessary to use a large amount of the drug, as the principle exists in the root in very small quantities (about 0.05 per cent.).

It was found during the investigation that the acrid principle existing in the root could be separated from the bitter principle by shaking an aqueous solution of the chloroformic extract of the extract with absolute ether, drawing off the ether and allowing it to evaporate, when a yellowish mass, having a very sharp, acrid taste, remained. This residue dissolved in water and was acid to litmus paper. The relative amount of this acrid principle contained in the drug was not determined, but the percentage is very small.

It is now thought that a plan has been mapped out by which future investigators, using large quantities of the drug, will be able to completely isolate the bitter principle, or taraxacin, from taraxacum root, and by elementary analysis determine its ultimate composition. Fifty pounds of the drug have been extracted with chloroform, and during the next winter it is hoped this work will be fully accomplished.