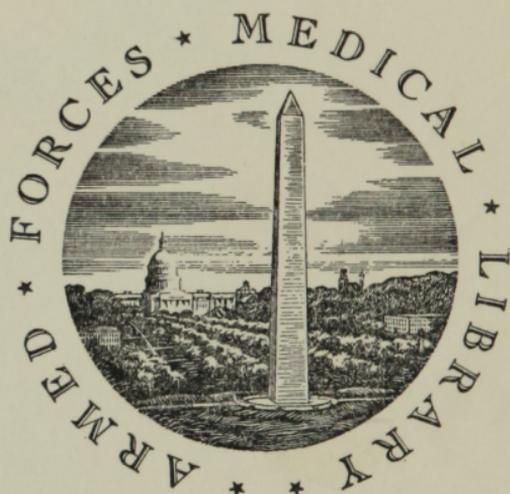
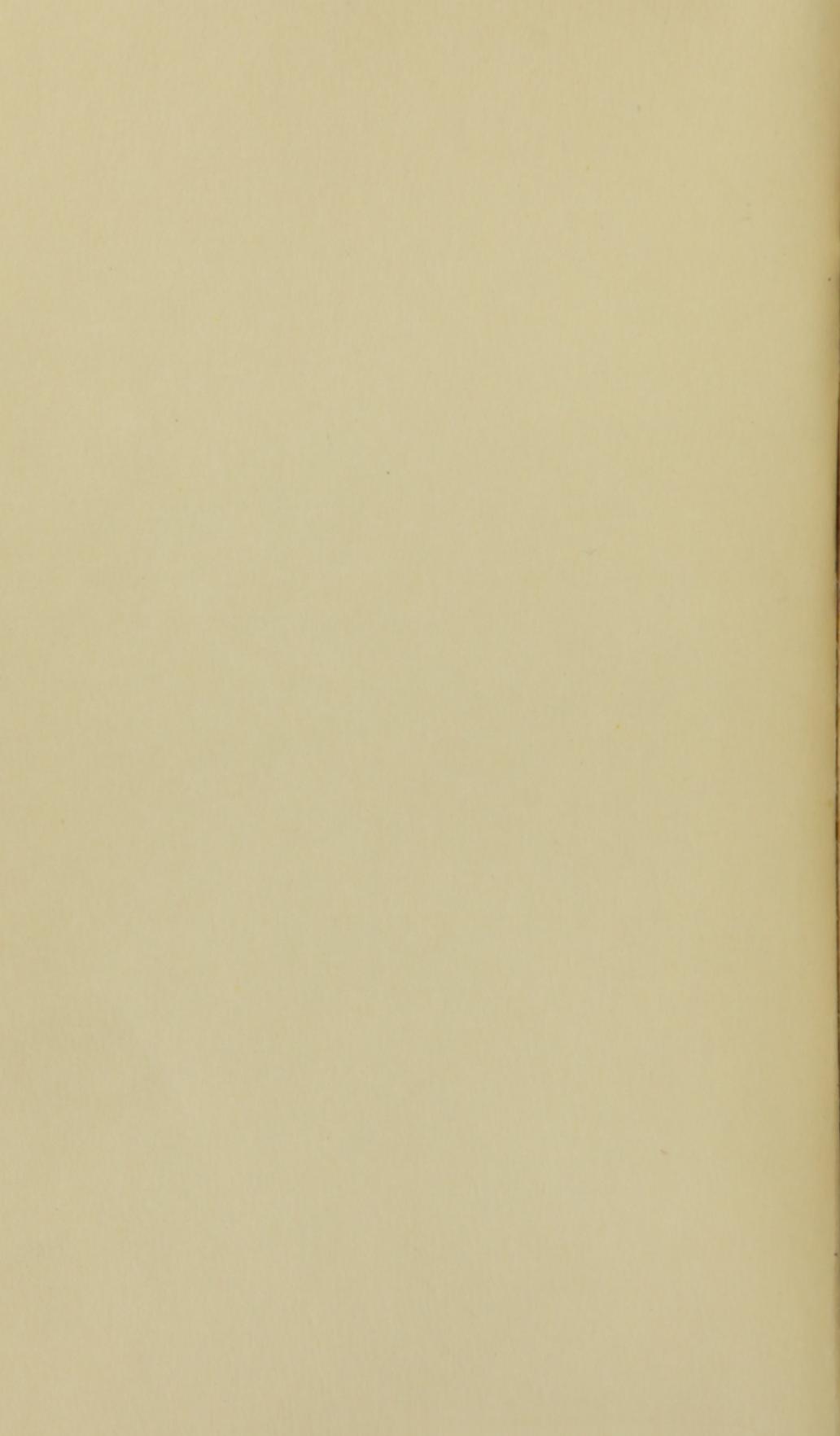


UNITED STATES OF AMERICA



FOUNDED 1836

WASHINGTON, D.C.



AN

INVESTIGATION OF THE PROPERTIES

OF THE

LIRIODENDRON TULIPIFERA,

OR

POPLAR-TREE.

BY PATRICK KERR ROGERS,

FORMERLY OF IRELAND; NOW OF PHILADELPHIA;
*Honorary Member of the Philadelphia Medical and
Chemical Societies.*

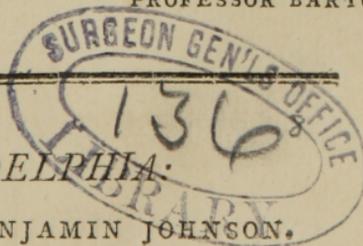
“ The man who discovers one valuable new medicine is a more
“ important **BENEFACTOR** to his species, than Alexander, Cæsar,
“ or an hundred other conquerors. Even his glory, in the estimati-
“ on of a *truly* civilized age, will be greater and more lasting,—”

PROFESSOR BARTON.

PHILADELPHIA:

PRINTED BY BENJAMIN JOHNSON.

.....
1802.



INVESTIGATION OF THE PROPERTIES

OF

ALUMINUM SULPHATE

DOCTORAL DISSERTATION

BY

WALTER W. RAY, M.D.

OF THE UNIVERSITY OF MICHIGAN

PHARMACEUTICAL CHEMISTRY

ANN ARBOR, MICHIGAN

WILLIAM B. EYRE

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1912

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AN
INAUGURAL
EXPERIMENTAL INQUIRY,
FOR THE DEGREE OF
DOCTOR OF MEDICINE ;
SUBMITTED TO THE EXAMINATION
OF THE
REV. JOHN EWING, S. T. P. PROVOST ;
THE
TRUSTEES AND MEDICAL FACULTY
OF THE
UNIVERSITY OF PENNSYLVANIA,
ON THE
TWENTY-SEVENTH DAY OF MAY, 1802.

407510

Doctor Cleaver
with compliments
and good wishes from

The Author

TO

BENJAMIN SMITH BARTON, M. D.

*Professor of Materia Medica, Natural History
and Botany,*

IN THE UNIVERSITY OF PENNSYLVANIA.

SIR,

AS a pledge of my gratitude, I dedicate to you the following pages. I need not trouble you with a formal apology, for the imperfections of this first effort, since it has already met with your approbation. Nor is this inscription intended to avert, by thus affixing an *illustrious name*, the censure which may fall upon its imperfections; but as a token of that affection and respect which you have inspired by an uninterrupted continuance of signal friendship.

If, in the course of my life, I may enjoy any happiness from my attachment to the sciences connected with medicine, it must ever be acknowledged, as, in an eminent degree, the result of your example, instruction and benignity. Indeed I cannot help regarding that day, as truly auspicious, on which I became your pupil.

That the enjoyment of *health* and *felicity* may enable you long to exercise those talents, which have hitherto been employed with so much success for the *health* and *felicity* of mankind, is the sincere wish of your

grateful friend and pupil,

THE AUTHOR.

TO
GEORGE ROGERS, M. D.
OF
NEWTONSTEWART,—IRELAND;
THIS DISSERTATION IS ALSO INSCRIBED
IN GRATEFUL TESTIMONY
OF THE
OBLIGATIONS I OWE HIM,
AS THE
KIND FRIEND,
THE
AFFECTIONATE RELATIVE,
AND THE
ATTENTIVE COUNSELLOR
OF MY EARLY YOUTH.
THE AUTHOR.

INTRODUCTION.

MAN is the favorite of nature. She has kindly conferred upon him the highest rank among the orders of her creatures. While his intellectual capacity may be regarded as her first and noblest donation, the subserviency of the vegetable kingdom, to his wants and his enjoyments, constitutes her next distinguished favor. As he travels over the variegated exuberance of the earth, he may regale his senses, his imagination, and his intellects, without fear of satiety. The same fertile source supplies him likewise, with a great part of his aliment; with many invaluable medicines, for the preservation, and the restoration of his health; and with innumerable means of promoting his comfort and happiness.

