

RUSKIN JOHN

PROSERPINA,

VOLUME 1

John Ruskin

Proserpina, Volume 1

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John Ruskin
Proserpina, Volume 1 / Studies of Wayside
Flowers, While the Air was Yet Pure
Among the Alps and in the Scotland
and England Which My Father Knew

PROSERPINA

INTRODUCTION

Brantwood, 14th March, 1874.

Yesterday evening I was looking over the first book in which I studied Botany,—Curtis's Magazine, published in 1795 at No. 3, St. George's Crescent, Blackfriars Road, and sold by the principal booksellers in Great Britain and Ireland. Its plates are excellent, so that I am always glad to find in it the picture of a flower I know. And I came yesterday upon what I suppose to be a variety of a favourite flower of mine, called, in Curtis, "the St. Bruno's Lily."

I am obliged to say "what I suppose to be a variety," because my pet lily is branched,¹ while this is drawn as unbranched, and especially stated to be so. And the page of text, in which this statement is made, is so characteristic of botanical books, and botanical science, not to say all science as hitherto taught for the blessing of mankind; and of the difficulties thereby accompanying its communication, that I extract the page entire, printing it, opposite, as nearly as possible in facsimile.

Now you observe, in this instructive page, that you have in the first place, nine names given you for one flower; and that among these nine names, you are not even at liberty to make your choice, because the united authority of Haller and Miller may be considered as an accurate balance to the single authority of Linnæus; and you ought therefore for the present to remain, yourself, balanced between the sides. You may be farther embarrassed by finding that the *Anthericum* of Savoy is only described as growing in Switzerland. And farther still, by finding that Mr. Miller describes two varieties of it, which differ only in size, while you are left to conjecture whether the one here figured is the larger or smaller; and how great the difference is.

Farther, If you wish to know anything of the habits of the plant, as well as its nine names, you are informed that it grows both at the bottoms of the mountains, and the tops; and that, with us, it flowers in May and June,—but you are not told when, in its native country.

The four lines of the last clause but one, may indeed be useful to gardeners; but—although I know my good father and mother did the best they could for me in buying this beautiful book; and though the admirable plates of it did their work, and taught me much, I cannot wonder that neither my infantine nor boyish mind was irresistibly attracted by the text of which this page is one of the most favourable specimens; nor, in consequence, that my botanical studies were—when I had attained the age of fifty—no farther advanced than the reader will find them in the opening chapter of this book.

¹ At least, it throws off its flowers on each side in a bewilderingly pretty way; a real lily can't branch, I believe: but, if not, what is the use of the botanical books saying "on an unbranched stem"?

Anthericum Liliastrum, Savoy Anthericum,

or St. Bruno's Lily

Class and Order

Hexandria Monogynia

Generic Character

***Cor.* 6-petala, patens. *Caps.* ovata**

Specific Character and Synonyms

ANTHERICUM *Liliastrum* foliis planis, scapo simplicissimo, corollis campanulatis, staminibus declinatis. *Linn. Syst. Vegetab. ed. 14. Murr. p. 330. Ait. Kew. v. I. p. 449.*

HEMEROCALLIS floribus patulis secundis. *Hall. Hist. n. 1230.*

PHALANGIUM magno flore. *Bauh. Pin. 29.*

PHALANGIUM Allobrogicum majus. *Clus. cur. app. alt.*

PHALANGIUM Allobrogicum. The Savoye Spider-wort. *Park. Parad. p. 150. tab. 151. f. 1.*

Botanists are divided in their opinions respecting the genus of this plant; Linnæus considers it as an *Anthericum*, Haller and Miller make it an *Hemerocallis*.

It is a native of Switzerland, where, Haller informs us it grows abundantly in the Alpine meadows, and even on the summits of the mountains; with us it flowers in May and June.

It is a plant of great elegance, producing on an unbranched stem about a foot and a half high, numerous flowers of a delicate white colour, much smaller but resembling in form those of the common white lily, possessing a considerable degree of fragrance, their beauty is heightened by the rich orange colour of their antheræ; unfortunately they are but of short duration.

Miller describes two varieties of it differing merely in size.

A loamy soil, a situation moderately moist, with an eastern or western exposure, suits this plant best; so situated, it will increase by its roots, though not very fast, and by parting of these in the autumn, it is usually propagated.

Parkinson describes and figures it in his *Parad. Terrest.*, observing that "divers allured by the beauty of its flowers, had brought it into these parts."

Which said book was therefore undertaken, to put, if it might be, some elements of the science of botany into a form more tenable by ordinary human and childish faculties; or—for I can scarcely say I have yet any tenure of it myself—to make the paths of approach to it more pleasant. In fact, I only know, of it, the pleasant distant effects which it bears to simple eyes; and some pretty mists and mysteries, which I invite my young readers to pierce, as they may, for themselves,—my power of guiding them being only for a little way.

Pretty mysteries, I say, as opposed to the vulgar and ugly mysteries of the so-called science of botany,—exemplified sufficiently in this chosen page. Respecting which, please observe farther;—Nobody—I can say this very boldly—loves Latin more dearly than I; but, precisely because I do love it (as well as for other reasons), I have always insisted that books, whether scientific or not, ought to be written either in Latin, or English; and not in a doggish mixture of the refuse of both.

Linnaeus wrote a noble book of universal Natural History in Latin. It is one of the permanent classical treasures of the world. And if any scientific man thinks his labors are worth the world's attention, let him, also, write what he has to say in Latin, finishedly and exquisitely, if it take him a month to a page.²

But if—which, unless he be one chosen of millions, is assuredly the fact—his lucubrations are only of local and temporary consequence, let him write, as clearly as he can, in his native language.

This book, accordingly, I have written in English; (not, by the way, that I *could* have written it in anything else—so there are small thanks to me); and one of its purposes is to interpret, for young English readers, the necessary European Latin or Greek names of flowers, and to make them vivid and vital to their understandings. But two great difficulties occur in doing this. The first, that there are generally from three or four, up to two dozen, Latin names current for every flower; and every new botanist thinks his eminence only to be properly asserted by adding another.

The second, and a much more serious one, is of the Devil's own contriving—(and remember I am always quite serious when I speak of the Devil,)—namely, that the most current and authoritative names are apt to be founded on some unclean or debasing association, so that to interpret them is to defile the reader's mind. I will give no instance; too many will at once occur to any learned reader, and the unlearned I need not vex with so much as one: but, in such cases, since I could only take refuge in the untranslated word by leaving other Greek or Latin words also untranslated, and the nomenclature still entirely senseless,—and I do not choose to do this,—there is only one other course open to me, namely, to substitute boldly, to my own pupils, other generic names for the plants thus faultfully hitherto titled.

As I do not do this for my own pride, but honestly for my reader's service, I neither question nor care how far the emendations I propose may be now or hereafter adopted. I shall not even name the cases in which they have been made for the serious reason above specified; but even shall mask those which there was real occasion to alter, by sometimes giving new names in cases where there was no necessity of such kind. Doubtless I shall be accused of doing myself what I violently blame in others. I do so; but with a different motive—of which let the reader judge as he is disposed. The practical result will be that the children who learn botany on the system adopted in this book will know the useful and beautiful names of plants hitherto given, in all languages; the useless and ugly ones they will not know. And they will have to learn one Latin name for each plant, which, when differing from the common one, I trust may yet by some scientific persons be accepted, and with ultimate advantage.

The learning of the one Latin name—as, for instance, *Gramen striatum*—I hope will be accurately enforced always;—but not less carefully the learning of the pretty English one—"Ladielace Grass"—with due observance that "Ladies' laces hath leaves like unto Millet in fashion, with many

² I have by happy chance just added to my Oxford library the poet Gray's copy of Linnaeus, with its exquisitely written Latin notes, exemplary alike to scholar and naturalist.

white veins or ribs, and silver strakes running along through the midst of the leaves, fashioning the same like to laces of white and green silk, very beautiful and faire to behold."

I have said elsewhere, and can scarcely repeat too often, that a day will come when men of science will think their names disgraced, instead of honoured, by being used to barbarise nomenclature; I hope therefore that my own name may be kept well out of the way; but, having been privileged to found the School of Art in the University of Oxford, I think that I am justified in requesting any scientific writers who may look kindly upon this book, to add such of the names suggested in it as they think deserving of acceptance, to their own lists of synonyms, under the head of "Schol. Art. Oxon."

The difficulties thrown in the way of any quiet private student by existing nomenclature may be best illustrated by my simply stating what happens to myself in endeavouring to use the page above facsimile'd. Not knowing how far St. Bruno's Lily might be connected with my own pet one, and not having any sufficient book on Swiss botany, I take down Loudon's *Encyclopædia of Plants*, (a most useful book, as far as any book in the present state of the science *can* be useful,) and find, under the head of *Anthericum*, the Savoy Lily indeed, but only the following general information:—"809. *Anthericum*. A name applied by the Greeks to the stem of the asphodel, and not misapplied to this set of plants, which in some sort resemble the asphodel. Plants with fleshy leaves, and spikes of bright yellow flowers, easily cultivated if kept dry."

Hunting further, I find again my Savoy lily called a spider-plant, under the article *Hemerocallis*, and the only information which the book gives me under *Hemerocallis*, is that it means 'beautiful day' lily; and then, "This is an ornamental genus of the easiest culture. The species are remarkable among border flowers for their fine *orange*, *yellow*, or *blue* flowers. The *Hemerocallis cœrulea* has been considered a distinct genus by Mr. Salisbury, and called *Saussurea*." As I correct this sheet for press, however, I find that the *Hemerocallis* is now to be called '*Funkia*,' "in honour of Mr. Funk, a Prussian apothecary."

All this while, meantime, I have a suspicion that my pet Savoy Lily is not, in existing classification, an *Anthericum*, nor a *Hemerocallis*, but a *Lilium*. It is, in fact, simply a Turk's cap which doesn't curl up. But on trying '*Lilium*' in Loudon, I find no mention whatever of any wild branched white lily.

