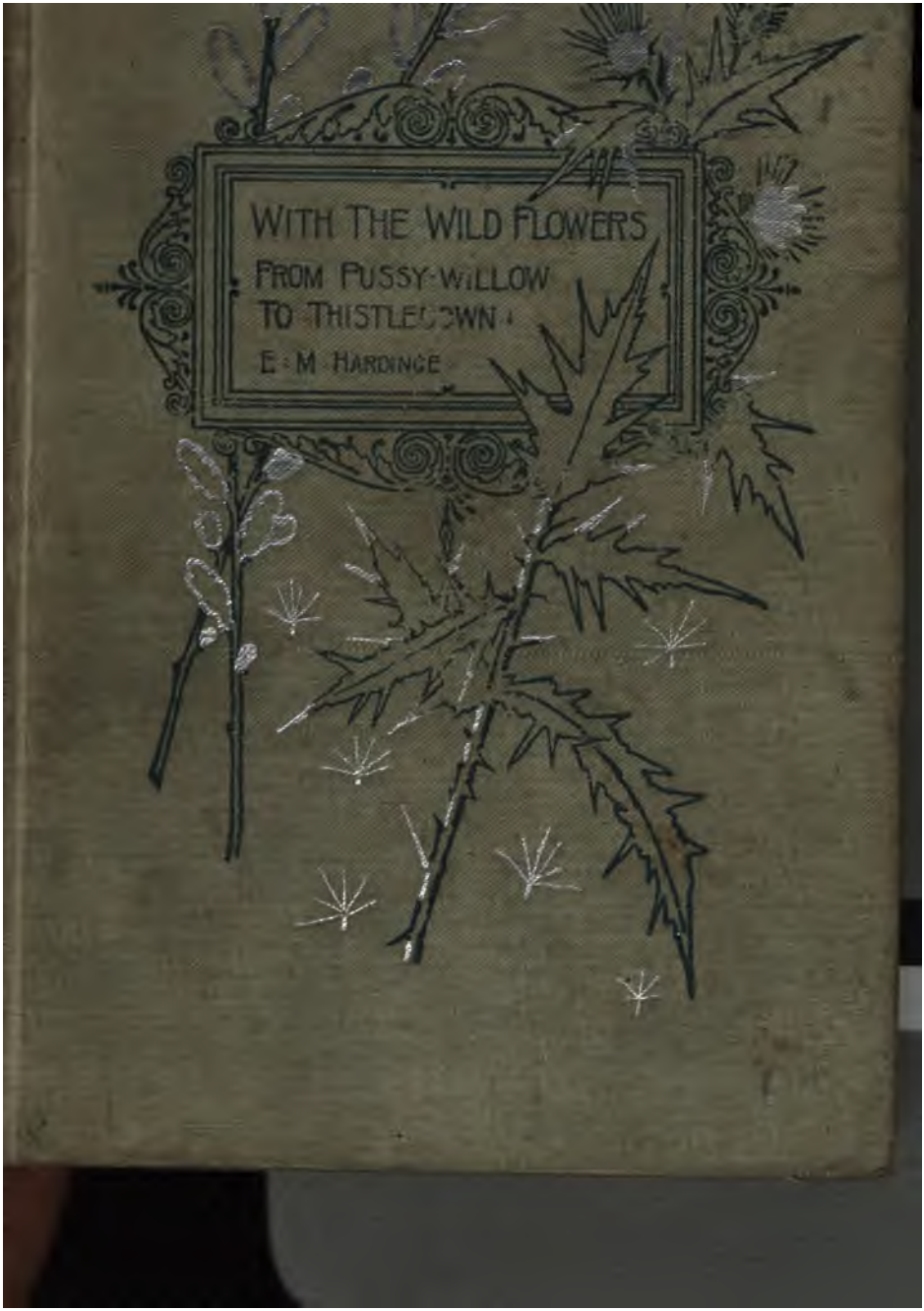

WITH THE WILD FLOWERS
FROM PUSSY-WILLOW
TO THISTLEDOWN
E. M HARDINGE

1, Flowers, Wild

QEG

Going

WITH THE WILD FLOWERS.