In the present performance, my attention has been engaged, by one of the finest ornaments of the vegetable kingdom. I have made an attempt, to investigate the natural constitution of the *Liriodendron* of America, and to ascertain how far it may be found useful, in lessening the evils, incident to our state of existence. It is already known to contribute very much to our convenience; as may be seen in its *Natural History*. And though it has, for a length of time, been thought to possess important medical virtues, yet little pains were taken to examine it, until one of my much honored teachers in medicine, *Doctor Rush*, made some trials of the powers of its root. He had much satisfaction from the use of the root as a bitter, or tonic medicine: the bark of the tree, however, I take to be an article endued with incomparably more valuable properties than the root.

During our perusal of the fascinating theories of learned physicians, on *speculative subjects*, such a one as *this*, may, to many of us appear rather humble for minute attention. The consideration of the present subject has, notwithstanding, given me some happiness. The finely embellished productions of nature can scarcely be investigated, but with delight : and when utility attends our inquiries concerning them, the pleasure resulting soon advances to felicity.

I should conceive a physician of the first talents more laudably employed, in ascertaining the properties of the humblest plant, that smiles in our forests, than in building a fragile system, however superb, which for a moment is admired, then ridiculed, and then totters into ruins. When we cast our eyes over the sciences connected with the healing art, the prospect assures us, that all systems of medicine are, like their authors, destined to die. The progressive state of knowledge, which will probably be perpetual in those branches, must necessarily effect their destruction soon after they are fabricated. But surely we are not to desert *this field of science*, so rich with fruits of inestimable value to mankind, because we are not likely to discover its utmost extent ; or because, in every corner of it, amid the entwined luxuriance of beauty and utility, error may be observed putting on the mantle of truth, and exhibiting its claims to the protection of genius.

That the *Liriodendron Tulipifera* well merits the attention of the American physician, will, I think, appear from the sequel. I could wish that adequate talents would find leisure to do it justice. It is, to me, a matter of regret, that engagements of some consequence, often forced me to break in upon the time, which was granted for its consideration. Nor did the season afford me an opportunity of fully determining its efficacy in disease. I

wished to ascertain its real value in those complaints in which it has been used by the country people ; and also, to try its virtues in other diseases, to which, from its peculiar constitution, and active powers, it appears to be adapted. I have not, however, been enabled to proceed so far at the present period. I have made the chemical investigation as satisfactory as I could ; and I have endeavored to give a view of its peculiar medical properties, with the influence it exerts on the healthy human frame. It was already observed, that the root has been found a good tonic, and I have no doubt, but that the bark of the tree, from its analysis, its effects on the healthy system, and its avered powers in disease, will become a valuable article of the *Materia Medica*. The ease with which it can be procured ought to make it a desirable substitute for expensive medicines of perhaps inferior efficacy. Should the present feeble effort contribute, in any way, to render this elegant vegetable more generally useful, it will be to me the happiest consideration.

SECTION I

A TREATISE ON THE HISTORY OF THE TULIP TREE.

I. THE TULIP TREE.

THE genus *Liriodendron* (Lam.) belongs to the class Polymorphic, and the order Polymorphic of the Natural System of Linnæus. This celebrated naturalist gives the following as generic characters: "Liriodendron, L. foliis ovatis, Petalis nup. Soles imbricatâ in a floribus."—In his Natural System, he ranks it under the sub-second order, Connatis.

In the System of Mr. De Jussieu, the genus *Liriodendron* is placed in the order Magnoliæ of the thuriferous class, along with several other genera, which are more or less allied to our plant. The principal of these genera are *Prinos*, *Lilium*, *Magnolia*, *Tilia*, and the *Quercus*; and a last comparison, beside other species, the essential property is called, and the character.

• A few more genera, however, are to be added.

SECTION I.

NATURAL HISTORY OF THE TULIP-TREE.

I. ITS ARRANGEMENT, &c.

THE genus *LIRIODENDRON* (Lyre-tree) belongs to the class *Polyandria*, and the order *Polygynia*, of the sexual system of LINNEUS. This celebrated naturalist gives the following as generic characters; “*Liriodendron*. Calix three-leaved. Petals nine. Seeds imbricated in a strobile.”*—In his Natural method, he ranks it under the fifty-second order, *Coadunatæ*.

In the system of Mr. De Jussieu, the genus *Liriodendron* is placed in the order *Magnoliæ* of the thirteenth class, along with several other genera, which are more or less allied to our plant. The principal of these genera are *Drymis*, *Illicium*, *Magnolia*, *Dillenia*, and the *Quassia*; which last comprehends, beside other species, the *Quassia* commonly so called, and the *Simaruba*.

* A system of vegetables, by a botanical society, at Lichfield.

Linneus describes *two* species*, denominating the first, *Liriodendron Tulipifera*, or Tulip-bearing, because its flowers are like those of the common garden tulip; the second, *Liriodendron Liliifera*, or lily-bearing, from the resemblance which its blossoms bear to lilies.

He thus distinguishes the species; “*Tulipifera*. 1. L. Leaves lobed. Tulip-bearing.—*Liliifera*. 2. L. Leaves lanced. Lily-bearing.

The first is the subject of the present inquiry. It has obtained a variety of names from the writers on natural history and botany. It is the *Tulipifera arbor Virginiana*, of Herman—The *Tulipifera Virginiana*†, and *Tulipifera Caroliniana*†, of Plucknet—The *Arbor Tulipifera Virginiana*, of Ray, and of Catesby||—The *Arbor Tulipifera Virginiana*, and *Poplar Vulgo*, of Clayton.—And the *White-wood*, and *Canoe-wood-tree*, of Cadwalladar Colden. The people of the United States know it by the names of *Tulip-tree*, *Poplar*, *White-wood*, &c**. It is

* The writer of the article *Liriodendron*, in the *Encyclopædia*, says there is but *one* species. It is certain, however, that there are at least *four* species. The *Liriodendron Liliifera* is a native of India, and is described by Rumphius, Burmann and other writers, who have examined either the living vegetable or dried specimens of it. The *Liriodendron Figo*, of Willdenow, has flowered in the garden of William Hamilton Esq. in the neighbourhood of Philadelphia.

† Pluck: *Almagestum Botanicum*—‡ *Phytologia*.

|| Ray's *Hist. Plantarum*, and Catesby's *Nat. Hist. Carolina*, Vol. I. page 48:

** Professor Barton's *Collections toward a Materia Medica of the United States*.

the *Len-nik-bi* of the Delaware-Indians, and the *Tse-u*, or *Tze-u* of the Cheerake*.

II. OF THE FRUCTIFICATION.

THE Calyx is two-fold ; consisting of a proper involucre of two leaflets, which are triangular, plane, and deciduous : and a perianth triphyllous†, the leaves of which open, and fall back, as the flower expands ; they are petal-form, oblong, concave and deciduous.

The Corolla has six, often more petals ; bell-shaped, oblong, obtuse, spatuled and variegated.

The Stamens are numerous ; the filaments are linear, shorter than the corolla, and inserted into the receptacle. The last is a circumstance distinctive of the class Polyandria. The anthers are linear and connected, longitudinally, to the sides of the filaments.

The Pistils are numerous ; the germs are

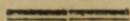
* It is, perhaps, worthy of observation, that Tfeu is the Chinese name for the *Musa Paradisiaca*, or Plantain-tree. This coincidence in language will hardly be considered as accidental, when it is recollected, that there are many vestiges of the languages of the Chinese and their Tartar neighbours, among the numerous tribes of America :

† Catesby has taken no notice of the involucre, tho' he has described the perianth or impalement : and in the *Encyclopædia*, there is mentioned, simply, a calyx triphyllous.

disposed in the form of a cone ; the style none, the stigmas globose.

There is no Pericarp; the seeds being imbricated in a strobile.

The seeds are numerous terminating in a lanced scale; near the base of the scale, from the interior side, an acute angle goes off, somewhat compressed at the base, by which they are attached to the spindle-shaped receptacle.



III. OF THE TREE IN GENERAL.

THE Tulip-tree often attains to a very large size. According to Catesby, and other observers, it not unfrequently measures thirty feet in circumference. It rises with an upright trunk to the height of seventy or eighty feet. The branches are not very numerous; they are irregular, crooked, and producing elbows in various directions. Those of two years old have a smooth brown bark; that of the summer shoots is still smoother, and of a shining blue-color. These tender branches are pithy. When broken, they emit a strong, but agreeable smell. The bark of young trunks is not remarkably rough; but as they become old, deep furrows are formed. The young trees make a fine appearance at all times, but are singularly beautiful when in flower.