I then try the next word in my specimen page of Curtis; but there is no '*Phalangium*' at all in Loudon's index. And now I have neither time nor mind for more search, but will give, in due place, such account as I can of my own dwarf branched lily, which I shall call St. Bruno's, as well as this *Liliastrum*—no offence to the saint, I hope. For it grows very gloriously on the limestones of Savoy, presumably, therefore, at the Grande Chartreuse; though I did not notice it there, and made a very unmonkish use of it when I gathered it last:—There was a pretty young English lady at the table-d'hôte, in the Hotel du Mont Blanc at St. Martin's,³ and I wanted to get speech of her, and didn't know how. So all I could think of was to go half-way up the Aiguille de Varennes, to gather St. Bruno's lilies; and I made a great cluster of them, and put wild roses all around them as I came down. I never saw anything so lovely; and I thought to present this to her before dinner,—but when I got down, she had gone away to Chamouni. My Fors always treated me like that, in affairs of the heart.

I had begun my studies of Alpine botany just eighteen years before, in 1842, by making a careful drawing of wood-sorrel at Chamouni; and bitterly sorry I am, now, that the work was interrupted. For I drew, then, very delicately; and should have made a pretty book if I could have got peace. Even yet, I can manage my point a little, and would far rather be making outlines of flowers, than writing; and I meant to have drawn every English and Scottish wild flower, like this cluster of bog heather opposite,⁴—back, and profile, and front. But '*Blackwood's Magazine*,' with its insults to Turner,

³ It was in the year 1860, in June.

⁴ Admirably engraved by Mr. Burgess, from my pen drawing, now at Oxford. By comparing it with the plate of the same flower in

dragged me into controversy; and I have not had, properly speaking, a day's peace since; so that in 1868 my botanical studies were advanced only as far as the reader will see in next chapter; and now, in 1874, must end altogether, I suppose, heavier thoughts and work coming fast on me. So that, finding among my notebooks, two or three, full of broken materials for the proposed work on flowers; and, thinking they may be useful even as fragments, I am going to publish them in their present state,—only let the reader note that while my other books endeavour, and claim, so far as they reach, to give trustworthy knowledge of their subjects, this one only shows how such knowledge may be obtained; and it is little more than a history of efforts and plans,—but of both, I believe, made in right methods.

One part of the book, however, will, I think, be found of permanent value. Mr. Burgess has engraved on wood, in reduced size, with consummate skill, some of the excellent old drawings in the *Flora Danica*, and has interpreted, and facsimile'd, some of his own and my drawings from nature, with a vigour and precision unsurpassed in woodcut illustration, which render these outlines the best exercises in black and white I have yet been able to prepare for my drawing pupils. The larger engravings by Mr. Allen may also be used with advantage as copies for drawings with pen or sepia.

Rome, 10th May (my father's birthday).

I found the loveliest blue asphodel I ever saw in my life, yesterday, in the fields beyond Monte Mario,—a spire two feet high, of more than two hundred stars, the stalks of them all deep blue, as well as the flowers. Heaven send all honest people the gathering of the like, in Elysian fields, some day!

CHAPTER I. MOSS

Denmark Hill, 3rd November, 1868.

1. It is mortifying enough to write,—but I think thus much ought to be written,—concerning myself, as 'the author of Modern Painters.' In three months I shall be fifty years old: and I don't at this hour—ten o'clock in the morning of the two hundred and sixty-eighth day of my forty-ninth year—know what 'moss' is.

There is nothing I have more *intended* to know—some day or other. But the moss 'would always be there'; and then it was so beautiful, and so difficult to examine, that one could only do it in some quite separated time of happy leisure—which came not. I never was like to have less leisure than now, but I *will* know what moss is, if possible, forthwith.

2. To that end I read preparatorily, yesterday, what account I could find of it in all the botanical books in the house. Out of them all, I get this general notion of a moss,—that it has a fine fibrous root,—a stem surrounded with spirally set leaves,—and produces its fruit in a small case, under a cap. I fasten especially, however, on a sentence of Louis Figuier's, about the particular species, *Hypnum*:—

"These mosses, which often form little islets of verdure at the feet of poplars and willows, are robust vegetable organisms, which do not decay."⁵

3. "Qui ne pourrissent point." What do they do with themselves, then?—it immediately occurs to me to ask. And, secondly,—If this immortality belongs to the *Hypnum* only?

It certainly does not, by any means: but, however modified or limited, this immortality is the first thing we ought to take note of in the mosses. They are, in some degree, what the "everlasting" is in flowers. Those minute green leaves of theirs do not decay, nor fall.

But how do they die, or how stop growing, then?—it is the first thing I want to know about them. And from all the books in the house, I can't as yet find out this. Meanwhile I will look at the leaves themselves.

4. Going out to the garden, I bring in a bit of old brick, emerald green on its rugged surface,⁶ and a thick piece of mossy turf.

First, for the old brick: To think of the quantity of pleasure one has had in one's life from that emerald green velvet,—and yet that for the first time to-day I am verily going to look at it! Doing so, through a pocket lens of no great power, I find the velvet to be composed of small star-like groups of smooth, strong, oval leaves,—intensely green, and much like the young leaves of any other plant, except in this;—they all have a long brown spike, like a sting, at their ends.

⁵ "Histoire des Plantes." Ed. 1865, p. 416.

⁶ The like of it I have now painted, Number 281, Case xii., in the Educational Series of Oxford.

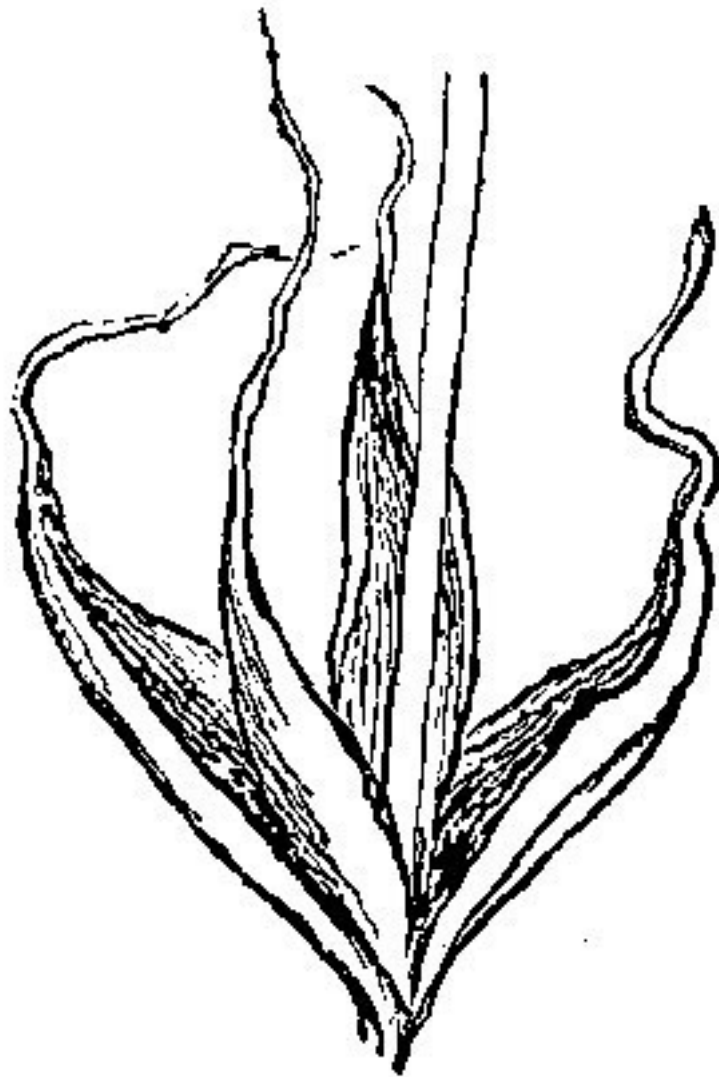


Fig. 1.

5. Fastening on that, I take the *Flora Danica*,⁷ and look through its plates of mosses, for their leaves only; and I find, first, that this spike, or strong central rib, is characteristic;—secondly, that the said leaves are apt to be not only spiked, but serrated, and otherwise angry-looking at the points;—thirdly, that they have a tendency to fold together in the centre (Fig. 1⁸); and at last, after an hour's work at them, it strikes me suddenly that they are more like pineapple leaves than anything else.

And it occurs to me, very unpleasantly, at the same time, that I don't know what a pineapple is!

Stopping to ascertain that, I am told that a pineapple belongs to the 'Bromeliaceæ'—(can't stop to find out what that means)—nay, that of these plants "the pineapple is the representative" (Loudon); "their habit is acid, their leaves rigid, and toothed with spines, their bractæas often coloured with scarlet, and their flowers either white or blue"—(what are their flowers like?) But the two sentences that most interest me, are, that in the damp forests of Carolina, the *Tillandsia*, which is an 'epiphyte' (*i.e.*, a plant growing on other plants,) "forms dense festoons among the branches of the trees, vegetating among the black mould that collects upon the bark of trees in hot damp countries; other species are inhabitants of deep and gloomy forests, and others form, with their spring leaves,

⁷ Properly, *Floræ Danicæ*, but it is so tiresome to print the diphthongs that I shall always call it thus. It is a folio series, exquisitely begun, a hundred years ago; and not yet finished.

⁸ Magnified about seven times. [See note](#) at end of this chapter.

an impenetrable herbage in the Pampas of Brazil." So they really seem to be a kind of moss, on a vast scale.

6. Next, I find in Gray,⁹ Bromeliaceæ, and—the very thing I want—"Tillandsia, the black moss, or long moss, which, *like most Bromelias*, grows on the branches of trees." So the pineapple is really a moss; only it is a moss that flowers but 'imperfectly.' "The fine fruit is caused by the consolidation of the imperfect flowers." (I wish we could consolidate some imperfect English moss-flowers into little pineapples then,—though they were only as big as filberts.) But we cannot follow that farther now; nor consider when a flower is perfect, and when it is not, or we should get into morals, and I don't know where else; we will go back to the moss I have gathered, for I begin to see my way, a little, to understanding it.

7. The second piece I have on the table is a cluster—an inch or two deep—of the moss that grows everywhere, and that the birds use for nest-building, and we for packing, and the like. It is dry, since yesterday, and its fibres define themselves against the dark ground in warm green, touched with a glittering light. Note that burnished lustre of the minute leaves; they are necessarily always relieved against dark hollows, and this lustre makes them much clearer and brighter than if they were of dead green. In that lustre—and it is characteristic of them—they differ wholly from the dead, aloë-like texture of the pineapple leaf; and remind me, as I look at them closely, a little of some conditions of chaff, as on heads of wheat after being threshed. I will hunt down that clue presently; meantime there is something else to be noticed on the old brick.