WITH THE WILD FLOWERS

FROM PUSSY-WILLOW TO THISTLE-DOWN

A RURAL CHRONICLE OF

Our Flower Friends and Foes

DESCRIBING THEM UNDER THEIR

FAMILIAR ENGLISH NAMES

BY

E. M. HARDINGE

NEW YORK

THE BAKER & TAYLOR CO.

5 AND 7 EAST 16TH STREET

[c 1894]

PREFACE.

Most of the matter in this little book has appeared in articles contributed to *Demorest's Family Magazine* and to the New York *Evening Post*.

These articles were written at various times and independently of one another. Hence their compilation may lack system, as the critics will say, if those arbiters of literary fate honor my little book with their consideration.

We have all heard the story of Charles Lamb, who wanted to be excused for arriving at the office so late in the morning because he left it so early in the afternoon. With similar logical sequence we plead indulgence for a shortcoming by calling attention to a lack. The book may be without system, but, gentle reader, it is without

technical terms. It is written in a tongue "understanded of the people."

To many of us botany has been presented at school merely as a list of scientific terms which eluded our memories and excited loathing in our souls. When one has been compelled to learn that a rose belongs to the series Phænogams, class dicotyledons, sub-class angiosperms, division polypetalous, and order Rosaceæ, it does not thereafter smell quite so sweet—Shakespeare to the contrary notwithstanding.

It would be far better to teach pupils first the *facts* of botany.

Let them learn how plants wake and sleep, how they store up food for themselves in hidden garners, how flowers lure insects, and how insects work for the flowers. Let them learn the marvels of vegetable structure.

As the lessons go on, a few—but only a few—technical terms must be used. These can be explained as they naturally occur, in connection with the subject.

Most of the nomenclature so laboriously learned in schools is useless even to the working botanist.

The most reliable guides to the flora of the greater part of the United States are the works of

Professor Gray, who was not addicted to the use of scientific language when his meaning could be conveyed in plain English. When his books do drop into technicalities, definitions of the ponderous words can always be sought and found in the glossary bound in with the volume.

The student who has been compelled to learn that canescent means hoary and that hypocrateriform means salver-shaped has been bothered to little purpose.

His real concern is to find out why the leaves are hoary and why the blossoms are salver-shaped. For there is a reason for everything in this beautiful creation. There is a reason why the flower unfolds in April, rather than in June or in September. There is a reason why it wears the particular color with which it adorns itself, a reason why its dainty cup is shallow or deep, and reasons for the peculiar form, size, and grouping of the leaves.

Nature students are always asking "why?" Some few of the wherefores are known, but many have not been found out yet, and if we ever learn them the flowers themselves must teach us, for the botanists do not know. It is a wonderful moment to the student when he learns the answer

even to one of the whys which the humblest weed suggests, for he feels that, ignorant and unworthy as he is, he has been, for one brief moment, taken into the confidence of the Creator.

E. M. HARDINGE.

CONTENTS.

LIST OF ILLUSTRATIONS.

WITH THE WILD FLOWERS.

I.

THE PLANT WORLD.

FEW persons have any idea what diversity exists among members of the vegetable kingdom. Some plants differ from others as widely as a shark differs from a wren, an elephant from a mosquito, or a crab from a rattlesnake.

We find among plants every gradation in size, from microscopic forms floating in fresh water to the giant trees of California three hundred feet in height. We find every degree of elaboration of structure, from a mere shapeless, jelly-like mass to the exquisite grace of the lily, and the wonderful organization of the little catch-fly, which, like a living creature, lures, secures, kills, and digests its insect prey.

Some growths, of the mushroom sort, in a single night spring up, mature, reproduce their species, and die. In contrast to their brief existence, think of the lives of the olive and the yew, Methusalehs among trees. England has hoary yews, centuries old, which perhaps were young saplings when William the Norman landed. They have stood tranquilly, adding every year a half-inch or so of new wood to the end of each twig, while society struggled from semi-barbarism to civilization; while cities sprang up, kings were born, grew gray, died and were supplanted; poets and teachers arose, gave their message to the world, and were silenced by death. Eastern travellers tell us that gnarled olive-trees are to-day standing in the Garden of Gethsemane which were mute witnesses to the agony of our Lord.