The branches are garnished with smooth leaves, which are commonly four or five inches long, and as many broad. They grow on foot-stalks which are about the length of a finger. The leaves are of a singular shape, resembling a heart at the base; being truncated, or appearing as if cut off, and a little notched at the extremity; and having two or three lobes on each side, rounded off, and pointed. The upper surface is smooth, and of a dark green color. The under surface is veined, and its color lighter. They fall early in autumn. The buds, for the ensuing year's shoots, begin soon after to dilate. They increase so rapidly in size, that, by the end of December, they are an inch long, and half an inch broad.

My preceptor, doctor Barton, has been informed, that the milk of cows, which have eaten of the buds, acquires a peculiar, disagreeable, bitterish taste.

The flowers are produced about the twentieth of May. They are supported by peduncles, which grow from the extremities of the branches. They somewhat resemble the tulip; but Catesby thinks, that in shape, they are more like the *Fritillaria*, or *Crown-Imperial*. They are composed of six, seven, or more petals, which toward the tops, are spotted with green, and toward the claws, with red and yellow. The flowers are nectar-bearing. A glandular structure of the petals, near their attachment to the receptacle, constitutes the nectary. The honey

is secreted in large quantity. It is calculated that the flowers of a large Tulip-tree may furnish several gallons of excellent honey. The bee is observed to be remarkably partial to the flowers of the Tulip-tree. Its partiality is easily accounted for. This most valuable of insects, whose industry has been proverbial for so many ages, prefers, notwithstanding, to lay up its store, at the least possible expence of labor.

There are two varieties of the Tulip-tree, namely, the yellow, and the white. It is very easy to distinguish their difference by the wood; but, perhaps, not otherwise. Both varieties afford excellent timber, which is employed for many purposes in this country. The yellow, is soft and brittle: it is cut into boards, heels for shoes, bowls, and trenchers. The white is hard, tough, and heavy: it is sawed into boards, joists, and other pieces for building*.

This magnificent vegetable is the favorite haunt of the *Oriolus* Baltimore, or Baltimore bird, which usually nestles under the shade of its foliage. Catesby, in his superb work, entitled *Natural History of Carolina, &c.* to which I have already referred, describes this bird, and its manner of building, which is somewhat curious.

* See Catesby's *Natural History of Carolina, &c.*—Marshall's *Arbus: Americanum.*—The Family of Plants, by a botanical society at Lichfield.—The *Encyclopædia*.

The Tulip-Tree, or poplar, is an indigenous vegetable of the United States. It is found, according to Catesby, in almost every part of the northern continent of America; from the cape of Florida to New England. To the northward of latitude 42, it is rather rare, and of inconsiderable stature. The trunks, which are often hollow, are made into Petty-augers, and Canoes, sufficient to contain many people. The Aborigines of this country esteem the Poplar, the fittest of all trees for this purpose.

SECTION II.

ANALYSIS OF THE BARK OF THE TULIP-TREE.

ON the 18th of March, two parcels of bark were taken from the *Liriodendron Tulipifera*, or Lyre-tree of America. One of the parcels was obtained from a trunk about twenty inches in diameter; the other from branches whose diameters varied from an inch to an inch and a half. That which was obtained from the branches, first became the subject of investigation. It was treated as follows.

I. DISTILLATION.

TWELVE ounces of the bark, and two pints of rain-water, were put into a glass vessel, which was kept close stopt, to prevent any aromatic or volatile principle from emanating. Having stood twenty four hours, the bark and infusion were submitted to the action of a gentle heat, in a glass retort, to which a receiver of the same kind was luted. Distillation being con-

tinued for several hours, a few ounces of fluid, not perfectly transparent, were collected in the receiver. An oily matter, in the form of a whitish scum, floated on its surface.

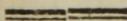
The distilled water, though not altogether insipid, possessed, only faintly, the peculiar flavor of the bark. It was somewhat acrid in the fauces. Its odor was exceedingly agreeable, being considerably impregnated with the grateful aroma of the vegetable.

The distilled water neither precipitated iron from its solutions; nor, affected, in the slightest manner, the blue color of vegetable substances.

The heat was now raised, by Argand's lamp, as high as the apparatus would admit. The liquor which came over had an acid and very astringent taste. It corrugated the mouth, and felt acrid in the fauces.

It changed blue vegetable substances red, and precipitated iron black.

RESULT. An essential oil, with aroma in profusion. An acrid, astringent acid.



II. INFUSION WITH COLD WATER.

A pound of bark was broken down into a coarse powder, in an iron mortar, and half a gallon of rain-water was affused on it. This,

having remained twelve hours, was poured off, and a second affusion performed. In this manner four infusions were made from the same bark, with this difference, that the two last were suffered to remain longer on the powder.

The first possessed a fragrant smell, resembling that of the bark; a yellowish tint; a feeble astringency; a saccharine, subacid taste; but scarcely any perceptible bitterness. It changed the blue color of litmus to a pale red; and produced in the solutions of iron a deep bottle-green.

The second infusion acquired the same properties, but less in degree or quantity. In the third they were barely perceptible; and in the fourth they could not be detected.

These infusions were thrown together and strained. When a portion of the mixture was agitated in a viol, it formed much froth, which did not suddenly disappear. The presence of a large quantity of mucilage was, at first sight, manifest.

ANALYSIS. Two pints of the infusion afforded, by evaporation, three drams of a dark-colored, gummi-resinous extract. During the early part of the evaporation, two scruples of pure fecula were deposited.

On three scruples of the extract I poured two ounces of alcohol. Nearly one scruple was dissolved. The solution was somewhat bitter.

I added to the spirituous solution an ounce of distilled water. No precipitate took place. But, when evaporated to half its quantity, the mixture became turbid, and flakes, soon after, floated in it. I separated this floccous precipitate by the filter; it weighed, when dry nearly three grains.—It was bitter. It readily dissolved in spirit, but not at all in water.

The fluid which passed the filter was again exposed to evaporate. It exhibited, in a short time, large curdles, similar, in appearance, to the coagulum of milk when broken down. This curdled precipitate, or gum-mucus, was of a yellowish white color. It dissolved, speedily, in spirit, and slowly, in a large quantity of water.

The bark which had been thus treated was dried. It made now a more acute impression on the tongue than when recent. Chewed for some time, it communicated a sensation of warmth to the mouth, resembling that produced by cloves. This warmth was blended with a moderate share of bitterness. Its increased acuteness of impression was owing, probably, to the abstraction of the mucilage, which, in the fresh bark, must have blunted the pungency of its bitter and aromatic principles. Alcohol extracted these principles entirely, leaving the bark quite insipid.

RESULT.	Fecula about	4	parts in 20
	Gum	10	
	Gum Mucous	5	19-20
	Resin		1-20

III. INFUSION WITH HOT WATER.

HALF a gallon of boiling water was poured upon a pound of bark, reduced to a coarse powder. Twelve hours after, the infusion was decanted, and an equal quantity of boiling water, again affused on the bark. This was repeated four times.

The first infusion was bitter, aromatic, and astringent.

The second, less bitter and aromatic; its astringency scarcely to be detected.

The third was not in the least astringent, nor did it possess any perceptible bitterness.

In the last affusion, the bark gave out neither bitterness, nor astringency.

ANALYSIS. A portion of the last mentioned liquor was evaporated. It deposited a little feculent matter which possessed a saccharine taste. This fecula was nearly insoluble in cold water, but readily diffusible in hot. Re-dissolved, and tested by the oxalic acid, it afforded a white precipitate, which denoted the existence of lime.

The alcohol of galls detected in it, the presence of iron, in very small quantity.

I mixed the several infusions, and evaporated, to the consistence of a very firm extract. The extract weighed three ounces and a half. I poured on one ounce of it, about six ounces of pure alcohol, which took up two drams. A gum blended with fecula and sugar was left behind. The spirituous solution contained about eighteen grains of resin, and five scruples, gum-mucous. The alcohol of galls detected iron, and the nitrate of silver, muriatic acid, in this solution. The gummy matter, exhibited as it dried, a great number of small shining crystals. Having distributed a part of it among three wine-glasses, I half-filled each with rain water. As soon as a solution was effected, the several portions were treated as follows:

The Nitrate of silver was added to one; it produced a precipitate, which I separated by the filter, and placed in pure water, where it remained undissolved. It was the Muriate of silver.

I added to another some tincture of litmus. The mixture became red.

The prussiate of lime produced in the third a blue tint which soon became greenish. I at first, concluded, from the production of the blue-color, that iron was present in the gummy solution. Farther reflection on experiments, however, force me to believe, that, the presence of iron cannot be ascertained by the prussiate of lime, or of potash; tho' contrary to the opinion of those

who have used them as tests for this purpose. It is only the *salts* of iron that effect the change of color when the prussiate of potash, or of lime is applied; and these salts act only by virtue of the *acid* which they contain. A quantity of iron being held in solution by those prussiates, an *acid* capable of decomposing the prussiate and seizing on its base, is *alone* necessary to the regeneration of prussian blue.