⁹ American,—'System of Botany,' the best technical book I have.

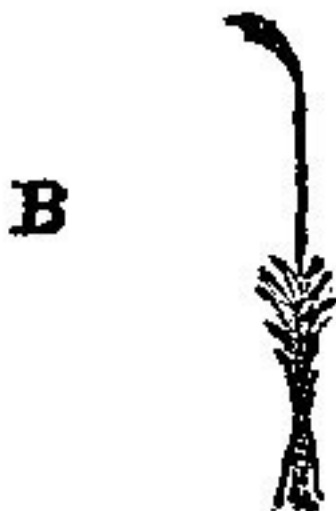
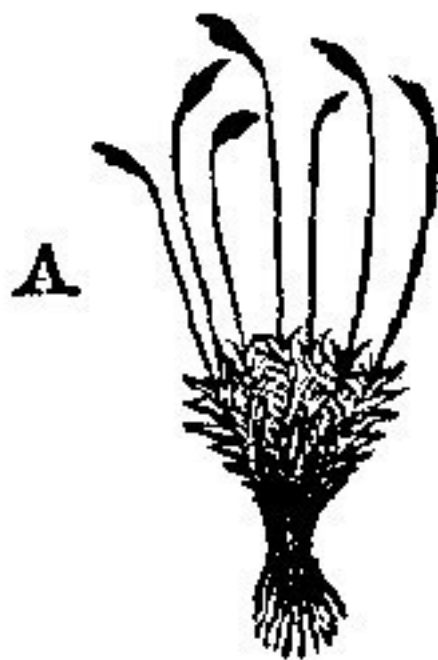


Fig. 2.

8. Out of its emerald green cushions of minute leaves, there rise, here and there, thin red threads, each with a little brown cap, or something like a cap, at the top of it. These red threads shooting up out of the green tufts, are, I believe, the fructification of the moss; fringing its surface in the woods, and on the rocks, with the small forests of brown stems, each carrying its pointed cap or crest—of infinitely varied 'mode,' as we shall see presently; and, which is one of their most blessed functions, carrying high the dew in the morning; every spear balancing its own crystal globe.

9. And now, with my own broken memories of moss and this unbroken, though unfinished, gift of the noble labour of other people, the *Flora Danica*, I can generalize the idea of the precious little plant, for myself, and for the reader.

All mosses, I believe, (with such exceptions and collateral groups as we may afterwards discover, but they are not many,) that is to say, some thousands of species, are, in their strength of existence, composed of fibres surrounded by clusters of dry *spinous* leaves, set close to the fibre they grow on. Out of this leafy stern descends a fibrous root, and ascends in its season, a capped seed.

We must get this very clearly into our heads. Fig. 2, A, is a little tuft of a common wood moss of Norway,¹⁰ in its fruit season, of its real size; but at present I want to look at the central fibre and its leaves accurately, and understand that first.

10. Pulling it to pieces, we find it composed of seven little company-keeping fibres, each of which, by itself, appears as in Fig. 2, B: but as in this, its real size, it is too small, not indeed for our respect, but for our comprehension, we magnify it, Fig. 2, C, and thereupon perceive it to be indeed composed of, *a*, the small fibrous root which sustains the plant; *b*, the leaf-surrounded stem which is the actual being, and main creature, moss; and, *c*, the aspirant pillar, and cap, of its fructification.

11. But there is one minor division yet. You see I have drawn the central part of the moss plant (*b*, Fig. 2,) half in outline and half in black; and that, similarly, in the upper group, which is too small to show the real roots, the base of the cluster is black. And you remember, I doubt not, how often in gathering what most invited gathering, of deep green, starry, perfectly soft and living wood-moss, you found it fall asunder in your hand into multitudes of separate threads, each with its bright green crest, and long root of blackness.

That blackness at the root—though only so notable in this wood-moss and collateral species, is indeed a general character of the mosses, with rare exceptions. It is their funeral blackness;—that, I perceive, is the way the moss leaves die. They do not fall—they do not visibly decay. But they decay *invisibly*, in continual secession, beneath the ascending crest. They rise to form that crest, all green and bright, and take the light and air from those out of which they grew;—and those, their ancestors, darken and die slowly, and at last become a mass of mouldering ground. In fact, as I perceive farther, their final duty is so to die. The main work of other leaves is in their life,—but these have to form the earth out of which all other leaves are to grow. Not to cover the rocks with golden velvet only, but to fill their crannies with the dark earth, through which nobler creatures shall one day seek their being.

12. "Grant but as many sorts of mind as moss." Pope could not have known the hundredth part of the number of 'sorts' of moss there are; and I suppose he only chose the word because it was a monosyllable beginning with *m*, and the best English general expression for despised and minute structures of plants. But a fate rules the words of wise men, which makes their words truer, and worth more, than the men themselves know. No other plants have so endless variety on so similar a structure as the mosses; and none teach so well the humility of Death. As for the death of our bodies, we have learned, wisely, or unwisely, to look the fact of that in the face. But none of us, I think, yet care to look the fact of the death of our minds in the face. I do not mean death of our souls, but of our mental work. So far as it is good *art*, indeed, and done in realistic form, it may perhaps not

¹⁰ 'Dicranum cerviculatum,' sequel to *Flora Danica*, Tab. MMCCX.

die; but so far as it was only good *thought*—good, for its time, and apparently a great achievement therein—that good, useful thought may yet in the future become a foolish thought, and then die quite away,—it, and the memory of it,—when better thought and knowledge come. But the better thought could not have come if the weaker thought had not come first, and died in sustaining the better. If we think honestly, our thoughts will not only live usefully, but even perish usefully—like the moss—and become dark, not without due service. But if we think dishonestly, or malignantly, our thoughts will die like evil fungi,—dripping corrupt dew.

13. But farther. If you have walked moorlands enough to know the look of them, you know well those flat spaces or causeways of bright green or golden ground between the heathy rock masses; which signify winding pools and inlets of stagnant water caught among the rocks;—pools which the deep moss that covers them—*blanched*, not black, at the root,—is slowly filling and making firm; whence generally the unsafe ground in the moorland gets known by being *mossy* instead of heathy; and is at last called by its riders, briefly, 'the Moss': and as it is mainly at these same mossy places that the riding is difficult, and brings out the gifts of horse and rider, and discomfits all followers not similarly gifted, the skilled crosser of them got his name, naturally, of 'moss-rider,' or moss-trooper. In which manner the moss of Norway and Scotland has been a taskmaster and Maker of Soldiers, as yet, the strongest known among natural powers. The lightning may kill a man, or cast down a tower, but these little tender leaves of moss—they and their progenitors—have trained the Northern Armies.

14. So much for the human meaning of that decay of the leaves. Now to go back to the little creatures themselves. It seems that the upper part of the moss fibre is especially *undecaying* among leaves; and the lower part, especially decaying. That, in fact, a plant of moss-fibre is a kind of persistent state of what is, in other plants, annual. Watch the year's growth of any luxuriant flower. First it comes out of the ground all fresh and bright; then, as the higher leaves and branches shoot up, those first leaves near the ground get brown, sickly, earthy,—remain for ever degraded in the dust, and under the dashed slime in rain, staining, and grieving, and loading them with obloquy of envious earth, half-killing them,—only life enough left in them to hold on the stem, and to be guardians of the rest of the plant from all they suffer;—while, above them, the happier leaves, for whom they are thus oppressed, bend freely to the sunshine, and drink the rain pure.

The moss strengthens on a diminished scale, intensifies, and makes perpetual, these two states,—bright leaves above that never wither, leaves beneath that exist only to wither.

15. I have hitherto spoken only of the fading moss as it is needed for change into earth. But I am not sure whether a yet more important office, in its days of age, be not its use as a colour.

We are all thankful enough—as far as we ever are so—for green moss, and yellow moss. But we are never enough grateful for black moss. The golden would be nothing without it, nor even the grey.

It is true that there are black lichens enough, and brown ones: nevertheless, the chief use of lichens is for silver and gold colour on rocks; and it is the dead moss which gives the leopard-like touches of black. And yet here again—as to a thing I have been looking at and painting all my life—I am brought to pause, the moment I think of it carefully. The black moss which gives the precious Velasquez touches, lies, much of it, flat on the rocks; radiating from its centres—powdering in the fingers, if one breaks it off, like dry tea. Is it a black species?—or a black-parched state of other species, perishing for the sake of Velasquez effects, instead of accumulation of earth? and, if so, does it die of drought, accidentally, or, in a sere old age, naturally? and how is it related to the rich green bosses that grow in deep velvet? And there again is another matter not clear to me. One calls them 'velvet' because they are all brought to an even surface at the top. Our own velvet is reduced to such trimness by cutting. But how is the moss trimmed? By what scissors? Carefullest Elizabethan gardener never shaped his yew hedge more daintily than the moss fairies smooth these soft rounded surfaces of green and gold. And just fancy the difference, if they were ragged! If the fibres had every one of them leave to grow at their own sweet will, and to be long or short as they liked, or, worse

still, urged by fairy prizes into laboriously and agonizingly trying which could grow longest. Fancy the surface of a spot of competitive moss!