When we remember how diverse are the conditions under which plants contrive to get a living, we see that there must of necessity be great diversity of size, form, and habits. There is a flora for every region, from the equator to the frozen circles; for the most fertile and also for the most barren soil. Some plants are parasitic on the living tissues of others. The mistletoe lives in this

way, and so does the dodder (Fig. 1), whose bright orange-colored stems may be seen twining among the herbage on any brookside. The Indian-pipe —sometimes called ghost-flower—is a parasite on

FIG. 1.—DODDER-PLANT (*Cuscuta*).

the roots of trees; its white stalks and waxy blossoms being fed by juices sucked or, rather, stolen from the oak or pine by which it is sheltered. Some plants feed, ghoul-like, on the dead bodies

of others; of this sort are the great wen-like fungi —white, yellow, orange, or red—which cling to decaying trees.

Beneath the ocean grows an endless variety of lovely seaweeds; while fresh-water weeds cover the bottom of every lake or slow-moving stream. A fungus, white as the driven snow and indescribably delicate, grows on the walls and floors of mines, and, unlike most members of the vegetable kingdom, evidently loves darkness rather than light.

Some degree of warmth is generally necessary to vegetation, but there is an exception even to this rule in the microscopic plants which have been found growing on the Arctic snow; these require the most intense cold. They are of a vivid ruby color, and grow in such innumerable masses as to impart their own rich hue to the snow on which they live, and are the cause of the patches of red snow occasionally seen by Arctic travellers.

Some tiny plants grow on the bodies of animals; some on the human body. One sort, visible only by aid of a powerful microscope, grows on open wounds, causing gangrene. A fungous growth in the throat is the cause of diphtheria. Recent medical discoveries prove that many diseases are

caused by the growth of microscopic vegetable forms on or in the body, and it is believed that further research will trace to the same source other of the ills that human flesh is heir to. Thus botany, in one direction, approaches the borders of medical science. So minute are these germs, often the cause of disease and death, that it would take a great number of them to make a mass as large as the head of a cambric needle. Their power to work mischief, however, emphatically teaches us not to despise "the day of small things."

Other tiny plants are dire enemies to the housekeeper. The skin which forms over improperly sealed preserves is a vegetable growth, as are also mildew and mould (Fig. 2). A bit of cheese-mould seen under a microscope is as pretty a sight as a tuft of ferns. While some minute plans destroy the fruits of our labor, others are helps to certain industries. To this latter class belong the ferments—the yeast-plant, which raises our bread and works the brewer's beer, and an allied growth which converts grape-juice into wine. The housekeeper mixing sponge is performing an operation similar to that of the farmer flinging grass-seed over a meadow. She is putting the sort of plant

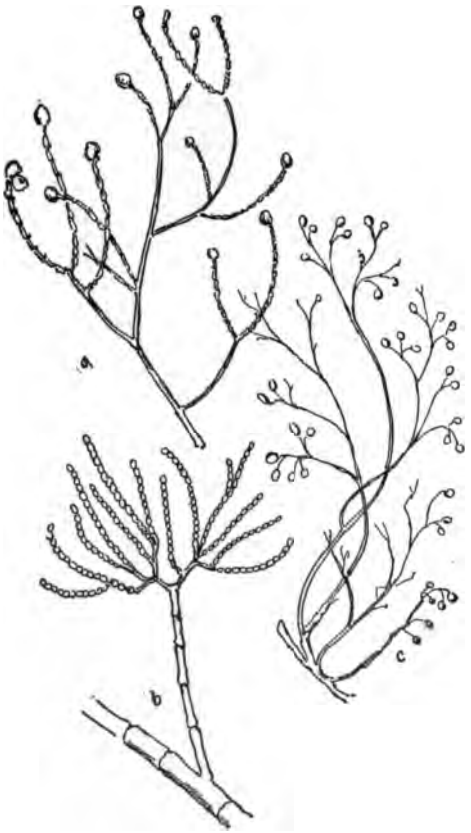


FIG. 2.—PLANT-LIKE MOULDS (magnified). *a*, Potato-mould ; *b* and *c*, Blue-mould.

she wants to raise into the sort of soil in which it is most likely to grow and prosper. With moderate warmth it grows and multiplies with wonderful rapidity, and in so doing alters the character of its soil—the sponge—making it light and porous. A sudden chill checks the growth of the yeast-plant, and heavy loaves are the result.