It was thought almost unnecessary to examine it by the alcohol of galls, as the solution was itself astringent, and, when added to solutions of iron, effected a precipitation. Still, however, I determined to have ocular evidence of the result. For I was pretty confident, from the analysis of a portion of the fourth infusion, in a separate state, that the extract contained iron. I added the gallic tincture—but, without producing any change of color. I was now persuaded that the iron had existed in a saline state in the extract; and, that it had been entirely dissolved by the spirit affused on it, which was afterwards proved to contain iron, and the muriatic acid.

RESULT.	Gum about 11 parts, or scruple	
	in	24
	Gum mucous 6.—	
	Resin nearly 1.—	
	Fecula nearly 6.—	
	Muriatic acid, perhaps in combination,	
	Iron,	
	Calcareous earth,	
	A muriatic or Essential salt.	

Five parts, only, of gum mucous had been taken up from the extract, by the alcohol. A strong mucilage was formed of the residue, to which a large proportion of spirit was added. The spirit dissolved one part more, of the gum mucous, leaving the other principles curdled at the bottom of the vessel.

IV. TINCTURE WITH ALCOHOL.

THE bark which had been repeatedly infused in cold water was, now, subjected to the action of alcohol. Twelve ounces, which I had procured in a highly concentrated state, by re-distilling with a low heat, the spirit of wine of the shops, were poured on it. In six days the tincture was examined. It was bitter, and possessed an elegant green color. It did not alter the blue color, of the tincture of turnsole; nor did it effect any change, in the solutions of iron. The residuum, when washed, was perfectly insipid.

ANALYSIS. To four ounces of the tincture, two of water were added.

The mixture instantly assumed a yellow-white color. A floccous precipitate gradually fell down, leaving the supernatant liquor more pellucid. Committed to the filter, the flakes remained on the paper. These flakes, when dried, weighed sixteen grains. During drying, they lost their yellow color, and acquired a beautiful light green.

The liquor which had passed the filter was set apart, and suffered to evaporate to half its quantity. At this period, large curd-like flakes floated in it. These were separated by the filter and dried. They remained of a white color. An infinite number of minute, saline crystals, glistened on the filtering paper last employed. Their quantity would be about three grs. This unexpected appearance induced me to expose the filtered liquor again, to the action of the atmosphere. I hoped, that by this means, I should obtain an essential salt in sufficient abundance to be examined. The evaporation was completed, but no crystals could be observed. A small portion of gum mucous, alone, remained in the vessel. Unable to satisfy myself in this way, I immersed the paper, which was bespangled with crystals, in some distilled water.

Into a portion of the water, I poured a little nitrate of silver, in solution. A white cloud was formed, which soon diffused itself throughout the whole of the fluid. Thus the presence of the muriatic acid was evinced, but the base with which it had been united was not ascertained.

Into another portion, I let fall a few drops of the prussiate of potash; but no precipitate ensued, to indicate the presence of ponderous earth. A bluish tint was the only visible effect.

The prussiate of lime was added to a third, and paper stained by the tincture of rhubarb, immersed in the mixture; the color of the paper

was changed to a brown. This, I think, goes some way to prove that the muriatic acid, has, in those crystals, an alkaline base. I shall offer an explanation, perhaps a lame one, of the chemical attractions which lead to this induction. The prussiate of lime, holding a quantity of iron in combination, is usually decomposed by an acid presented to it; in consequence of which, the prussic acid unites with the iron exclusively, forming prussian blue. Upon immersing the rhubarb paper, the affinity of the alkali with the muriatic acid, is weakened; the muriatic acid is attracted by the lime, which can scarcely be said to exist in a state of perfect combination; prussian blue is regenerated, and muriate of lime is formed; while, the attraction of the alkali is exerted on the rhubarb. Let what will become of this explanation, thus much is certain; alkalies have the effect of changing the tincture of rhubarb brown; and paper, colored by that tincture, sustained, in the present instance, such a change.

The green matter which was separated by the first filter was divided into four portions, on one of which a dram of alcohol was poured; a solution was speedily effected. The green, bitter resin, imparted its color and taste to the spirit. It was free from astringency.

Upon another, a dram of distilled water was affused; but, seeming to have no action, the quantity was gradually increased to four ounces, without diminishing the weight of the resin; and without acquiring the slightest impregnation.

Upon the third, a little fulphuric ether was poured. The resin was slowly dissolved. The ethereal solution possessed a brown color.

The remaining portion was placed in sweet oil, which rendered it so soft, as to be miffible by agitation.

The coagulum or gum mucous, separated by the second filter had a warm taste, with a degree of bitterness, barely perceptible. It was readily soluble in alcohol, and slowly in a very large proportion of water; sweet oil softened and swelled it; and sulphuric ether gradually, but slowly, dissolved it. The gum mucous weighed thirty grains.

RESULT	Gum mucous	30	grains
	Refin	16	
A muriatic, or	Essential salt	3	

The salt, I am of opinion, is composed of the muriatic acid, and an alkaline base. The brilliancy of the crystals was probably owing, to some peculiar modification of their arrangement on the paper.

V. IGNITION.

The bark which had been subjected to the action, first, of water, and then of spirit, was burned. Water was poured upon the ashes, the lixivium decanted, and then evaporated.

I thus procured a small quantity of vegetable alkali.

A little sulphur having been melted, by a gentle heat, part of the alkali was added, and mixed with it, until a hepar, or sulphure, was formed. The sulphure was dissolved in distilled water and afterwards precipitated by the alcohol of galls. The supernatant liquor being, after some time, decanted, to a part of it, the gallic tincture was added more lavishly. A dark brown color was produced. To the remainder the oxalic acid was added; a white precipitate resulted.

Another portion of the alkali dissolved in water, was barely neutralized by sulphuric acid. The liquor was evaporated by the heat of a lamp until crystals began to form, when it was set apart. The greater part of the salt having crystallized, the water was poured off, and treated by tests. Lime and iron were again detected in it.

RESULT.	Potash,
	Iron,
	Calcareous earth.

VI. FERMENTATION.

FOUR pounds of bark were put into an earthen vessel, and a gallon of boiling water affused over it. The vessel was about half filled.

It was left open, and on the top of a stove, where its temperature must have been from 95° to 120°, of Fahrenheit's thermometer. In five days a vinous fermentation seemed to exist: on the sixth it appeared more evident: a considerable extrication of carbonic acid gas taking place, a sheet of froth was expanded over the surface of the liquor. The peculiar fragrance of the bark could, no longer, be perceived.

ANALYSIS. In eight days I distilled. A quantity of fluid came over, which contained a portion of spirit of wine. I concentrated the spirit by a second distillation. It had the taste and smell of that procured from peaches.

A portion of the fermented infusion had been left in the earthen vessel. It proceeded, soon after, to the acetous fermentation, forming an acid liquor, equal in strength to a mixture of one part vinegar with two of water. During this stage of the fermentation, an oily matter, of a white color, inodorous, and insipid, collected on its surface. This oleagenous substance, I skimmed off, and dried, that is, freed, by exposure to the air, of the watery fluid mixed with it. I then submitted it, in separate portions, to the action of several menstrua.

Ether dissolved it.

The mineral acids, first, oxygenated or burned it, and afterwards dissolved it.

The alkalies speedily united with it.

It was not miscible, in spirit, nor in water.

With the assistance of yeast, to promote the vinous fermentation, the bark of the Poplar would, I am persuaded, yield a pretty large quantity of spirit, though sugar does not appear to be abundant in it.

RESULT. Spirit of wine,
Vinegar,
Oil.

VII. DECOCTION.

A decoction was made by boiling four pounds of the recent bark in a gallon of rain water. It possessed a brown color, an unpleasent, but warm bitterness, which to the taste, disguised its weak astringency, and a disagreeable odor, which no way resembled the pure aroma of the recent bark, or its simple infusion.

It changed the tincture of litmus red; and formed a black precipitate with the solutions of iron. The unpleasent odor was owing, no doubt, to the action of the heat on some of the principles extracted.

The decoction afforded five ounces of a black, or very dark brown, extract. I poured, on two drams of the extract, four ounces of alcohol: nearly two scruples were dissolved; but it required many days to effect a solution of so large a proportion. The spirituous solution, or tinc-

ture, possessed a yellow-brown color, and an unpleasant bitternefs, much more intense than that of the decoction. The residue had a nauseous sweet taste, and a somewhat paler brown than the entire extract.

Being fully persuaded, that the action of the fire had produced a very great alteration, and new disposition, of the virtues and principles of the decoction, I did not think it desirable to enter into a minute analysis, which could shed no light on the natural constitution of the bark.