16. But how is it that they are subdued into that spherical obedience, like a crystal of wavellite?¹¹ Strange—that the vegetable creatures growing so fondly on rocks should form themselves in that mineral-like manner. It is true that the tops of all well-grown trees are rounded, on a large scale, as equally; but that is because they grow from a central stem, while these mossy mounds are made out of independent filaments, each growing to exactly his proper height in the sphere—short ones outside, long in the middle. Stop, though; *is* that so? I am not even sure of that; perhaps they are built over a little dome of decayed moss below.¹² I must find out how every filament grows, separately—from root to cap, through the spirally set leaves. And meanwhile I don't know very clearly so much as what a root is—or what a leaf is. Before puzzling myself any farther in examination either of moss or any other grander vegetable, I had better define these primal forms of all vegetation, as well as I can—or rather begin the definition of them, for future completion and correction. For, as my reader must already sufficiently perceive, this book is literally to be one of studies—not of statements. Some one said of me once, very shrewdly, When he wants to work out a subject, he writes a book on it. That is a very true saying in the main,—I work down or up to my mark, and let the reader see process and progress, not caring to conceal them. But this book will be nothing but process. I don't mean to assert anything positively in it from the first page to the last. Whatever I say, is to be understood only as a conditional statement—liable to, and inviting, correction. And this the more because, as on the whole, I am at war with the botanists, I can't ask them to help me, and then call them names afterwards. I hope only for a contemptuous heaping of coals on my head by correction of my errors from them;—in some cases, my scientific friends will, I know, give me forgiving aid;—but, for many reasons, I am forced first to print the imperfect statement, as I can independently shape it; for if once I asked for, or received help, every thought would be frostbitten into timid expression, and every sentence broken by apology. I should have to write a dozen of letters before I could print a line, and the line, at last, would be only like a bit of any other botanical book—trustworthy, it might be, perhaps; but certainly unreadable. Whereas now, it will rather put things more forcibly in the reader's mind to have them retouched and corrected as we go on; and our natural and honest mistakes will often be suggestive of things we could not have discovered but by wandering.

On these guarded conditions, then, I proceed to study, with my reader, the first general laws of vegetable form.

¹¹ The reader should buy a small specimen of this mineral; it is a useful type of many structures.

¹² Lucca, *Aug. 9th, 1874*.—I have left this passage as originally written, but I believe the dome is of accumulated earth. Bringing home, here, evening after evening, heaps of all kinds of mosses from the hills among which the Archbishop Ruggieri was hunting the wolf and her whelps in Ugolino's dream, I am more and more struck, every day, with their special function as earth-gatherers, and with the enormous importance to their own brightness, and to our service, of that dark and degraded state of the inferior leaves. And it fastens itself in my mind mainly as their distinctive character, that as the leaves of a tree become wood, so the leaves of a moss become earth, while yet a normal part of the plant. Here is a cake in my hand weighing half a pound, bright green on the surface, with minute crisp leaves; but an inch thick beneath in what looks at first like clay, but is indeed knitted fibre of exhausted moss. Also, I don't at all find the generalization I made from the botanical books likely to have occurred to me from the real things. No moss leaves that I can find here give me the idea of resemblance to pineapple leaves; nor do I see any, through my weak lens, clearly serrated; but I do find a general tendency to run into a silky filamentous structure, and in some, especially on a small one gathered from the fissures in the marble of the cathedral, white threads of considerable length at the extremities of the leaves, of which threads I remember no drawing or notice in the botanical books. Figure 1 represents, magnified, a cluster of these leaves, with the germinating stalk springing from their centre; but my scrawl was tired and careless, and for once, Mr. Burgess has copied *too* accurately.

CHAPTER II. THE ROOT

1. Plants in their perfect form consist of four principal parts,—the Root, Stem, Leaf, and Flower. It is true that the stem and flower are parts, or remnants, or altered states, of the leaves; and that, speaking with close accuracy, we might say, a perfect plant consists of leaf and root. But the division into these four parts is best for practical purposes, and it will be desirable to note a few general facts about each, before endeavouring to describe any one kind of plant. Only, because the character of the stem depends on the nature of the leaf and flower, we must put it last in order of examination; and trace the development of the plant first in root and leaf; then in the flower and its fruit; and lastly in the stem.

2. First, then, the Root.

Every plant is divided, as I just said, in the main, into two parts, and these have opposite natures. One part seeks the light; the other hates it. One part feeds on the air; the other on the dust.

The part that loves the light is called the Leaf. It is an old Saxon word; I cannot get at its origin. The part that hates the light is called the Root.

In Greek, ῥίζα, Rhiza.¹³

In Latin, Radix, "the growing thing," which shortens, in French, into Race, and then they put on the diminutive 'ine,' and get their two words, Race, and Racine, of which we keep Race for animals, and use for vegetables a word of our own Saxon (and Dutch) dialect,—'root'; (connected with Rood—an image of wood; whence at last the Holy Rood, or Tree).

3. The Root has three great functions:

1st. To hold the plant in its place.

2nd. To nourish it with earth.

3rd. To receive vital power for it from the earth.

With this last office is in some degree,—and especially in certain plants,—connected, that of reproduction.

But in all plants the root has these three essential functions.

First, I said, to hold the Plant in its place. The Root is its Fetter.

You think it, perhaps, a matter of course that a plant is not to be a crawling thing? It is not a matter of course at all. A vegetable might be just what it is now, as compared with an animal;—might live on earth and water instead of on meat,—might be as senseless in life, as calm in death, and in all its parts and apparent structure unchanged; and yet be a crawling thing. It is quite as easy to conceive plants moving about like lizards, putting forward first one root and then another, as it is to think of them fastened to their place. It might have been well for them, one would have thought, to have the power of going down to the streams to drink, in time of drought;—of migrating in winter with grim march from north to south of Dunsinane Hill side. But that is not their appointed Fate. They are—at least all the noblest of them, rooted to their spot. Their honour and use is in giving immoveable shelter,—in remaining landmarks, or lovemarks, when all else is changed:

"The cedars wave on Lebanon,
But Judah's statelier maids are gone."

¹³ Learn this word, at any rate; and if you know any Greek, learn also this group of words: "ὥς ῥίζα ἐν γῇ διψοσῇ," which you may chance to meet with, and even to think about, some day.

4. Its root is thus a form of fate to the tree. It condemns, or indulges it, in its place. These semi-living creatures, come what may, shall abide, happy, or tormented. No doubt concerning "the position in which Providence has placed *them*" is to trouble their minds, except so far as they can mend it by seeking light, or shrinking from wind, or grasping at support, within certain limits. In the thoughts of men they have thus become twofold images,—on the one side, of spirits restrained and half destroyed, whence the fables of transformation into trees; on the other, of spirits patient and continuing, having root in themselves and in good ground, capable of all persistent effort and vital stability, both in themselves, and for the human States they form.

5. In this function of holding fast, roots have a power of grasp quite different from that of branches. It is not a grasp, or clutch by contraction, as that of a bird's claw, or of the small branches we call 'tendrils' in climbing plants. It is a dead, clumsy, but inevitable grasp, by swelling, *after* contortion. For there is this main difference between a branch and root, that a branch cannot grow vividly but in certain directions and relations to its neighbour branches; but a root can grow wherever there is earth, and can turn in any direction to avoid an obstacle.¹⁴

6. In thus contriving access for itself where it chooses, a root contorts itself into more serpent-like writhing than branches can; and when it has once coiled partly round a rock, or stone, it grasps it tight, necessarily, merely by swelling. Now a root has force enough sometimes to split rocks, but not to crush them; so it is compelled to grasp by *flattening* as it thickens; and, as it must have room somewhere, it alters its own shape as if it were made of dough, and holds the rock, not in a claw, but in a wooden cast or mould, adhering to its surface. And thus it not only finds its anchorage in the rock, but binds the rocks of its anchorage with a constrictor cable.

7. Hence—and this is a most important secondary function—roots bind together the ragged edges of rocks as a hem does the torn edge of a dress: they literally stitch the stones together; so that, while it is always dangerous to pass under a treeless edge of overhanging crag, as soon as it has become beautiful with trees, it is safe also. The rending power of roots on rocks has been greatly overrated. Capillary attraction in a willow wand will indeed split granite, and swelling roots sometimes heave considerable masses aside, but on the whole, roots, small and great, bind, and do not rend.¹⁵ The surfaces of mountains are dissolved and disordered, by rain, and frost, and chemical decomposition, into mere heaps of loose stones on their desolate summits; but, where the forests grow, soil accumulates and disintegration ceases. And by cutting down forests on great mountain slopes, not only is the climate destroyed, but the danger of superficial landslip fearfully increased.

8. The second function of roots is to gather for the plant the nourishment it needs from the ground. This is partly water, mixed with some kinds of air (ammonia, etc.,) but the plant can get both water and ammonia from the atmosphere; and, I believe, for the most part does so; though, when it cannot get water from the air, it will gladly drink by its roots. But the things it cannot receive from the air at all are certain earthy salts, essential to it (as iron is essential in our own blood), and of which when it has quite exhausted the earth, no more such plants can grow in that ground. On this subject you will find enough in any modern treatise on agriculture; all that I want you to note here is that this feeding function of the root is of a very delicate and discriminating kind, needing much searching and mining among the dust, to find what it wants. If it only wanted water, it could get most of that by spreading in mere soft senseless limbs, like sponge, as far, and as far down, as it could—but to get the *salt* out of the earth it has to *sift* all the earth, and taste and touch every grain of it that it can,

¹⁴ "Duhamel, botanist of the last century, tells us that, wishing to preserve a field of good land from the roots of an avenue of elms which were exhausting it, he cut a ditch between the field and avenue to intercept the roots. But he saw with surprise those of the roots which had not been cut, go down behind the slope of the ditch to keep out of the light, go under the ditch, and into the field again." And the Swiss naturalist Bonnet said wittily, apropos of a wonder of this sort, "that sometimes it was difficult to distinguish a cat from a rosebush."

¹⁵ As the first great office of the mosses is the gathering of earth, so that of the grasses is the binding of it. Theirs the Enchanter's toil, not in vain,—making ropes out of sea-sand.

with fine fibres. And therefore a root is not at all a merely passive sponge or absorbing thing, but an infinitely subtle tongue, or tasting and eating thing. That is why it is always so fibrous and divided and entangled in the clinging earth.

9. "Always fibrous and divided"? But many roots are quite hard and solid!