According to some estimates, botanists count one hundred thousand species of plants. The number growing in a single meadow will surprise any one who has patience to count them. The writer has gathered thirty sorts in a bit of ground chosen at haphazard and rather less than two feet square.

This great vegetable kingdom, comprising members so diverse in form, so different in habits, and so dispersed as to area, is divided very simply into two great tribes or *series.* These are: those plants which bear flowers, or Phanerogams; and those which do not, or Cryptogams.

To the first series, the Phanerogams, belong most of our familiar friends of wood and field. All trees bear flowers. The blossoms of many sorts are greenish, and appear in early spring when we are looking for the bursting of the leaf-buds. They are apt to be taken by a casual observer for

young leaves. All grasses also produce blossoms. They are often green, generally small and inconspicuous, and are the most evanescent of all flowers.

Could this have been known to the Hebrew poet, who, seeking an image to express the brevity of human life, says that man's strength and beauty pass away "as the flower of the grass"? In the tranquil outdoor life of a pastoral people many of the wonders of nature might be noted, and taught by father to child. It does not follow that the green growing things about us are either better known or better loved because in these days we bestow on their delicate organs a ponderous Latin nomenclature.

The Cryptogamia, or flowerless plants, are mostly minute, sometimes invisible to the naked eye. Microscopic work is necessary to the attainment of much knowledge in this branch of botany, which is full of difficulty and less generally interesting than the study of flowering plants.

The series of Cryptogamia comprises ferns, horsetails, mosses, lichens, fungi, moulds; the minute vegetable growths already noted, which cause disease, fermentation, and decay; and tiny things which float in fresh water, called diatoms

and desmids. These latter have little silicious shells and were for a long time supposed to be very minute shell-fish.

The appearance of ferns and mosses is familiar to every one accustomed to woodland walks. Horsetails, called also scouring-rushes, are leafless plants with hollow, jointed stems. The branches spring from the main stalk in a series of circles, after the fashion of the spokes of a wheel or the ribs of an umbrella.

Lichens are crinkled, papery growths, in soft, indefinite tints of brown, green, and gray. They spread themselves over rocks, tree-trunks, or unpainted wood. Some humble members of this family resemble smears of paint somewhat blistered by the sun. One sort, of the color of iron-rust, clings to the trunks of cedars and locusts. Other varieties appear as white stains or as little clusters of dark green dots on the surface of smooth rocks.

These humble rock-lichens are to-day carrying on a work begun by their ancestors before the grass grew or the first flower unfolded its petals to the light. They are among the first-born of the great family of plants. Their function in the plan of nature is to prepare the hard, bare rock

for the support of higher forms of vegetable life. Examine a stone to which they cling, and you will find that each lichen grows in a shallow depression. This it has hollowed out for itself by dissolving and then absorbing the substance of its rocky home. When it dies and decays, the mineral substances it has gathered will be left as fine dust on the surface of the stone. This may afford a foothold to some moss or larger lichen, or may be washed down by showers, to mingle with the soil and help to nourish a fern or flowering plant.

Lichens love shade, and always grow most abundantly on the north side of a tree-trunk where the sunshine never reaches them. This is said to have been noticed by the keen-eyed Indian hunters, and observation of the growth on tree-trunks was one method by which they guided themselves through the trackless forests. Any one travelling along a country road running east and west and bounded by rail fences can observe for himself this peculiarity of lichenous growth. The noon sun shining in the south daily warms the fence on the north side of the road, while the opposite fence lies in shadow. The shade-loving lichens accordingly will cluster thickly along the south fence, while that bounding the road on the other

hand (on the side toward the road, at least) is nearly bare.

On account of their ability to endure cold, lichens and mosses grow farther toward the poles than any other forms of vegetation; and they are still observed by the mountain-climber who has left beneath him the haunts and homes of higher species of plants.

Fungi comprise mushrooms, truffles, the various sorts of toadstools, and the fat, moist growths which cling to decaying wood.

A great difference between Phanerogams and Cryptogams is in their method of reproducing their kind. Flowering plants produce seeds; flowerless plants, spores. The seed contains a tiny plant, completely formed, and a store of food provided by the parent plant to support the seedling till it can form a root and grub for its own living (Fig. 3).