VIII. TINCTURE WITH PROOF-SPIRIT.

Upon two pounds of the recent bark, I poured four pints of proof-spirit. After standing eight days, the tincture was poured off. It possessed a pretty strong bitter taste, with a very evident aromatic flavor. Its color was yellow, inclining to green; its smell, grateful. It was found to contain as much astringency as the decoction, or infusion. United to the tincture of turnsole, the result betrayed the presence of a small quantity of acid.

On the same bark I affused, afresh, an equal quantity of proof-spirit. This was suffered to remain four days, and then decanted. The bark, when washed, seemed perfectly insipid. Rain-water, poured on it, and permitted to stand two days, acquired not the slightest impregnation of its sensible qualities. The whole of

those qualities seemed to be perfectly extracted by the proof-spirit. I believe, however, it does not take up the whole of the gum and fecula, which is dissolved by hot, or even by cold water. The water, which, I have just said, was affused on the insipid bark, though it remained, itself, insipid, inodorous, and transparent, dissolved a portion of mucilage, which I proved by evaporation.

ANALYSIS. Two pints of the first-made tincture were distilled in a glass retort, with a constant and gentle heat, supplied by Argand's lamp. When one third of the liquor had passed into the receiver the process was discontinued. The distilled spirit contained the essential oil, and aroma, of the vegetable. It possessed a grateful flavor. The warmth it produced in the mouth, proved more lasting than that, which results from the application of common spirit. In the fauces it felt peculiarly acrid.

Two pints of the first, and two of the last-made tincture were mixed together. I found that water added to a portion of this tincture effected a precipitation; the precipitate, however, remained suspended in the supernatant fluid. This result led me to evaporate, slowly, the four pints which had been thrown together down to two; expecting, that the tincture, thus saturated, would afford a more copious, and a more easily separable precipitate, on the addition of water. The evaporation being so accomplished, I poured two ounces of water, into the two pints of sa-

turated spirituous tincture. An abundant precipitation rapidly ensued; and, by adding two ounces more, of water, the separation was rendered perfect. The precipitate was collected from the tincture, by straining, and was found, when dried, to weigh seven scruples. The milky liquor which had passed the filter deposited, on standing, nearly another scruple of the same resinous material; this being also collected, I placed the liquor in a shallow vessel, in order to accelerate spontaneous evaporation. I obtained, by this method, one ounce and two grains, of a gummy mass, through which, minute saline crystals were visible. This mass, treated by pure spirit of wine, afforded five drams of a mucous matter, which, tho' it was precipitated by a small quantity of water, was soluble in a very large proportion. The residue, which the alcohol did not dissolve, was an impure gum. The salt had, for its acid, the muriatic, as appeared upon adding the nitrate of silver.

The resin, procured by the aqueous precipitant, was greenish, bitter, inodorous, and free from all astringency.

The gum mucous, taken up by the spirit, from the gummy mass already mentioned, was slightly bitter, very aromatic, odorant, of a white or pale color, and free from astringency.

The impure gum, which remained after the action of the spirit, was, when washed and dried, of a brown hue, insipid, inodorous, and some-

what astringent; but this last character, by no means so prominent as might be expected. Was the astringency partially neutralized by a portion of iron, and, did it thence produce the brown color?

RESULT. Impure gum, 3 drams, 10 grains;
 Gum-mucous, 5 drams, nearly;
 Pure resin, 2 drams, 2 scruples.
 A muriatic or Essential salt in very small quantity.

Most of the preceding experiments and analyses were repeated on the inner bark of the trunk. This seemed to contain most astringency, that of the branches, most essential oil and aroma. These were the only observable differences.

SECTION III.

ANALYSIS OF THE BARK OF THE ROOT.

HAVING scraped off the cuticle, from roots of the Poplar, which were from one to two inches in diameter, the bark was stripped from the ligneous substance, cut transversely into very small pieces, and treated in the following manner.

I. DISTILLATION.

EIGHT ounces of the bark were infused in two pints of cold water, for twelve hours. The whole was then subjected to a low degree of heat, in a glass retort, to which, a tubulated receiver was luted. The receiver was kept stopt. At the end of six hours the distillation was discontinued. The quantity of fluid, which had passed over, amounted to three ounces. A portion of essential oil covered its surface. The distilled water was agreeably odorant, limpid, almost insipid on the tongue, and somewhat acrid in the fauces.

The color of the infusion, from which it had been drawn off, was a pale yellow.

A high degree of heat, being again applied, as in the distillation of the bark of the branches, a quantity of an empyreumatic fluid passed into the receiver, which did not contain a particle of acid or astringent matter.

II. INFUSION WITH COLD WATER.

EIGHT ounces of bark being dried, were broken down, in a marble mortar, into a coarse powder. Two pints of rain-water were affused upon the powder, and, in twelve hours, poured off: an equal quantity was again affused, and suffered to stand for the same length of time; when, it was also decanted. Affusion was thus repeated four times.

The liquor, to which the bark was first committed, acquired a mucilaginous consistence; a pale yellow color; an agreeable smell; and, a very faint bitterness.

The second infusion possessed the same sensible qualities in a less proportion; in the third, they were scarcely perceptible: in the fourth, they could not be discovered. Neither, possessed any astringency. To a portion of the first, I added a solution of martial vitriol, which produced no other effect, in point of color, than a slight

change of the yellowish, toward a greenish tint, not stronger in shade, than a common infusion of green tea. It is, I think, a circumstance worth being remarked, that the root is destitute of the astringent acid, which exists in abundance, in the bark of the trunk and branches. I submit the fact to the consideration of physiologists and botanists for a theory.

The several infusions just noticed, were mixed and strained. The whole was set apart to evaporate, except a few ounces, which were reserved, to be treated by chemical tests.

The liquor produced no change of color in the tincture of litmus.

It did not perceptibly affect the solutions of iron.

Neither the oxalic acid, the nitrate of silver, nor the muriated barytes, was observed to effect a precipitation.

The extract obtained by evaporating the infusions, I committed to a vessel containing spirit of wine. The quantity of the extract did not exceed half an ounce; of the spirit, there were four ounces. One dram was dissolved. The portion taken up by the spirit consisted of one part resin, and nine parts gum-mucous. What the alcohol did not dissolve was an impure gum.

III. TINCTURE WITH ALCOHOL.

THE powdered bark, which had been subjected to the action of water, was now treated with pure spirit of wine. It afforded an intensely bitter tincture, of a beautiful orange-color, inclining to red. This tincture was evaporated to half its quantity, and a part of it diluted with a small portion of distilled water. Upon adding the water, it assumed a milky appearance, a little curdled, and yellowish. It afforded a pure resin, and a gum mucous in the proportion of one part of the former to two of the latter. The resin was intensely bitter; the gum mucous, very feebly so. The remainder of the tincture, having been concentrated by evaporation, was treated by tests, in the same manner as the infusion, (sect. 3.) and with a similar result.

IV. INFUSION WITH HOT WATER.

THE infusion made with boiling water, is a much stronger bitter, than that made with cold; yet it is much less intense than either the tincture by proof, or by pure spirit.

The hot infusion differs remarkably from the cold, in point of color. The latter possessed, as I have said, a pale yellow; the former, an elegant dark orange, inclining to red; nearly, tho'

not precisely the color of the spirituous tinctures. Some persons to whom it had been exhibited, said its color was an approach toward a clear crimson.

The same curious difference took place in the bark of the root, treated by the cold and hot water. The latter acquired a red hue, while the former retained its pristine yellow color.

About a quart of the infusion made with boiling water, was decanted from the bark, and suffered to stand several days in a glass vessel secured by a ground stopper. Upon taking out the stopper to examine it, I was struck with a powerful smell of pitch. The emanation was so abundant, that it could be perceived at the distance of some feet, from the vessel containing the infusion. No other sensible change had taken place in the liquor, except a very slight tendency toward the acetous fermentation. It retained its original bitterness, its fine orange-red color, &c.

V. DECOCTION.

THREE pounds of bark were boiled in a gallon of rain-water. The decoction was a pretty strong bitter, of a very dark brown color. It afforded a shining black extract, intensely bitter. Doctor Rush, in a short paper, in the transactions of the College of Physicians of Philadelphia, mentions this extract, as one, equal to that of

gentian. This information should, I think, render it worthy the attention of the apothecaries, of this country at least. For reasons similar to those mentioned, when treating of the decoction of the bark of the tree, I did not enter into an analysis of this extract. It is sufficient to observe that it was found destitute of astringency, and that it produced, in the form of decoction, no change of color in the tincture of turnsole. I must have contained mucilage, gum mucous, and resin; each of which may have undergone some slight modification, in consequence of the continued application of heat, during boiling.

SECTION IV.

OF THE EFFECTS OF THE TULIPIFERA BARK ON THE HUMAN SYSTEM, &c.