No; the active part of the root is always, I believe, a fibre. But there is often a provident and passive part—a savings bank of root—in which nourishment is laid up for the plant, and which, though it may be underground, is no more to be considered its real root than the kernel of a seed is. When you sow a pea, if you take it up in a day or two, you will find the fibre below, which is root; the shoot above, which is plant; and the pea as a now partly exhausted storehouse, looking very woful, and like the granaries of Paris after the fire. So, the round solid root of a cyclamen, or the conical one which you know so well as a carrot, are not properly roots, but permanent storehouses,—only the fibres that grow from them are roots. Then there are other apparent roots which are not even storehouses, but refuges; houses where the little plant lives in its infancy, through winter and rough weather. So that it will be best for you at once to limit your idea of a root to this,—that it is a group of growing fibres which taste and suck what is good for the plant out of the ground, and by their united strength hold it in its place; only remember the thick limbs of roots do not feed, but only the fine fibres at the ends of them which are something between tongues and sponges, and while they absorb moisture readily, are yet as particular about getting what they think nice to eat as any dainty little boy or girl; looking for it everywhere, and turning angry and sulky if they don't get it.

10. But the root has, it seems to me, one more function, the most important of all. I say, it seems to me, for observe, what I have hitherto told you is all (I believe) ascertained and admitted; this that I am going to tell you has not yet, as far as I know, been asserted by men of science, though I believe it to be demonstrable. But you are to examine into it, and think of it for yourself.

There are some plants which appear to derive all their food from the air—which need nothing but a slight grasp of the ground to fix them in their place. Yet if we were to tie them into that place, in a framework, and cut them from their roots, they would die. Not only in these, but in all other plants, the vital power by which they shape and feed themselves, whatever that power may be, depends, I think, on that slight touch of the earth, and strange inheritance of its power. It is as essential to the plant's life as the connection of the head of an animal with its body by the spine is to the animal. Divide the feeble nervous thread, and all life ceases. Nay, in the tree the root is even of greater importance. You will not kill the tree, as you would an animal, by dividing its body or trunk. The part not severed from the root will shoot again. But in the root, and its touch of the ground, is the life of it. My own definition of a plant would be "a living creature whose source of vital energy is in the earth" (or in the water, as a form of the earth; that is, in inorganic substance). There is, however, one tribe of plants which seems nearly excepted from this law. It is a very strange one, having long been noted for the resemblance of its flowers to different insects; and it has recently been proved by Mr. Darwin to be dependent on insects for its existence. Doubly strange therefore, it seems, that in some cases this race of plants all but reaches the independent life of insects. It rather *settles* upon boughs than roots itself in them; half of its roots may wave in the air.

11. What vital power is, men of science are not a step nearer knowing than they were four thousand years ago. They are, if anything, farther from knowing now than then, in that they imagine themselves nearer. But they know more about its limitations and manifestations than they did. They have even arrived at something like a proof that there is a fixed quantity of it flowing out of things and into them. But, for the present, rest content with the general and sure knowledge that, fixed or flowing, measurable or immeasurable—one with electricity or heat or light, or quite distinct from any of them—life is a delightful, and its negative, death, a dreadful thing, to human creatures; and that you can give or gather a certain quantity of life into plants, animals, and yourself by wisdom and courage, and by their reverses can bring upon them any quantity of death you please, which is a much more serious point for you to consider than what life and death are.

12. Now, having got a quite clear idea of a root properly so called, we may observe what those storehouses, refuges, and ruins are, which we find connected with roots. The greater number of plants feed and grow at the same time; but there are some of them which like to feed first and grow afterwards. For the first year, or, at all events, the first period of their life, they gather material for their future life out of the ground and out of the air, and lay it up in a storehouse as bees make combs. Of these stores—for the most part rounded masses tapering downwards into the ground—some are as good for human beings as honeycombs are; only not so sweet. We steal them from the plants, as we do from the bees, and these conical upside-down hives or treasuries of Atreus, under the names of carrots, turnips, and radishes, have had important influence on human fortunes. If we do not steal the store, next year the plant lives upon it, raises its stem, flowers and seeds out of that abundance, and having fulfilled its destiny, and provided for its successor, passes away, root and branch together.

13. There is a pretty example of patience for us in this; and it would be well for young people generally to set themselves to grow in a carrotty or turnippy manner, and lay up secret store, not caring to exhibit it until the time comes for fruitful display. But they must not, in after-life, imitate the spendthrift vegetable, and blossom only in the strength of what they learned long ago; else they soon come to contemptible end. Wise people live like laurels and cedars, and go on mining in the earth, while they adorn and embalm the air.

14. Secondly, Refuges. As flowers growing on trees have to live for some time, when they are young in their buds, so some flowers growing on the ground have to live for a while, when they are young, *in* what we call their roots. These are mostly among the Drosidæ¹⁶ and other humble tribes, loving the ground; and, in their babyhood, liking to live quite down in it. A baby crocus has literally its own little dome—domus, or duomo—within which in early spring it lives a delicate convent life of its own, quite free from all worldly care and dangers, exceedingly ignorant of things in general, but itself brightly golden and perfectly formed before it is brought out. These subterranean palaces and vaulted cloisters, which we call bulbs, are no more roots than the blade of grass is a root, in which the ear of corn forms before it shoots up.

15. Thirdly, Ruins. The flowers which have these subterranean homes form one of many families whose roots, as well as seeds, have the power of reproduction. The succession of some plants is trusted much to their seeds: a thistle sows itself by its down, an oak by its acorns; the companies of flying emigrants settle where they may; and the shadowy tree is content to cast down its showers of nuts for swines' food with the chance that here and there one may become a ship's bulwark. But others among plants are less careless, or less proud. Many are anxious for their children to grow in the place where they grew themselves, and secure this not merely by letting their fruit fall at their feet, on the chance of its growing up beside them, but by closer bond, bud springing forth from root, and the young plant being animated by the gradually surrendered life of its parent. Sometimes the young root is formed above the old one, as in the crocus, or beside it, as in the amaryllis, or beside it in a spiral succession, as in the orchis; in these cases the old root always perishes wholly when the young one is formed; but in a far greater number of tribes, one root connects itself with another by a short piece of intermediate stem; and this stem does not at once perish when the new root is formed, but grows on at one end indefinitely, perishing slowly at the other, the scars or ruins of the past plants being long traceable on its sides. When it grows entirely underground it is called a root-stock. But there is no essential distinction between a root-stock and a creeping stem, only the root-stock may be thought of as a stem which shares the melancholy humour of a root in loving darkness, while yet it has enough consciousness of better things to grow towards, or near, the light. In one family it is even fragrant where the flower is not, and a simple houseleek is called '*rhodiola rosea*,' because its root-stock has the scent of a rose.

¹⁶ Drosidæ, in our school nomenclature, is the general name, including the four great tribes, iris, asphodel, amaryllis, and lily. See reason for this name given in the 'Queen of the Air,' Section II.

16. There is one very unusual condition of the root-stock which has become of much importance in economy, though it is of little in botany; the forming, namely, of knots at the ends of the branches of the underground stem, where the new roots are to be thrown out. Of these knots, or 'tubers,' (swollen things,) one kind, belonging to the tobacco tribe, has been singularly harmful, together with its pungent relative, to a neighbouring country of ours, which perhaps may reach a higher destiny than any of its friends can conceive for it, if it can ever succeed in living without either the potato, or the pipe.

17. Being prepared now to find among plants many things which are like roots, yet are not; you may simplify and make fast your true idea of a root as a fibre or group of fibres, which fixes, animates, and partly feeds the leaf. Then practically, as you examine plants in detail, ask first respecting them: What kind of root have they? Is it large or small in proportion to their bulk, and why is it so? What soil does it like, and what properties does it acquire from it? The endeavour to answer these questions will soon lead you to a rational inquiry into the plant's history. You will first ascertain what rock or earth it delights in, and what climate and circumstances; then you will see how its root is fitted to sustain it mechanically under given pressures and violences, and to find for it the necessary sustenance under given difficulties of famine or drought. Lastly you will consider what chemical actions appear to be going on in the root, or its store; what processes there are, and elements, which give pungency to the radish, flavour to the onion, or sweetness to the liquorice; and of what service each root may be made capable under cultivation, and by proper subsequent treatment, either to animals or men.

18. I shall not attempt to do any of this for you; I assume, in giving this advice, that you wish to pursue the science of botany as your chief study; I have only broken moments for it, snatched from my chief occupations, and I have done nothing myself of all this I tell you to do. But so far as you can work in this manner, even if you only ascertain the history of one plant, so that you know that accurately, you will have helped to lay the foundation of a true science of botany, from which the mass of useless nomenclature,¹⁷ now mistaken for science, will fall away, as the husk of a poppy falls from the bursting flower.

¹⁷ The only use of a great part of our existing nomenclature is to enable one botanist to describe to another a plant which the other has not seen. When the science becomes approximately perfect, all known plants will be properly figured, so that nobody need describe them; and unknown plants be so rare that nobody will care to learn a new and difficult language, in order to be able to give an account of what in all probability he will never see.

CHAPTER III. THE LEAF

1. In the first of the poems of which the English Government has appointed a portion to be sung every day for the instruction and pleasure of the people, there occurs this curious statement respecting any person who will behave himself rightly: "He shall be like a tree planted by the river side, that bears its fruit in its season. His leaf also shall not wither; and you will see that whatever he does will prosper."

I call it a curious statement, because the conduct to which this prosperity is promised is not that which the English, as a nation, at present think conducive to prosperity: but whether the statement be true or not, it will be easy for you to recollect the two eastern figures under which the happiness of the man is represented,—that he is like a tree bearing fruit "in its season;" (not so hastily as that the frost pinch it, nor so late that no sun ripens it;) and that "his leaf shall not fade." I should like you to recollect this phrase in the Vulgate—"folium ejus non defluet"—shall not fall *away*,—that is to say, shall not fall so as to leave any visible bareness in winter time, but only that others may come up in its place, and the tree be always green.

2. Now, you know, the fruit of the tree is either for the continuance of its race, or for the good, or harm, of other creatures. In no case is it a good to the tree itself. It is not indeed, properly, a part of the tree at all, any more than the egg is part of the bird, or the young of any creature part of the creature itself. But in the leaf is the strength of the tree itself. Nay, rightly speaking, the leaves *are* the tree itself. Its trunk sustains; its fruit burdens and exhausts; but in the leaf it breathes and lives. And thus also, in the eastern symbolism, the fruit is the labour of men for others; but the leaf is their own life. "He shall bring forth fruit, in his time; and his own joy and strength shall be continual."