Split a bean (one that has been soaked for a few hours in water is best), and you will see the plan on which the seed is formed. On the outside are two skins, which we have torn in our investigations into the bean's anatomy. The outer skin is thick and tough; the inner is delicate and fine, and adheres to the outer, so that at first there may

appear to be but one. The bean separates naturally into halves. Between them we find a tiny

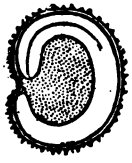


FIG. 3*a*.—SECTION OF THE SEED OF CORN-COCKLE (magnified).

FIG. 3*b*.—SECTION OF THE SEED OF OXALIS (magnified).

Showing the two seed-coats, the baby plant, and the store of nourishment. (From *The Vegetable World.*)

FIG. 4*a*.—HARICOT BEAN.

(From *The Vegetable World.*)

FIG. 4*b*.—GERMINATION OF THE HARICOT BEAN.

(From *The Vegetable World.*)

plant with two pale leaves folded close, a white stem, and at the end of the stem a thickened por-

tion whence the root of the future will spring. The halves of the bean contain rich starches for the baby plant (Fig. 4). These are the essential

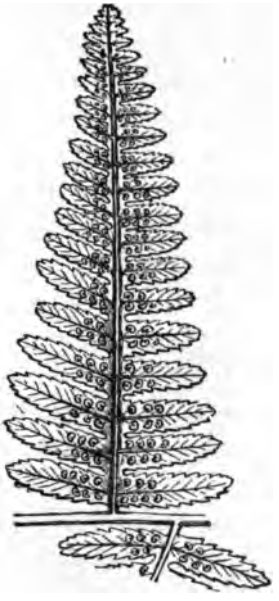


FIG. 5*a*.—PART OF THE LOWER SURFACE OF A FERN-LEAF.

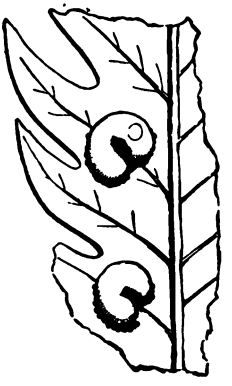


FIG. 5*b*.—MAGNIFIED PORTION OF THE LOWER SURFACE.

(From *The Vegetable World*.)

parts of a seed: an outer and an inner coat, a young plant completely formed, and (in most instances) a store of nourishment for its support during the earlier part of its existence.

The spore of a Cryptogam is much simpler in its structure. It is a tiny round object, barely visible, or microscopic, and consists of but a single cell, a little semi-transparent bag filled with a jelly-like substance. Most of our common ferns have lines or dots on the back of the leaf (Fig. 5) which are at first green, afterward brown. On examination they will be found to be rows or clusters of tiny objects resembling very small seeds. These are spore-cases, and contain the true spores, which are as fine as the finest powder (Fig. 6).

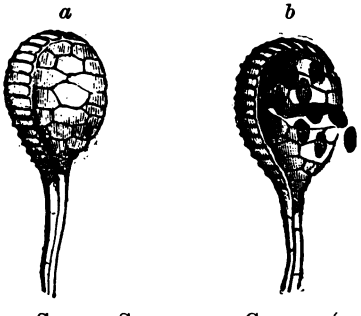


FIG. 6.—*a*, A SINGLE SPORE-CASE CLOSED (much magnified). *b*, OPENING TO LET OUT THE SPORES.
(From *The Vegetable World.*)

Thus one of these lines or dots represents many hundreds or even thousands of future plants.

Some ferns produce their spores on the top instead of at the back of the leaf. One sort, the

Botrychium, common in damp woods, by an odd, two-story arrangement carries its spore-cases aloft on a stalk rising out of the middle of the delicate leaf. The leaf of the maidenhair has a scalloped edge, and each scallop, just at the very end, is folded backward over the spores. The bracken, common along roadsides, is almost the largest of our native ferns, yet produces the tiniest spore-cases. They are as small as grains of dust, and lie in a fine line just at the edge of the shining dark green leaf.

According to an old English superstition, bracken spores confer upon their finder the power of becoming invisible at will. In reference to this, Falstaff says, when he and his cronies have eluded justice after a madcap breach of law and order, "We have the receipt [i.e., are in possession] of fern-seed. We walk invisible."

II.

FLOWERS AND THEIR VISITORS.

"THE lovely wild flowers," says Jean Ingelow, "are the flowers which God made."