IN this part of my inquiry I have endeavoured to ascertain the effects of the Tulipifera bark on the human system. I regret, that the time allotted for the investigation of the subject, in a general way, has not permitted me to extend, sufficiently, my experiments for this essential purpose.

I. OF THE INFUSION.

HAVING prepared an infusion of the inner bark of the Tulip-tree, by pouring on four ounces of it, a pint of boiling water; it was set apart for use. I first attempted to ascertain its influence upon my own constitution, which is one, not difficult to be affected by active medicines. With this intent, on the afternoon of a cool day, I seated myself at some distance from a little fire, which kept the temperature of the apartment at 60°. of Fahrenheits thermometer. My skin was less warm than ordinary. My

pulse beat seventy four strokes in a minute. I had a slight head-ach, that had visited me, during several previous weeks, on the approach of evening. Bathing my head in cold water, or drinking some draughts of it, usually had the effect of removing the pain for that evening; these means did not, however, prevent its return. It may likewise be proper to remark, that the free use of tea, when taken early in the afternoon, frequently produced the same salutary effect, which resulted from the cold affusion.

Under these circumstances, I took a wine-glass full of our medicine, and resolved to repeat the dose every five minutes, until it should produce some sensible effect on my system. I did not pretend to anticipate any particular effect. No change being observed during the first five minutes, the dose was repeated; and from this period, the influence exerted on my pulse became considerable.

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My pulse beat	<table border="1" style="border-collapse: collapse; text-align: center; width: 100%;"> <tr> <td style="padding: 2px;">74</td> <td style="padding: 2px;"> </td> <td style="padding: 2px;">72</td> <td style="padding: 2px;"> </td> <td style="padding: 2px;">72</td> <td style="padding: 2px;"> </td> <td style="padding: 2px;">71</td> <td style="padding: 2px;"> </td> <td style="padding: 2px;">72</td> <td style="padding: 2px;"> </td> <td style="padding: 2px;">72</td> <td style="padding: 2px;"> </td> <td style="padding: 2px;">70</td> <td style="padding: 2px;"> </td> <td style="padding: 2px;">70</td> <td style="padding: 2px;"> </td> <td style="padding: 2px;">71</td> <td style="padding: 2px;"> </td> <td style="padding: 2px;">71</td> <td style="padding: 2px;"> </td> <td style="padding: 2px;">70</td> <td style="padding: 2px;"> </td> <td style="padding: 2px;">71</td> </tr> </table>	74		72		72		71		72		72		70		70		71		71		70		71	strokes.
74		72		72		71		72		72		70		70		71		71		70		71			

Five minutes after I took the second dose, my skin became a little warmer; and I felt as in a more agreeable temperature. In ten minutes my pulse beat fuller and softer. I began, at the same time, to perspire freely. In fifteen minutes I was bathed in sweat; my skin felt, to the persons around me, warmer than usual; while, to myself, it seemed more cool. In twenty minutes, my pulse, still soft, was less

full; my headach now began to abate, and in twenty-five minutes it was entirely removed. In half an hour, the sudorific effect was diminished, and in thirty-five minutes, it could not be observed. The medicine appeared, afterwards, to act in some degree as a diuretic; of this operation, however, I cannot speak with confidence, as other circumstances may have had their influence. A considerable coolness of the skin which supervened, may have contributed to increase the secretion of urine.

The same doses were repeated the next afternoon, at the usual time of the accession of the headach. A gentle sweat was produced; the urinary secretion, subsequently increased; and the headach prevented.

2. A gentleman, in good health, twenty-three years of age, and his pulse beating seventy-one, soft and full strokes in a minute, took four ounces of the same infusion. It was used, in this, as well as in the preceding experiment, cold.

In	1	5	10	15	20	25	30	35	40	45	50	minutes
His pulse beat	71	78	74	67	73	73	72	75	75	75	75	strokes.

About the tenth minute, the fullness of his pulse was evidently increased. Toward the fifteenth, his skin became warmer. In thirty minutes his hands were moist with sweat; and in thirty-five, this effect was extended over his back, and between his shoulders. In forty minutes, the fullness and force of his pulse was manifestly diminished.

At the expiration of one hour, the same gentleman took two ounces more, of the infusion; his pulse still beating seventy-five strokes in a minute.

In	1	3	5	10	15	20	25	30	35	40	minutes
His pulse beat	75	76	74	69	72	72	71	70	71	21	strokes.

His pulse continuing less full and tense, its stroke felt, about the fifteenth minute, somewhat quick. Towards the thirty-fifth, it grew smaller: and in forty minutes, its diminished force, and size, were very striking.

That boiling water extracts, some of the principal virtues of the *Tulipifera* bark, is clearly evinced by the preceding experiments: and the effects related, correspond precisely, with the intimation given by my learned preceptor, concerning the properties of this plant, which, he says, has active powers, as a stimulant and sudorific. I shall again have occasion to refer to that passage of his paper, in the transactions of the American Philosophical Society, where he mentions the *Liriodendron Tulipifera*, as a remedy which has been used for the bite of the rattle-snake in horses.

II. OF THE BARK IN POWDER.

1. A quantity of bark, taken from branches of one and two inches in diameter, was reduced to a fine powder. About an hour after break-

fast, my pulse beating seventy-six strokes in a minute, I took two scruples of the powder, diffused in a little milk.

In	1	3	5	10	15	20	25	30	35	40	45	50	60	minutes
My pulse beat	76	76	74	72	70	70	72	72	73	69	70	71	71	strokes.

In ten minutes I felt considerable nausea, and the force of my pulse began to diminish. In twenty, my skin became a little warmer than usual; but this effect was transient, for I soon began to sweat, which produced a coolness over my body. About the thirty-fifth minute I grew languid. The nausea and langor continued for several hours.

Three days having elapsed, I repeated the experiment with a very different result. The same quantity of the powder was taken, but it produced neither nausea, heat, sweating, nor langor. It had, however, an influence on my pulse, very similar to that, which it exerted in the first instance. It not only lessened its frequency, but it likewise reduced its tension and fulness. It appeared to act very considerably on the kidneys. The last effect was only such as might be expected, since no diaphoresis was produced by the medicine.

2. To a gentleman, nineteen years of age, healthy, his pulse beating seventy-five strokes in a minute, I gave one scruple of the powder.

In	1	5	10	15	20	25	30	35	40	45	50	60	minutes
His pulse beat	75	82	85	83	80	82	80	78	78	80	81	82	strokes.

In fifteen minutes, his pulse began to increase in fullness and force. In thirty, it became somewhat irregular: each stroke seemed to be succeeded by a convulsive throb, making, on the fingers, a peculiar impression of a double pulsation, with jerking. It affected neither his stomach nor the cutaneous exhalents. It may be proper to remark, that the experiment was made in a cold apartment.

These experiments with the powder are sufficient to shew, that the *Tulipifera* bark is a stimulant, and that, as such, it is endued with very promising powers. They also prove, that, like all active medicines, it is capable of producing very different, and even opposite effects, in different constitutions. Two scruples, taken by myself, without having at any time increased the force of the circulation, lowered my pulse both in frequency and tension: half the quantity taken by Mr. — increased, remarkably, the frequency, fullness, and tension of his pulse. That which I took, notwithstanding its influence on my pulse, acted as a powerful stimulant: it produced nausea, which could be the effect of a stimulating or irritating power only; it produced a transient heat over the surface of the body, and increased the excitement of the cutaneous exhalents, or capillary vessels, which are, in like manner, effects of stimulating powers exclusively. And like all powerful stimulants, its operation was succeeded by languor.

3. A grain of the powdered bark was snuffed up the nose. It instantly produced heat, and exquisite pain, in the schneiderian membrane. The mucous of the part was secreted in large quantity; and the pungency of the impression, creating a sympathetic action in the lachrymal glands, caused an abundant flow of tears.

schneiderian membrane

III. OF THE EXTRACTS OF THE BARK.

1. ABOUT two hours after dinner, a dram of the extract, obtained by decoction, was taken by a gentleman in perfect health.

It increased the frequency, fulness, and tension of his pulse; produced a heat over the surface of his body, which was not perceptible to himself; and excited, in a little time after, considerable nausea, which was accompanied by a more copious perspiration. His hands sweated; his back felt moist; and his cheeks became less florid than natural. The appearance of his tongue was not altered. He fancied it acted as a diuretic toward the evening.

2. Two drams of the same extract were taken by myself, early in the afternoon. The dose seemed to render my pulse more full than ordinary; while it lessened its frequency and quickness. In ten minutes, it produced heat; in fifteen, a sweat, and considerable nau-

sea. In thirty minutes the nausea ceased, and I became languid and drowsy. I endeavoured to preserve my skin in its natural temperature, by drawing nearer to the fire as the sweating abated; which probably prevented any subsequent diuretic operation.