3. Notice next the word 'folium.' In Greek, φύλλον, 'phyllon.'

"The thing that is born," or "put forth." "When the branch is tender, and putteth forth her leaves, ye know that summer is nigh." The botanists say, "The leaf is an expansion of the bark of the stem." More accurately, the bark is a contraction of the tissue of the leaf. For every leaf is born out of the earth, and breathes out of the air; and there are many leaves that have no stems, but only roots. It is 'the springing thing'; this thin film of life; rising, with its *edge* out of the ground—infinately feeble, infinitely fair. With Folium, in Latin, is rightly associated the word Flos; for the flower is only a group of singularly happy leaves. From these two roots come foglio, feuille, feuillage, and fleur;—blume, blossom, and bloom; our foliage, and the borrowed foil, and the connected technical groups of words in architecture and the sciences.

4. This *thin* film, I said. That is the essential character of a leaf; to be thin,—widely spread out in proportion to its mass. It is the opening of the substance of the earth to the air, which is the giver of life. The Greeks called it, therefore, not only the born or blooming thing, but the spread or expanded thing—"πεταλον." Pindar calls the beginnings of quarrel, "petals of quarrel." Recollect, therefore, this form, Petalos; and connect it with Petasos, the expanded cap of Mercury. For one great use of both is to give shade. The root of all these words is said to be ΠΙΕΤ (Pet), which may easily be remembered in Greek, as it sometimes occurs in no unpleasant sense in English.

5. But the word 'petalos' is connected in Greek with another word, meaning, to fly,—so that you may think of a bird as spreading its petals to the wind; and with another, signifying Fate in its pursuing flight, the overtaking thing, or overflying Fate. Finally, there is another Greek word meaning 'wide,' πλατυς (platys); whence at last our 'plate'—a thing made broad or extended—but especially made broad or 'flat' out of the solid, as in a lump of clay extended on the wheel, or a lump of metal extended by the hammer. So the first we call Platter; the second Plate, when of the precious metals. Then putting *b* for *p*, and *d* for *t*, we get the blade of an oar, and blade of grass.

6. Now gather a branch of laurel, and look at it carefully. You may read the history of the being of half the earth in one of those green oval leaves—the things that the sun and the rivers have made out of dry ground. Daphne—daughter of Enipeus, and beloved by the Sun,—that fable gives you at once the two great facts about vegetation. Where warmth is, and moisture—there, also, the leaf. Where no warmth—there is no leaf; where there is no dew—no leaf.

7. Look, then, to the branch you hold in your hand. That you *can* so hold it, or make a crown of it, if you choose, is the first thing I want you to note of it;—the proportion of size, namely, between the leaf and *you*. Great part of your life and character, as a human creature, has depended on that. Suppose all leaves had been spacious, like some palm leaves; solid, like cactus stem; or that trees had grown, as they might of course just as easily have grown, like mushrooms, all one great cluster of leaf round one stalk. I do not say that they are divided into small leaves only for your delight, or your service, as if you were the monarch of everything—even in this atom of a globe. You are made of your proper size; and the leaves of theirs: for reasons, and by laws, of which neither the leaves nor you know anything. Only note the harmony between both, and the joy we may have in this division and mystery of the frivolous and tremulous petals, which break the light and the breeze,—compared to what with the frivolous and tremulous mind which is in us, we could have had out of domes, or penthouses, or walls of leaf.

8. Secondly; think awhile of its dark clear green, and the good of it to you. Scientifically, you know green in leaves is owing to 'chlorophyll,' or, in English, to 'greenleaf.' It may be very fine to know that; but my advice to you, on the whole, is to rest content with the general fact that leaves are green when they do not grow in or near smoky towns; and not by any means to rest content with the fact that very soon there will not be a green leaf in England, but only greenish-black ones. And thereon resolve that you will yourself endeavour to promote the growing of the green wood, rather than of the black.

9. Looking at the back of your laurel-leaves, you see how the central rib or spine of each, and the lateral branchings, strengthen and carry it. I find much confused use, in botanical works, of the words Vein and Rib. For, indeed, there are veins *in* the ribs of leaves, as marrow in bones; and the projecting bars often gradually depress themselves into a transparent net of rivers. But the *mechanical* force of the framework in carrying the leaf-tissue is the point first to be noticed; it is that which admits, regulates, or restrains the visible motions of the leaf; while the system of circulation can only be studied through the microscope. But the ribbed leaf bears itself to the wind, as the webbed foot of a bird does to the water, and needs the same kind, though not the same strength, of support; and its ribs always are partly therefore constituted of strong woody substance, which is knit out of the tissue; and you can extricate this skeleton framework, and keep it, after the leaf-tissue is dissolved. So I shall henceforward speak simply of the leaf and its ribs,—only specifying the additional veined structure on necessary occasions.

10. I have just said that the ribs—and might have said, farther, the stalk that sustains them—are knit out of the *tissue* of the leaf. But what is the leaf tissue itself knit out of? One would think that was nearly the first thing to be discovered, or at least to be thought of, concerning plants,—namely, how and of what they are made. We say they 'grow.' But you know that they can't grow out of nothing;—this solid wood and rich tracery must be made out of some previously existing substance. What is the substance?—and how is it woven into leaves.—twisted into wood?

11. Consider how fast this is done, in spring. You walk in February over a slippery field, where, through hoar-frost and mud, you perhaps hardly see the small green blades of trampled turf. In twelve weeks you wade through the same field up to your knees in fresh grass; and in a week or two more, you mow two or three solid haystacks off it. In winter you walk by your currant-bush, or your vine. They are shrivelled sticks—like bits of black tea in the canister. You pass again in May, and the currant-bush looks like a young sycamore tree; and the vine is a bower: and meanwhile the forests, all over this side of the round world, have grown their foot or two in height, with new leaves—so

much deeper, so much denser than they were. Where has it all come from? Cut off the fresh shoots from a single branch of any tree in May. Weigh them; and then consider that so much weight has been added to every such living branch, everywhere, this side the equator, within the last two months. What is all that made of?

12. Well, this much the botanists really know, and tell us,—It is made chiefly of the breath of animals: that is to say, of the substance which, during the past year, animals have breathed into the air; and which, if they went on breathing, and their breath were not made into trees, would poison them, or rather suffocate them, as people are suffocated in uncleansed pits, and dogs in the Grotta del Cane. So that you may look upon the grass and forests of the earth as a kind of green hoar-frost, frozen upon it from our breath, as, on the window-panes, the white arborescence of ice.

13. But how is it made into wood?

The substances that have been breathed into the air are charcoal, with oxygen and hydrogen, —or, more plainly, charcoal and water. Some necessary earths,—in smaller quantity, but absolutely essential,—the trees get from the ground; but, I believe all the charcoal they want, and most of the water, from the air. Now the question is, where and how do they take it in, and digest it into wood?

14. You know, in spring, and partly through all the year, except in frost, a liquid called 'sap' circulates in trees, of which the nature, one should have thought, might have been ascertained by mankind in the six thousand years they have been cutting wood. Under the impression always that it *had been* ascertained, and that I could at any time know all about it, I have put off till to-day, 19th October, 1869, when I am past fifty, the knowing anything about it at all. But I will really endeavour now to ascertain something, and take to my botanical books, accordingly, in due order.

(1) Dresser's "Rudiments of Botany." 'Sap' not in the index; only Samara, and Sarcocarp,—about neither of which I feel the smallest curiosity. (2) Fiquier's "Histoire des Plantes."¹⁸ 'Sève,' not in index; only Serpolet, and Sherardia arvensis, which also have no help in them for me. (3) Balfour's "Manual of Botany." 'Sap,'—yes, at last. "Article 257. Course of fluids in exogenous stems." I don't care about the course just now: I want to know where the fluids come from. "If a plant be plunged into a weak solution of acetate of lead,"—I don't in the least want to know what happens. "From the minuteness of the tissue, it is not easy to determine the vessels through which the sap moves." Who said it was? If it had been easy, I should have done it myself. "Changes take place in the composition of the sap in its upward course." I dare say; but I don't know yet what its composition is before it begins going up. "The Elaborated Sap by Mr. Schultz has been called 'latex.'" I wish Mr. Schultz were in a hogshead of it, with the top on. "On account of these movements in the latex, the laticiferous vessels have been denominated cinenchymatous." I do not venture to print the expressions which I here mentally make use of.

15. Stay,—here, at last, in Article 264, is something to the purpose: "It appears then that, in the case of Exogenous plants, the fluid matter in the soil, containing different substances in solution, is sucked up by the extremities of the roots." Yes, but how of the pine trees on yonder rock?—Is there any sap in the rock, or water either? The moisture must be seized during actual rain on the root, or stored up from the snow; stored up, any way, in a tranquil, not actively sappy, state, till the time comes for its change, of which there is no account here.

16. I have only one chance left now. Lindley's "Introduction to Botany." 'Sap,'—yes,—'General motion of.' II. 325. "The course which is taken by the sap, after entering a plant, is the first subject for consideration." My dear doctor, I have learned nearly whatever I know of plant structure from you, and am grateful; and that it is little, is not your fault, but mine. But this—let me say it with all sincere respect—is not what you should have told me here. You know, far better than I, that 'sap' never does enter a plant at all; but only salt, or earth and water, and that the roots alone could not make it; and that, therefore, the course of it must be, in great part, the result or process of the actual

¹⁸ An excellent book, nevertheless.

making. But I will read now, patiently; for I know you will tell me much that is worth hearing, though not perhaps what I want.

Yes; now that I have read Lindley's statement carefully, I find it is full of precious things; and this is what, with thinking over it, I can gather for you.

17. First, towards the end of January,—as the light enlarges, and the trees revive from their rest,—there is a general liquefaction of the blood of St. Januarius in their stems; and I suppose there is really a great deal of moisture rapidly absorbed from the earth in most cases; and that this absorption is a great help to the sun in drying the winter's damp out of it for us: then, with that strange vital power,—which scientific people are usually as afraid of naming as common people are afraid of naming Death,—the tree gives the gathered earth and water a changed existence; and to this new-born liquid an upward motion from the earth, as our blood has from the heart; for the life of the tree is out of the earth; and this upward motion has a mechanical power in pushing on the growth. "*Forced onward* by the current of sap, the plumule ascends," (Lindley, p. 132.)—this blood of the tree having to supply, exactly as our own blood has, not only the forming powers of substance, but a continual evaporation, "approximately seventeen times more than that of the human body," while the force of motion in the sap "is sometimes five times greater than that which impels the blood in the crural artery of the horse."

