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C H A P. IV.

Of the USES of the RIND.

THE Rind, as thin as it is, and as inconsiderable as it may seem, is a part of the vegetable structure, of the highest and most essential use: it covers the whole tree, both above; and, what is much more important, under the ground; and contains the great and original organs by which it grows.

To take a right view of its importance and utility we must observe some yet unnoticed parts of its construction: and that these may be rendered more distinct than in their state of nature, 'tis proper to convey coloured fluids into the several vessels. The divisibility of matter has been often spoken of with wonder, but it has
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never been manifested to the senses in a degree at all to be compared with what is exhibited by such impregnations of vegetable parts.

It may be now observed, that at the letter *g* in Fig. 4. there appear dots upon the highly magnified vessels: but to know what they are requires yet greater powers of the Microscope, and more assistance. There are scarce any limits to the degrees of magnifying that may be obtained by the combination of two object glasses, of different powers, as the construction of this Microscope admits: nor are the means of more assistance wanting; since coloured liquors may be thrown into the small vessels of Plants: nay, and into the very smallest of all, liquors, which tho' pellucid and colourless when received, may be coloured after they are lodged there; altho' the matter of that colouring would have rendered the liquid too thick to have passed in the same condition.

As the vessels of the Rind are of different diameters in various trees, tho' their construction and that of the Blebs is perfectly the same in all; it will be best to choose for this purpose the Rind
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of a tree wherein they are largest. The advantages I receive from the garden of her Royal Highness the Princess Dowager of Wales, at Kew, (who, best of Princesses and of Women! is pleased, undeserving as I am, to honour me with her royal patronage and protection,) that garden, where every tree that has been seen in Europe is at hand; have given me opportunities of so many trials, that I can happily save the pains of others in this and all the following instances; by saying what best answers. To the present purpose the Rind of the Ash-leaved Maple is finely suited. A piece of this may be obtained of two inches long, and will very successfully answer the intention. Such a piece being prepared without either alum or spirit, but dried from the water in which it had been macerated, is to be impregnated with lead in the following manner; to shew the apertures by their colour.

Diffolve one dram of sugar of lead in an ounce and a half of water: filter this thro' paper, and pour it into a tea-cup. Clip off a thin slice of what was the lower end of the piece of Rind, as it grew on the tree, and plunge it

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near

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near an inch deep in the liquor; keep it upright between two pieces of stick, so that one half or more may be above the water: whelm a wine and water glass over the tea-cup, and set the whole in a warm place. When it has stood two days, take it out, and clip off all that part which was in the liquor, and throw it away.

The circumstances here mentioned, trivial as they seem, must be attended to: the operation will not succeed even if the covering glass be omitted: it keeps a moist atmosphere about the Rind, and makes its vessels supple.

While this is standing, put into a basin two ounces of quick lime, and an ounce of orpiment; pour upon them a pint and a half of boiling water; stir the whole together; and when it has stood a day and night, it will be fit for use. This is the Liquor Probatorius Vini of some of the German chymists: it discovers lead when wines are adulterated with it; and will shew it any where.

Put a little of this liquor in a tea-cup, and plunge the piece of Rind half-way into it.

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In the former part of this experiment the vessels of the Rind have been filled with a solution of lead; that makes of itself no visible alteration in them: but this colourless impregnation, when the Orpiment Lixivium gets to it, becomes of a deep brown: the vessels themselves appear somewhat the darker for it; but these dots, which are real openings, now are seen to be plainly such, the colour being perfectly visible in them, and much darker than in the vessels. Plate V. Fig 1. *a b*.

This object must always be viewed dry, and is best kept in one of those Sliders which the Noble Person, to whom, in a manner, all that are called my Improvements are originally owing, has directed to be made with glasses instead of Talcs.

If a piece of the Rind, thus impregnated, be gently rubbed between the fingers till the parts are separated, we shall be able in one place or other to get a view of the vessels all round, and of the films which form the Blebs between them. These last consist of mere membrane:

no power of the Microscope shews any thing vascular in their structure: they are a kind of bladders, closed at bottom and open at the top, with a space, greater or less, between the top of one and the bottom of another. Fig. 2. *a a*.