3. One hour after breakfast, I took a scruple of the extract obtained by proof spirit.

The quickness and tension of my pulse were somewhat increased, while its frequency was diminished. In ten minutes I felt much nausea; and in fifteen, I began to perspire very freely. About the twentieth minute, the quickness and tension of my pulse began to abate; and in half an hour, it was weaker, smaller, less regular, and much less frequent. The nausea proved very disagreeable for at least two hours. Some ineffectual efforts to vomit were produced. Languor and drowsiness succeeded the nausea, and continued during the remainder of the day.

It appears from these experiments, that the extracts by water, and by spirit, produce on the system pretty nearly the same effects, which result from the use of the infusion and powder. They likewise show, that the extract by spirit is much more powerful than that obtained by decoction with water. The former, though more bitter, is more agreeable than the latter.

The simple infusion of the bark is the most agreeable form in which it can be used. It likewise produces its sudorific effects sooner than the other preparations. It is less powerful than the powder, and more powerful than the extract obtained by boiling the bark in water.

IV. OF THE ANTISEPTIC POWERS OF THE TULIPIFERA BARK.

1. Having taken from a piece of beef, a portion of muscle without any fat, three ounces of it were distributed equally, among three glass vessels. Into one of the vessels, I put half an ounce of powdered Tulipifera bark; into another, as much peruvian bark; and into the third, a similar quantity of common salt: I then poured into each, half a pint of rain water, diffused the powders by agitation, and suffered the vessel to remain open.

In three days, no change was to be observed, in the vessels in which the Tulipifera and the peruvian barks were infused; but a disagreeable emanation began to proceed, from that which contained the solution of salt.

In six days, a most fetid odor issued from the last mentioned vessel; the meat, when taken out and washed, still retained the putrid smell. The odor of the other vessels, containing the infusions of the barks, betrayed not the least tendency toward a putrescent state. These in-

fusions, however, proceeded, about this time, to the acetous fermentation. They produced, in the tincture of turnsole, a much deeper red, than recent infusions of the same articles had been found to effect. They likewise emitted a smell somewhat sour, though not so much so, as totally to destroy, in the infusion of the Tulip-tree bark, the original fragrance of that substance.

In twelve days, the meat was taken from those infusions, perfectly free from any putrid taint. That which had been committed to the action of the peruvian bark was considerably bitter to the taste: that which had been treated by the bark of the Tulip-tree was bitter and aromatic. A person, who was present when I examined the meat, said, that the latter portion possessed the taste and smell of allspice, mingled with some bitterness.

2. One dram of the powdered bark of the Tulip-tree was rubbed over an ounce of beef which was free from fat. As much peruvian bark was rubbed over another ounce of the same meat. Half a dram of common salt was sprinkled over a third. The three portions of beef, thus treated, were laid upon separate plates, and covered by inverting other plates over them; expecting by this means, that while the surrounding atmosphere was permitted to act on the beef, the emanations arising from it would not be so speedily carried off or dissipated.

No change of odor was perceived until the fourth day. At this period, the portion treated by the peruvian bark emitted a smell, rather unpleasant, which seemed to denote an incipient putrefaction. That treated by the bark of the Tulip-tree, was not observed to emit any such odor; it should be remarked, however, that the stronger fragrance of this bark, may have disguised it, in this early stage of putrefaction. That which I had salted was perfectly cured.

In eight days, the piece, on which the peruvian bark had been rubbed, was pretty much advanced in putrefaction. Upon uncovering it, I perceived a strong smell of volatile alkali; I applied a glass stopper, moistened with muriatic acid, to the ammoniacal atmosphere, and a white cloud expanded over the plate. This confirmed the idea, that volatile alkali was disengaged. The same thing took place with the piece of beef, committed to the action of the Tulipifera bark. The smell of the latter was somewhat less offensive than that of the former, yet it appeared to be equally advanced in putrefaction.

SECTION V.

OF THE USE OF THE TULIP-TREE IN MEDICINE.

I. PROPERTIES OF THE BARK OF THE TREE AS A MEDICINE.

IT is *incitant*. Though the bark of the Tulip-tree is a very considerable stimulant, I am not certain that it is one of so high an order, as to claim a place among the proper *incitantia*. In the arrangement of doctor Darwin it might, for some reasons be placed in this class: thus he says, “these” (*incitantia*) “promote both the secretions and absorptions, increase the natural heat, and remove those pains, which originate from the defect of irritative motions, termed nervous pains”. I have found the *Tulipifera* bark to produce all those effects. The same great physician, however, makes an observation elsewhere, which, though he has not been entirely governed by it himself, tends to shew that such an arrangement of our article would be

less proper. Thus he says, "It is probable, that some of the articles in the subsequent catalogue," (of incitantia) "do not induce intoxication; though they have been esteemed to do so; as tobacco, hemlock, nux vomica, flavifagria; and on this account should rather belong to other arrangements, as to the secernentia, or forbentia, or invertentia." The author seems desirous to admit into this class, such stimulants only, as are intoxicating and universal.

2. I have already considered this bark as a *stimulant*. From its sensible qualities, and its effects on the healthy system, it might with some propriety be placed among the stimulants, in the arrangement of Doctor Cullen. Yet, as it is no more characterized by its odorant, aromatic, or heating properties, than by some others, it probably would not have been so arranged, by this celebrated author.

3. It is placed by my preceptor, Doctor Barton, in his "Collections towards a Materia Medica of the United States," under the head of *tonics*. This is, no doubt, its proper arrangement: though, from its great sudorific powers, and its effects on the pulse, it would seem to aspire to a place among his class of stimulants, or *incitants*, strictly so called.

4. The bark of the Tulip-tree is a powerful *diaphoretic*. This property may be considered as secondary, and must necessarily depend upon its primary incitant power. "All of the diaphoretics

ate," says Doctor Cullen, "either by exciting the force of the circulation, or by exciting the action of the extreme vessels on the surface of the body only; and these two actions take place sometimes separately and sometimes together." This account, of the operation of diaphoretic medicines, is exemplified in the experiments, which were instituted, to ascertain the effects of the *Tulipifera* bark, on the human system.

5. It is sometimes *diuretic*. Most diaphoretic medicines prove diuretic, when the skin is kept cooler than usual: and diuretics, on the other hand, if the skin be kept warm, promote sweat instead of urine. This alternation of effects, governed by the temperature of the skin, I have seen repeatedly produced, by the bark of the Tulip-tree. Were a class of *secernentia* to be established, in conformity to the plan of Dr. Darwin, would not the *Liriodendron Tulipifera* be placed in it, with some propriety? But such a class should, if possible, have other limits than those given to it by Dr. Darwin; otherwise, it would monopolize the whole *Materia Medica*: it would at least include every active stimulant, and of course, every useful medicine.

6. The bark of the Tulip-tree is *astringent*. This quality is not very considerable: yet, united as it is, with some bitterness, and a very important proportion of an aromatic substance, it may have some very valuable influence, in modifying the common effects of the natural

combination of those principles. The astringency has, for example, been no despicable agent, in union with the other qualities, when this bark has been successful in the cure of intermitting fevers.

7. Is it an absorbent? It would appear that all medicines, which stimulate the secreting system, in an eminent degree, should necessarily excite the absorbents, more or less, at the same time. Thus, when an unusual diaphoresis is supported, by means of medicine, without increasing the supply of fluids in the system, by drink, or otherwise; the lymphatics of the cellular membrane, or some other branch of the absorbents, must be excited into greater action, in order to furnish fluid for elimination: for it is scarcely probable, that the serum already existing in the blood, should support diaphoresis long, without an accelerated absorption of moisture from the atmosphere, or of that, deposited in the cells and cavities of the body. Hence diuretics remove dropical swellings, by promoting absorption from the cellular membrane. Emetics and cathartics promote this kind of absorption in a similar way; and thus, are often successful in anasarca. And perhaps all powerful sudorifics produce costiveness, and high-colored urine, by stimulating the lacteals and the absorbents of the bladder. It is manifest, then, that those medicines must act decidedly as absorbents.

“ Absorption from the cellular membrane,” says Dr. Darwin, “ is promoted by bitter vege-

tables." And the same author observes, that "intestinal absorption is increased by astringent vegetables, as rhubarb, &c." Consequently, we may consider the bark of the Tulip-tree, both from its effects on the system, and from its sensible qualities, as an incitant of the absorbents. Doctor Darwin considers his sorbentia, as strengtheners, or tonics, when used in such doses, as do not perceptibly increase the natural secretions and excretions.

The bark of the *root* of the Tulip-tree, I regard simply as a *tonic*. It is a strong bitter, containing a small portion of a warm aromatic principle, with an essential oil. It is more exclusively a stimulant of the absorbent system than the bark of the tree; and therefore it is more purely tonic. This article, on account of its simplicity, does not require any farther disquisition, concerning its virtues as a medicine.