18. Hence generally, I think we may conclude thus much,—that at every pore of its surface, under ground and above, the plant in the spring absorbs moisture, which instantly disperses itself through its whole system "by means of some permeable quality of the membranes of the cellular tissue invisible to our eyes even by the most powerful glasses" (p. 326); that in this way subjected to the vital power of the tree, it becomes sap, properly so called, which passes downwards through this cellular tissue, slowly and secretly; and then upwards, through the great vessels of the tree, violently, stretching out the supple twigs of it as you see a flaccid waterpipe swell and move when the cock is turned to fill it. And the tree becomes literally a fountain, of which the springing streamlets are clothed with new-woven garments of green tissue, and of which the silver spray stays in the sky,—a spray, now, of leaves.

19. That is the gist of the matter; and a very wonderful gist it is, to my mind. The secret and subtle descent—the violent and exulting resilience of the tree's blood,—what guides it?—what compels? The creature has no heart to beat like ours; one cannot take refuge from the mystery in a 'muscular contraction.' Fountain without supply—playing by its own force, for ever rising and falling all through the days of Spring, spending itself at last in gathered clouds of leaves, and iris of blossom.

Very wonderful; and it seems, for the present, that we know nothing whatever about its causes;—nay, the strangeness of the reversed arterial and vein motion, without a heart, does not seem to strike anybody. Perhaps, however, it may interest you, as I observe it does the botanists, to know that the cellular tissue through which the motion is effected is called Parenchym, and the woody tissue, Bothrenchym; and that Parenchym is divided, by a system of nomenclature which "has some advantages over that more commonly in use,"¹⁹ into merenchyma, conenchyma, ovenchyma, atractenchyma, cylindrenchyma, colpenchyma, cladenchyma, and prismenchyma.

20. Take your laurel branch into your hand again. There are, as you must well know, innumerable shapes and orders of leaves;—there are some like claws; some like fingers, and some like feet; there are endlessly cleft ones, and endlessly clustered ones, and inscrutable divisions within divisions of the fretted verdure; and wrinkles, and ripples, and stitchings, and hemmings, and pinchings, and gatherings, and crumplings, and clippings, and what not. But there is nothing so constantly noble as the pure leaf of the laurel, bay, orange, and olive; numerable, sequent, perfect in setting, divinely simple and serene. I shall call these noble leaves 'Apolline' leaves. They characterize many orders of plants, great and small,—from the magnolia to the myrtle, and exquisite 'myrtile' of

¹⁹ Lindley, 'Introduction to Botany,' vol. i., p. 21. The terms "wholly obsolete," says an authoritative botanic friend. Thank Heaven!

the hills, (bilberry); but wherever you find them, strong, lustrous, dark green, simply formed, richly scented or stored,—you have nearly always kindly and lovely vegetation, in healthy ground and air.

21. The gradual diminution in rank beneath the Apolline leaf, takes place in others by the loss of one or more of the qualities above named. The Apolline leaf, I said, is strong, lustrous, full in its green, rich in substance, simple in form. The inferior leaves are those which have lost strength, and become thin, like paper; which have lost lustre, and become dead by roughness of surface, like the nettle,—(an Apolline leaf may become dead by *bloom*, like the olive, yet not lose beauty); which have lost colour and become feeble in green, as in the poplar, or *crudely* bright, like rice; which have lost substance and softness, and have nothing to give in scent or nourishment; or become flinty or spiny; finally, which have lost simplicity, and become cloven or jagged. Many of these losses are partly atoned for by gain of some peculiar loveliness. Grass and moss, and parsley and fern, have each their own delightfulness; yet they are all of inferior power and honour, compared to the Apolline leaves.

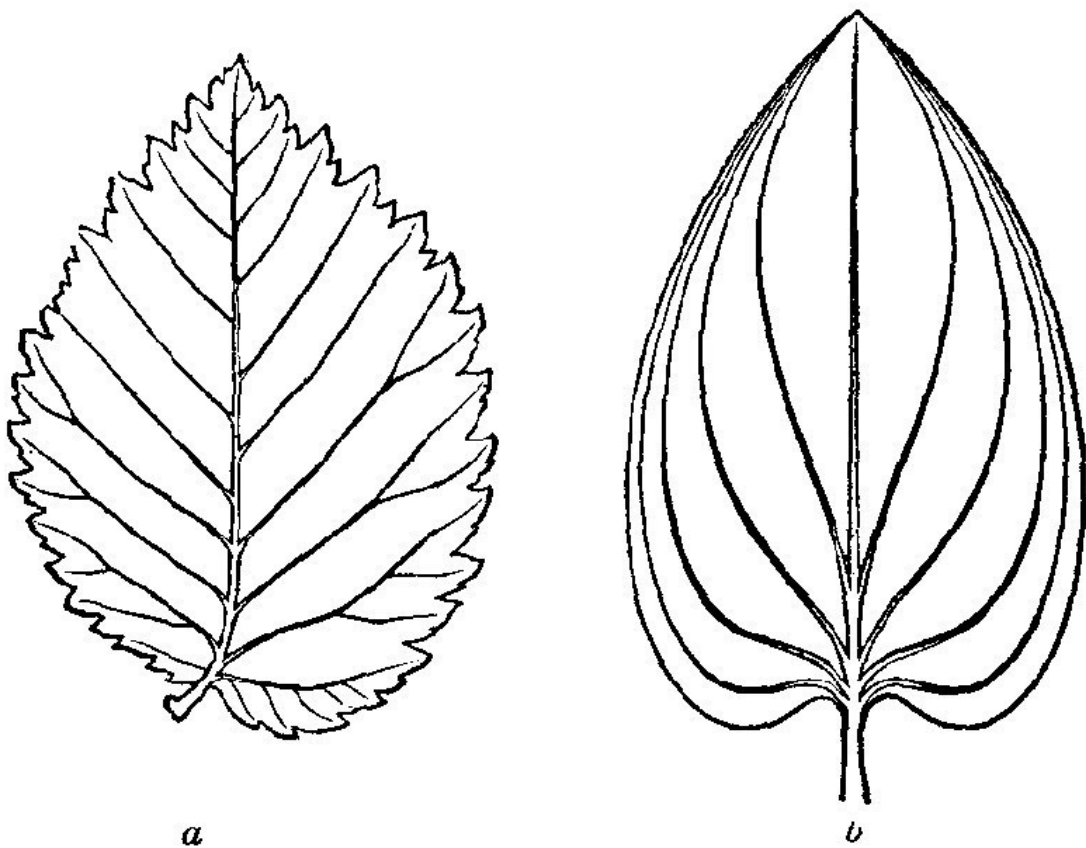


Fig. 3.

22. You see, however, that though your laurel leaf has a central stem, and traces of ribs branching from it, in a vertebrated manner, they are so faint that we cannot take it for a type of vertebrate structure. But the two figures of elm and alisma leaf, given in *Modern Painters* (vol. iii.), and now here repeated, Fig. 3, will clearly enough show the opposition between this vertebrate form, branching again usually at the edges, *a*, and the softly opening lines diffused at the stem, and gathered at the point of the leaf *b*, which, as you almost without doubt know already are characteristic of a vast group of plants, including especially all the lilies, grasses, and palms, which for the most part are the signs of local or temporary moisture in hot countries;—local, as of fountains and streams; temporary, as of rain or inundation.

But temporary, still more definitely in the day, than in the year. When you go out, delighted, into the dew of the morning, have you ever considered why it is so rich upon the grass;—why it is *not*

upon the trees? It is partly on the trees, but yet your memory of it will be always chiefly of its gleam upon the lawn. On many trees you will find there is none at all. I cannot follow out here the many inquiries connected with this subject, but, broadly, remember the branched trees are fed chiefly by rain,—the unbranched ones by dew, visible or invisible; that is to say, at all events by moisture which they can gather for themselves out of the air; or else by streams and springs. Hence the division of the verse of the song of Moses: "My doctrine shall drop as the rain; my speech shall distil as the dew: as the *small* rain upon the tender *herb*, and as the showers upon the grass."

23. Next, examining the direction of the veins in the leaf of the alisma, *b*, Fig. 3, you see they all open widely, as soon as they can, towards the thick part of the leaf; and then taper, apparently with reluctance, pushing each other outwards, to the point. If the leaf were a lake of the same shape, and its stem the entering river, the lines of the currents passing through it would, I believe, be nearly the same as that of the veins in the aquatic leaf. I have not examined the fluid law accurately, and I do not suppose there is more real correspondence than may be caused by the leaf's expanding in every permitted direction, as the water would, with all the speed it can; but the resemblance is so close as to enable you to fasten the relation of the unbranched leaves to streams more distinctly in your mind,—just as the toss of the palm leaves from their stem may, I think, in their likeness to the springing of a fountain, remind you of their relation to the desert, and their necessity, therein, to life of man and beast.

24. And thus, associating these grass and lily leaves always with fountains, or with dew, I think we may get a pretty general name for them also. You know that Cora, our Madonna of the flowers, was lost in Sicilian Fields: you know, also, that the fairest of Greek fountains, lost in Greece, was thought to rise in a Sicilian islet; and that the real springing of the noble fountain in that rock was one of the causes which determined the position of the greatest Greek city of Sicily. So I think, as we call the fairest branched leaves 'Apolline,' we will call the fairest flowing ones 'Arethusan.' But remember that the Apolline leaf represents only the central type of land leaves, and is, within certain limits, of a fixed form; while the beautiful Arethusan leaves, alike in flowing of their lines, change their forms indefinitely,—some shaped like round pools, and some like winding currents, and many like arrows, and many like hearts, and otherwise varied and variable, as leaves ought to be,—that rise out of the waters, and float amidst the pausing of their foam.

25. Brantwood, *Easter Day*, 1875.—I don't like to spoil my pretty sentence, above; but on reading it over, I suspect I wrote it confusing the water-lily leaf, and other floating ones of the same kind, with the Arethusan forms. But the water-lily and water-ranunculus leaves, and such others, are to the orders of earth-loving leaves what ducks and swans are to birds; (the swan is the water-lily of birds;) they are *swimming* leaves; not properly watery creatures, or able to live under water like fish, (unless when dormant), but just like birds that pass their lives on the surface of the waves—though they must breathe in the air.