The hydrangeas and snowballs on our lawns, the hundred-leaved and cabbage roses in our borders, and the whole category of "double" flowers have been greatly altered by generations of culture. They are, in their present form at least, flowers which man has made. They have been trained into the forms familiar to us by ignorant gardeners bent on producing big blossoms, pleased, like children or savages, by mere masses of color, and lacking the more refined appreciation of graceful forms. In the heart of a double flower will be found a mere crumpled mass of shapeless leaves. The plan on which its parts were once arranged has been obliterated and the exquisite symmetry of its natural shape destroyed. For the purposes of the botanist, as to the eye of the artist, the "doubled" flower is spoiled.

To study the parts of the flower, therefore, we must gather blossoms from country hedgerows, or some single flowers from our garden-beds or window-boxes.

However, a rose will show all the central organs (unless it be that triumph of misdirected horticultural zeal a "cabbage" rose), for only long and arduous culture will take the heart out of the queen of flowers.

On the outside of most flowers is a row of leaves, generally, but not always, green. Each one of these outer leaves is a sepal, and all the sepals together form the calyx, or little cup. Sometimes they are all together, in fact as well as in name, having grown into a sort of cup around the flower. This is the case in the carnation. Within the calyx is a second row of flower-leaves, brightly colored or white. Each of these bright delicate leaves is a petal, and all together are spoken of as the corolla, or little crown. The petals of the geranium are scarlet, pink, or white; those of the violet are purple, and those of the buttercup golden. Like the sepals, the petals are sometimes entirely separate, as in the rose, and sometimes united, as in the morning-glory.

In examining a fully opened flower, it is some-

times a little difficult to distinguish between calyx and corolla. In the garden balsam they are alike in color and texture, and in the wild columbine, called by country children "jacket and breeches," the calyx fairly outdoes the corolla in the brilliancy of its scarlet dye. When a doubt exists, it may be solved by looking at the bud, for in it the calyx is always wrapped around the closely folded petals. Indeed, this seems its principal use in the economy of the plant, for some flowers drop the calyx at the moment of unfolding. The expanding poppy slips off its sepals, and drops them in the shape of a little green liberty-cap from the tips of its liberated petals. The hepatica, called harbinger of spring, the anemone, and many other flowers have but one row of blossom-leaves, so delicate in tint and texture that we would be disposed to call them petals. To the botanist, however, they are sepals, and a single row of leaves encircling a flower is usually considered as forming the calyx.

Within the petals of a rose, unless it be a very "double" rose indeed, there is a close ring of delicate upright threads, each ending in a little knob of gold.

These are the stamens, and, insignificant though

they look, they are very important in the flower's economy.

The slender thread is the filament, and the knob is the anther. The filament is not essential, and is sometimes dispensed with altogether, many deep throated flowers having only a row of anthers fastened to the inside of the corolla (Fig. 7).

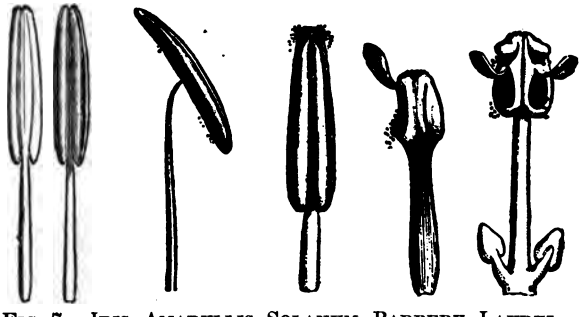


FIG. 7.—IRIS, AMARYLLIS, SOLANUM, BARBERY, LAUREL. Different Form of Stamens (magnified). (From *The Vegetable World.*)

The anther is really a little powder-box, and after a while it bursts open, spilling a quantity of fine dust, sometimes brown, but usually golden. This is "pollen," and without it we would have no flower-seeds.

The grains of pollen, when magnified from one to two hundred diameters, are seen to be exquisitely regular and dainty in form. Those shed by

the stamens of the rose of Sharon are little globes, covered with bristly points. Those of the lily are smooth and oval, like miniature eggs, and those of the musk-plant are globular and adorned with a deep spiral groove (Fig. 8).