II. OF THE BARK OF THE TREE, AS A REMEDY IN DISEASE.

1. In the Intermittent Fever. It is the opinion of many, that this bark is but little inferior to the Cinchona: see Doctor Barton's "Collections for an essay towards a Materia Medica of the united states." It probably exerts its febrifuge powers in the same manner likewise; but this cannot be affirmed as certain. Like the peruvian bark, it possesses bitterness and

astringency: to these qualities, however, there is added, in the *Tulipifera* bark, a much larger proportion of aromatic matter, than is contained in the other,

I am confident that neither of them cure intermittents by any specific virtue. They act by virtue of their stimulus; and their success depends upon the quantity of stimulation they produce; the order of vessels upon which they principally act; and the state of the system, at the time they are employed. They may be said to cure by their tonic operation; because they stimulate the absorbents, and the stomach chiefly; while they increase less obviously, the excitement of the heart and arteries. They may be said to cure by creating a new action, which means the same thing; for I suspect the new action is primarily transmitted from the stomach to some one or more branches of the absorbent system. By this means, the necessary quantity of fluid is supplied to the blood-vessels, and thence their natural excitement is supported; the cold paroxysms of intermittents are thus prevented, and the hot fits, consequently obviated. So, when intermitting fevers are badly treated, or when tone has not been imparted to the frame, by exciting the absorbents to their accustomed functions, disagreeable disorders almost constantly supervene: a continued quiescence of the cellular lymphatics is succeeded by dropsy; a similar state of the hepatic branch, is followed by an enlargement of the liver; and defective energy in the lacteals, gives rise to diarrhoea, &c.

I think the efficacy of our medicine may be much improved, by mixing equal parts of the powdered bark of the tree, and that of the root together. In such a form, its sensible qualities would at least approach nearer to those of the peruvian bark; and the proportion of its heating property would be diminished, which may frequently be desirable in the employment of it. If it has been already found to be but little inferior, I see no reason why it should not, thus blended, prove equal, and sometimes superior, to that celebrated febrifuge. Besides, as it is an article endued with active properties, and as it was, till of late, employed by ignorant people only, who knew neither the time, nor the manner, in which it should be exhibited; it must often have proved ineffectual, or even injurious, when it would, in the hands of physicians, have produced the happiest effects. This consideration gives me a still stronger presumption of its future usefulness. I would observe, with respect to the heating quality of the Tulip-tree bark, that it may, in many cases, render the medicine more efficacious; particularly in cold phlegmatic constitutions, or when a degree of torpor appears to be extended over the sanguiferous system, accompanied with want of appetite, during the apyrexia.

The practice which my preceptor, Doctor Barton, recommends, in his lectures, of giving a few grains of rhubarb, combined with the peruvian bark, throughout the whole course of the disease, would, no doubt, be equally proper in

the exhibition of our remedy: this practice is still more necessary, if the intestinal absorption excited by the medicine be so great, as to induce costiveness; and under such a circumstance, the rhubarb should be added in a quantity just sufficient to overcome constipation, by increasing the peristaltic motion of the bowels.

2. In Dropsy. I am of opinion that the bark of the Tulip-tree, either separately, or combined with the bark of its root, may be found of great service in certain forms and stages of dropsy. Its powers as a sudorific or diuretic, and its property of stimulating the absorbents, are sufficient reasons for entertaining this opinion. I regret that it has not been put to the test of experience.

In the management of dropsy, though much advantage is derived from the proper employment of vegetable or metallic tonics, in almost every form of the complaint, these remedies are not always entirely to be depended upon. This complaint is not only frequently the consequence of, but is often attended with, a febrile affection. Here, then, evacuations are necessary; and they prove useful in two ways; first, they remove the febrile diathesis which is sometimes very considerable; secondly, they are often the most powerful promoters of absorption in all parts of the body. Emetics, cathartics, &c. do not, however, supercede the use of tonics. They are, in many cases, necessary antecedents, or auxiliaries; while, in many others, such eva-

cuations are not to be employed; but the cure is chiefly to be trusted to strengthening and cordial medicines; that is, to such as influence the absorbents, without either increasing debility, or creating febrile action in the blood-vessels.

3. In Hepatitis. In enlargements of the liver, and other affections of that viscus; unattended by inflammation, or after inflammation has been subdued; the bark of the root would be a useful addition to the metallic tonics. Would the bark of the tree, in such cases, prove too heating? I think not, where the torpor and debility of the whole frame are considerable.

4. In Chlorosis. In this disease tonics are principally relied upon; particularly chalybeates and bitters conjoined. These, with small opiates at night, and gentle laxatives daily, commonly restore the catamenia. Here, likewise, our medicine will no doubt prove serviceable.

5. In Typhus fever. After the continuance of this fever for some time, I imagine the bark of the Tulip-tree would be found useful. It should not be employed in this disease while any inflammatory diathesis is present. When this diathesis does not exist, and when there is great prostration of strength, I should have much dependence on its efficacy, if skilfully exhibited.

These remarks I would apply to all fevers taking on a typhus type, or becoming chronic.

6. In Rheumatism. Our medicine has, in some parts of the United States, acquired much reputation as a remedy in this disease*. It has been used, I imagine, with most apparent advantage, in the chronic rheumatism; as it would, perhaps, prove too stimulating, in the acute, or inflammatory forms of this disease.

7. In Gout. I know nothing of the virtues of our bark in this disease, but what is communicated to the public, in the work of my preceptor, already mentioned. I beg leave to transcribe his note on this article. Having observed, that, in the United States, it has been used in the present, as well as the last named disease, with much reputation, he says—"As a medicine possessing properties very nearly allied to those of the *calida amara*, or heating bitters, which have, for ages, formed a part of the celebrated gout powders, I think it not improbable, that the Liriodendron may have been used, with the seeming advantage of putting off, for a time, the inflammatory paroxysm of the gout. But the well known history of the gout powder, is not calculated to encourage one to use (as a remedy for the worst of diseases) a medicine which might only alter the shape of the disease, and give it a direction to the more essentially important part of the human frame."—The habitual use of bitter medicines for some years, as of Portland's

* See Doctor Barton's Collections towards an essay on the *Materia Medica* of the United States.

powder, or of the peruvian bark, has had the apparent effect of relieving gouty patients. These medicines are conceived, however, to induce, after some years, other sudden and fatal diseases. Doctor Darwin mentions two cases of this kind, which fell under his notice. One of the patients died of apoplexy; the other, of an inflammation of the liver.

8. As an Anthelmintic. I have not learned that the bark of the Tulip-tree has been used to destroy worms in man. Mr. Washington, my fellow graduate, informs me, that it is a common practice with the negroes in Virginia, to give the horses, troubled with worms, strong decoctions of the root of the Liriodendron. He had not attended much, to the anthelmintic power of this article, on the horse. It is presumable, from our knowledge of its tonic property, and from the universality of this practice, among those sable horse-doctors, that some advantage results from its employment.

9. As an antidote against the poison of the *Crotalus Horridus*, or Rattle Snake. The following note I have found in a paper of my preceptor's, on the subject of this poison.*—
 “Among the Cheerake, and probably among other American tribes, the inner bark of this tree,” (the *Liriodendron Tulipifera*) “after be-

* “An account of the most effectual means, of preventing the deleterious consequences of the bite of the *Crotalus Horridus*, or Rattle Snake;” by Doctor Barton.

ing bruised, is infused in water, and the infusion given to horses which have been bitten by the Rattle snake. It is not improbable, that this medicine may sometimes be of service in those cases, as it is certain, that the bark of the American *Liriodendron* possesses very active powers, as a stimulant, and sudorific. I have never heard that this bark has been employed for the bite of the Rattle snake in man."

10. Will it be of use in any stage of Syphilis? Mr. Lawson, in his history of North Carolina, speaks of a disease resembling syphilis, which prevails among the Indians; and in which, our medicine is considered as a specific. He thus describes it;—"The *Struma* is not uncommon among these savages, and another distemper, which is, in some respects, like the *pox*, but is attended with no gonorrhoea. This, not seldom, bereaves them of their nose. I have seen three or four of them rendered most miserable spectacles by this distemper. Yet, when they have been so negligent, as to let it run on without curbing it, at last they make shift to patch themselves up, and live for many years after; and such men commonly turn doctors. I have known two or three of these no-nosed doctors, in great esteem amongst these savages. The juice of the *Tulip-tree* is used as a proper remedy for this distemper." From Mr. Lawson's manner of describing this disease, as one which the Indians can subdue; and from the

Tulip-tree being regarded as the proper remedy; whatever may be the nature of the affection, our confidence in the powers of this vegetable should be farther increased.

THE END.

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