As to the Vessels, their composition is much more to be regarded; they are every where pierced with openings; but of these the outer ones first seen, are by far the largest: there are two other series of them; the larger of which, tho' still much less than the former, are placed against the interstitial spaces, between Bleb and Bleb; and the smallest open into the Blebs themselves. Fig. 3. *a b*.

I should think it is not easy to err as to the uses of these openings; when we see their construction so exactly: and those uses being understood, we shall have made no small advance in the knowledge of vegetation. Let us, if you please, philosophic Reader, consider them first in that part of the Tree which is under ground, the Root: here they are always surrounded with some degree of moisture: let us, together with these objects, consider those everlasting agents heat and cold;

cold ; not to say heat in its various degrees, for that were speaking too abstrusely. Heat can be no where present but it expands substances : cold no where but it contracts them.

We see a Root, equalling more than a third part of the Tree above ground, in the extent of its surface ; this surface is covered with the Rind, thus pierced ; which is connected also with the parts underneath it. The cold of winter contracts the whole ; the parts are drawn closer together ; and the mouths of these innumerable vessels are shut, or nearly shut, by this contraction : a little, and but a very little, of the half-congealed moisture of the ground gets into them. This suffices for the service of the Tree, when there is little heat also to cause perspiration ; and when in the deciduous Trees, (the far greater part of those of our country) the very organs of the greatest perspiration, the Leaves, do not exist.

The warmth of spring arrives : the fluids of the earth grow thinner, every part of the Root expands ; this opens the mouths of the vessels, and the torrent of nutrition rushes in. A great

deal of it ascends, but more diffuses itself among the circumjacent parts: the mouths of the second order deliver out a great deal to all the interstitial space; and those of the third into the Blebs themselves; and these being naturally open, soon run over. Thus every part of the Rind, and every coat of it, and even the interstitial space between its innermost coat and the Bark, are filled with a fine fluid; and the whole is supple; and it then easily separates from the under coverings.

The very course and progress of the fluid may be shewn in this part, even by an easier preparation: only that different Rinds must be sought for this purpose; the vessels in some being larger than in others. Repeated trials have shewn me that the whole progress may be easily marked in the three following kinds; with only a tincture of cochineal.

Put half an ounce of cochineal in powder into half a pint of spirit of wine; set it in a warm place, and shake it often, for four days; then filter off the clear tincture. Put an inch depth of this into a cup; and set upright in it pieces of the Rind of Ash, White Willow, and Ozier; prepared,

prepared, as has been directed, by maceration in water; for in that way one trouble does for a hundred kinds. Let an inch of the Rinds also stand up out of the tincture. After twenty-four hours take them out, clip off the part which was immersed in the fluid, and save the rest for observation.

Here is a farther instance of the divisibility of matter. Tho' colour disappears in a great measure under the Microscope; the more as the power of magnifying increases; yet in the first of these Rinds, that of the common Ash, the course of the vessels, is very distinctly and beautifully seen by it; for they and they only are crimson. In this species the colouring liquor enters only by the open ends of the vessels; for the mouths at their sides seem too much contracted in the drying to receive it: it ascends their whole length, and shews itself at the exterior apertures or mouths, but penetrates no farther. Fig. 4.

In the Willow Rind, shewn at Fig. 5. the interstitial spaces, as well as the vessels, are crimson: therefore, among the vast variety of construction among the Rinds of several trees,

the mouths of the second series are in this larger than in the Ash. It must be so; because the colouring liquor was the same to both, and only the construction of the body itself could in one instance have admitted it through passages which were closed to it in the other.

In the Willow, the apertures of the third order still refusing passage to the coloured fluid, the Blebs retained their natural Olive complexion; but 'tis not so in the Rind of Ozier, there every series of mouths are open enough to let out the crimson liquor, and the whole substance of the Rind is stained with it. Fig. 6.

From hence Philosophy will judge (and it will judge with safety) why the leaves of the Ash appear later than those of the White Willow, and why the Open Ozier precedes even these. Elder and Gooseberry Rinds admit this universal tinge more readily than Ozier; but they are not so easily separated and prepared. The same philosophic truth arises also here: their texture is the openest of that in any Rinds; and 'tis therefore they appear the heralds of the Spring, and harbingers of every other verdure.

C H A P.

RIND WITH FILLED VESSELS

Pl. 5.