And these natant leaves, as they lie on the water surface, do not want strong ribs to carry them,²⁰ but have very delicate ones beautifully branching into the orbéd space, to keep the tissue nice and flat; while, on the other hand, leaves that really have to grow under water, sacrifice their tissue, and keep only their ribs, like coral animals; ('Ranunculus heterophyllus,' 'other-leaved Frog-flower,' and its like,) just as, if you keep your own hands too long in water, they shrivel at the finger-ends.

26. So that you must not attach any great botanical importance to the characters of contrasted aspects in leaves, which I wish you to express by the words 'Apolline' and 'Arethusan'; but their mythic importance is very great, and your careful observance of it will help you completely to understand the beautiful Greek fable of Apollo and Daphne. There are indeed several Daphnes, and the first root of the name is far away in another field of thought altogether, connected with the Gods of Light. But

²⁰ "You should see the girders on under-side of the Victoria Water-lily, the most wonderful bit of engineering, of the kind, I know of."—('Botanical friend.')

etymology, the best of servants, is an unreasonable master; and Professor Max Müller trusts his deep-reaching knowledge of the first ideas connected with the names of Athena and Daphne, too implicitly, when he supposes this idea to be retained in central Greek theology. 'Athena' originally meant only the dawn, among nations who knew nothing of a Sacred Spirit. But the Athena who catches Achilles by the hair, and urges the spear of Diomed, has not, in the mind of Homer, the slightest remaining connection with the mere beauty of daybreak. Daphne chased by Apollo, may perhaps—though I doubt even this much of consistence in the earlier myth—have meant the Dawn pursued by the Sun. But there is no trace whatever of this first idea left in the fable of Arcadia and Thessaly.

27. The central Greek Daphne is the daughter of one of the great *river* gods of Arcadia; her mother is the Earth. Now Arcadia is the Oberland of Greece; and the crests of Cyllene, Erymanthus, and Mænalus²¹ surround it, like the Swiss forest cantons, with walls of rock, and shadows of pine. And it divides itself, like the Oberland, into three regions: first, the region of rock and snow, sacred to Mercury and Apollo, in which Mercury's birth on Cyllene, his construction of the lyre, and his stealing the oxen of Apollo, are all expressions of the enchantments of cloud and sound, mingling with the sunshine, on the cliffs of Cyllene.

"While the mists
Flying, and rainy vapours, call out shapes
And phantoms from the crags and solid earth
As fast as a musician scatters sounds
Out of his instrument."

Then came the pine region, sacred especially to Pan and Mænalus, the son of Lycaon and brother of Callisto; and you had better remember this relationship carefully, for the sake of the meaning of the constellations of Ursa Major and the Mons Mænalus, and of their wolf and bear traditions; (compare also the strong impression on the Greek mind of the wild leafiness, nourished by snow, of the Boëotian Cithæron,—"Oh, thou lake-hollow, full of divine leaves, and of wild creatures, nurse of the snow, darling of Diana," (Phœnissæ, 801)). How wild the climate of this pine region is, you may judge from the pieces in the note below²² out of Colonel Leake's diary in crossing the Mænalian range in spring. And then, lastly, you have the laurel and vine region, full of sweetness and Elysian beauty.

28. Now as Mercury is the ruling power of the hill enchantment, so Daphne of the leafy peace. She is, in her first life, the daughter of the mountain river, the mist of it filling the valley; the Sun, pursuing, and effacing it, from dell to dell, is, literally, Apollo pursuing Daphne, and *adverse* to her; (not, as in the earlier tradition, the Sun pursuing only his own light). Daphne, thus hunted, cries to her mother, the Earth, which opens, and receives her, causing the laurel to spring up in her stead.

²¹ Roughly, Cyllene 7,700 feet high; Erymanthus 7,000; Mænalus 6,000.

²² *March 3rd.*—We now ascend the roots of the mountain called Kastaniá, and begin to pass between it and the mountain of Alonístena, which is on our right. The latter is much higher than Kastaniá, and, like the other peaked summits of the Mænalian range, is covered with firs, and deeply at present with snow. The snow lies also in our pass. At a fountain in the road, the small village of Bazeniko is half a mile on the right, standing at the foot of the Mænalian range, and now covered with snow. Saetá is the most lofty of the range of mountains, which are in face of Levídhí, to the northward and eastward; they are all a part of the chain which extends from Mount Khelmós, and connects that great summit with Artemisium, Parthenium, and Parnon. Mount Saetá is covered with firs. The mountain between the plain of Levídhí and Alonístena, or, to speak by the ancient nomenclature, that part of the Mænalian range which separates the Orchomenia from the valleys of Helisson and Methydrium, is clothed also with large forests of the same trees; the road across this ridge from Lavídhí to Alonístena is now impracticable on account of the snow. I am detained all day at Levídhí by a heavy fall of snow, which before the evening has covered the ground to half a foot in depth, although the village is not much elevated above the plain, nor in a more lofty situation than Tripolitzá. *March 4th.*—Yesterday afternoon and during the night the snow fell in such quantities as to cover all the plains and adjacent mountains; and the country exhibited this morning as fine a snow-scene as Norway could supply. As the day advanced and the sun appeared, the snow melted rapidly, but the sky was soon overcast again, and the snow began to fall.

That is to say, wherever the rocks protect the mist from the sunbeam, and suffer it to water the earth, there the laurel and other richest vegetation fill the hollows, giving a better glory to the sun itself. For sunshine, on the torrent spray, on the grass of its valley, and entangled among the laurel stems, or glancing from their leaves, became a thousandfold lovelier and more sacred than the same sunbeams, burning on the leafless mountain-side.

And farther, the leaf, in its connection with the river, is typically expressive, not, as the flower was, of human fading and passing away, but of the perpetual flow and renewal of human mind and thought, rising "like the rivers that run among the hills"; therefore it was that the youth of Greece sacrificed their hair—the sign of their continually renewed strength,—to the rivers, and to Apollo. Therefore, to commemorate Apollo's own chief victory over death—over Python, the corrupter,—a laurel branch was gathered every ninth year in the vale of Tempe; and the laurel leaf became the reward or crown of all beneficent and enduring work of man—work of inspiration, born of the strength of the earth, and of the dew of heaven, and which can never pass away.

29. You may doubt at first, even because of its grace, this meaning in the fable of Apollo and Daphne; you will not doubt it, however, when you trace it back to its first eastern origin. When we speak carelessly of the traditions respecting the Garden of Eden, (or in Hebrew, remember, Garden of Delight,) we are apt to confuse Milton's descriptions with those in the book of Genesis. Milton fills his Paradise with flowers; but no flowers are spoken of in Genesis. We may indeed conclude that in speaking of every herb of the field, flowers are included. But they are not named. The things that are *named* in the Garden of Delight are trees only.

The words are, "every tree that was pleasant to the sight and good for food;" and as if to mark the idea more strongly for us in the Septuagint, even the ordinary Greek word for tree is not used, but the word ξυλον,—literally, every 'wood,' every piece of *timber* that was pleasant or good. They are indeed the "vivi travi,"—living rafters, of Dante's Apennine.

Do you remember how those trees were said to be watered? Not by the four rivers only. The rivers could not supply the place of rain. No rivers do; for in truth they are the refuse of rain. No storm-clouds were there, nor hidings of the blue by darkening veil; but there went up a *mist* from the earth, and watered the face of the ground,—or, as in Septuagint and Vulgate, "There went forth a fountain from the earth, and gave the earth to drink."

30. And now, lastly, we continually think of that Garden of Delight, as if it existed, or could exist, no longer; wholly forgetting that it is spoken of in Scripture as perpetually existent; and some of its fairest trees as existent also, or only recently destroyed. When Ezekiel is describing to Pharaoh the greatness of the Assyrians, do you remember what image he gives of them? "Behold, the Assyrian was a cedar in Lebanon, with fair branches; and his top was among the thick boughs; the waters nourished him, and the deep brought him up, with her rivers running round about his plants. Under his branches did all the beasts of the field bring forth their young; and under his shadow dwelt all great nations."

31. Now hear what follows. "The cedars *in the Garden of God* could not hide *him*. The fir trees were not like his boughs, and the chestnut trees were not like his branches; nor any tree in the Garden of God was like unto him in beauty."

So that you see, whenever a nation rises into consistent, vital, and, through many generations, enduring power, *there* is still the Garden of God; still it is the water of life which feeds the roots of it; and still the succession of its people is imaged by the perennial leafage of trees of Paradise. Could this be said of Assyria, and shall it not be said of England? How much more, of lives such as ours should be,—just, laborious, united in aim, beneficent in fulfilment, may the image be used of the leaves of the trees of Eden! Other symbols have been given often to show the evanescence and slowness of our lives—the foam upon the water, the grass on the housetop, the vapour that vanishes away; yet none of these are images of true human life. That life, when it is real, is *not* evanescent; is *not* slight; does *not* vanish away. Every noble life leaves the fibre of it interwoven for ever in the work of the world; by so much, evermore, the strength of the human race has gained; more stubborn in the

root, higher towards heaven in the branch; and, "as a teil tree, and as an oak,—whose substance is in them when they cast their leaves,—so the holy seed is in the midst thereof."

32. Only remember on what conditions. In the great Psalm of life, we are told that everything that a man doeth shall prosper, so only that he delight in the law of his God, that he hath not walked in the counsel of the wicked, nor sat in the seat of the scornful. Is it among these leaves of the perpetual Spring,—helpful leaves for the healing of the nations,—that we mean to have our part and place, or rather among the "brown skeletons of leaves that lag, the forest brook along"? For other leaves there are, and other streams that water them,—not water of life, but water of Acheron. Autumnal leaves there are that strew the brooks, in Vallombrosa. Remember you how the name of the place was changed: "Once called 'Sweet water' (Aqua bella), now, the Shadowy Vale." Portion in one or other name we must choose, all of us,—with the living olive, by the living fountains of waters, or with the wild fig trees, whose leafage of human soul is strewed along the brooks of death, in the eternal Vallombrosa.

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