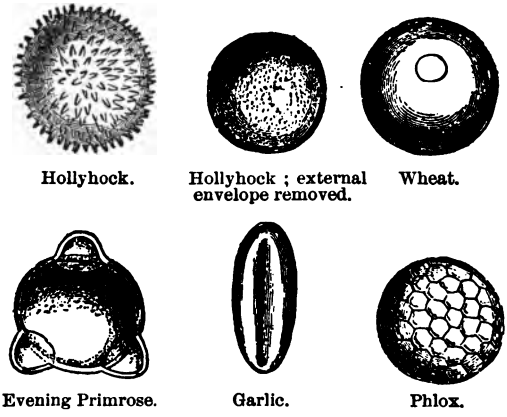
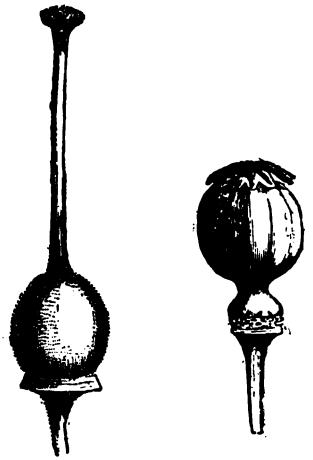


FIG. 8.—POLLEN-GRAINS (much magnified).
(From *The Vegetable World.*)

In the very heart of the flower we find the pistil or pistils, for there are sometimes many. That of the tulip is a sturdy affair, green at the base, yellow at the top, and dividing into three heads. Hepatica and anemone have many pistils, which are all huddled together in the blossom's centre and look like little green seeds. They are in real-

ity seed-cases (Fig. 9). The duty of the pistil in the floral division of labor is to form, guard, and in due time distribute the young seed. In its lower part, at flowering time, we may find one or



Chinese Primrose. Poppy.

FIG. 9.—PISTIL FORMS (magnified).

(From *The Vegetable World.*)

more, likely many, tiny pale green bodies, destined to become seeds if all goes well.

The pistil is tipped with a little gummy knob or glutinous point. This organ, the stigma, is designed to receive grains of pollen on its surface,

and is sticky that they may adhere. If, by ill-fortune, no pollen-grains reach the spot nature has so skilfully prepared for them, the immature seeds in the pistil will die when the flower withers, "cut off," in the words of a doleful, country-newspaper poet, "in the morning of their early days."

But directly the desired grain of life-giving dust settles on the waiting stigma, it begins to grow there in a wonderful way. From its interior comes a slender tube which grows downward through the pistil, as a vigorous rootlet sinks into loose soil. At length it reaches and pierces one of the baby seeds in the base of the pistil. Besides the tiny tube, the pollen-grain contains a wee drop of fluid. This now flows down into the infant seed and imparts to it the mysterious gift of life. The seed is then, in technical language, "fertilized."

When a plant grows in rich soil and in a warm atmosphere, its stamens and pistils have a tendency to turn into petals. In the heart of a garden rose or double geranium we can see this transformation actually taking place. On the outside of the flower is a row of symmetrical petals, those which nature, unassisted, produced. Those just within are less perfect in form; and

as we approach the centre of the flower they grow more and more shapeless, till at the head we find a little cluster of nondescript organs in actual transition from stamens to petals.

Some garden flowers have all their central organs converted into petals. These never set a single seed, but are propagated entirely by cuttings. A slip cut from a double rose or geranium will tend to produce flowers like those of the plant from which it was taken. By subjecting the cutting again to the influences of rich soil and warmth, this tendency will be fostered. Thus, in the course of generations, the florist produces double flowers and the hundred-leaved and cabbage roses, which have a countless mass of petals, instead of the five of the wild rose, but scarcely any stamens or pistils whatever.

New petals can also be developed—one might almost say created—by diligent culture. A wild pink has five petals, ten stamens, and two pistils almost grown together. The garden carnation was originally formed upon the same plan, and could therefore possess but seventeen petals, even were all the central organs changed by cultivation. The pistil, however, retains its natural form, and there are usually two or three distorted stamens,

which remain as nature made them, in spite of adverse circumstances. Besides these, we find a great mass of white or deep red flower-leaves. The delicate calyx, which was made to inclose five petals, not such a number as this, is unequal to the occasion, and often splits open all down one side.

Till within recent years, botanists have supposed that the germ in the forming seed of a flower received its quickening influences from pollen shed by the stamens of that self-same flower. Later discoveries, however, have proved that the pollen which develops the ovules is, in most cases, brought from some other blossom, and even in many instances from some other plant. The fertilizing dust is wafted to the stigma in two ways —by the wind and by insects. A cursory glance at a flower will tell us in which way its fetching and carrying are done. Those accustomed to depend upon the wind—those which are, in botanical phrase, "wind-fertilized"—have no need to attract the attention of passing insects. Hence they are scentless, and have small greenish petals or none. Of this sort are the flowers of rushes sedges, and grasses, and those of many trees (Fig. 10). Some—for instance, the blossoms of the

pine-tree and those of the arbor vitæ—are so inconspicuous that they can scarcely be detected even by diligent search. Wind-fertilized flowers produce no honey.

On the other hand, those flowers which are in the habit of having pollen brought to them by insects lure their bright-winged visitors by perfume or by a display of splendid or dainty petals. All those blossoms which catch the eye, those which brighten the garden or "paint the meadows with delight," are insect-fertilized. Their sweet scents and conspicuous corollas may be regarded as advertisements to catch the attention of the passing insect and to notify him of the presence of the honey which he is seeking. "Where free lunches are provided," quaintly observes Professor Gray, "some advan-

FIG. 10. — BLOSSOM OF THE WHEAT. (From *The Vegetable World.*

tage is generally expected from the treat." The blossom gives up its sweets in order that it may receive the fertilizing pollen upon its stigma, and so may be enabled to set its seed.

To change the simile, the insect is, in her humble way, a wage-worker, and receives her pay for fetching and carrying pollen in the drops of honey which she gathers. The bumblebee, going with business-like directness from clover-head to clover-head, gets her velvety body sprinkled thickly with golden dust. In extracting the sweetness which lies deep down in the long purple tubes she crawls all over the blossom-head, and some of the pollen which has clung to her breast and legs is sure to be left upon the stigmas. She has also brushed against the anthers, and taken a fresh supply of the yellow powder with which she will fly to another clover-head. Thus she pays for the honey which she takes, and she and the flower form a mutual-benefit society. Deprived of her visits, the purple clover would not set a single seed, for the blossom tubes are too deep for the little honey-bee. Her proboscis is too short to reach the spot where the honey is stored, and she wisely neglects the purple clover for its white cousin and for other flowers which

will better serve her turn. In New Zealand, where the bumblebee is not a resident, the purple clover has to be freshly sown each year with seed brought from England.

Huxley has proved that there is a direct ratio between the quantity of purple clover in any given section of country and the number of old maids. The demonstration is as follows: Old maids keep cats; cats are enemies to the field-mouse; these mice in turn are the foes of the bumblebee, for they devour the little store of honey which that thrifty insect lays by for its winter sustenance. Bumblebees are the pollen-carriers of the purple clover. Hence the more old maids there are in a region, the more plentifully it is stocked with cats; the fewer, therefore, are the field-mice; the greater is the number of the bumblebees, and the more abundant, in consequence, is the crop of red clover.

Without cross-fertilization, that is to say, unless the stigmas are dusted with pollen brought from the anthers of some other flower, the ovules of many plants will not mature at all. If a branch of mountain laurel is inclosed in gauze, its blossoms will not set a single seed. This is, no doubt, a reason why even the single flowers

raised in greenhouses so seldom perfect their fruit. Many of them are exotics, accustomed to be visited and fertilized by tropical insects. The calla lily in its wild state probably has its fetching and carrying done by some South American marsh-fly.

There are some flowers sufficient to themselves —accustomed to mature their seed by the aid of pollen received from their own stamens. In a few sorts, the anthers open and the pistil is fertilized before the bud expands. Generally, however, even in cases where the ovule can be quickened by pollen from the self-same flower, better, stronger, and more numerous seeds will be formed if the pistil can get pollen from another blossom, or, better still, from another plant of the same sort.

It seems at first as if the result of insect visits would be to "mix things up" hopelessly. One would think that poppy-pollen would be carried to the rose, rose-pollen to the buttercup, and buttercup-pollen to the daisy, in "confusion worse confounded." This is guarded against in a variety of ways. The stigma is seldom affected by pollen from a flower of widely differing species. Rose-pollen on the lily and poppy-pollen on the butter-

cup produce no vitalizing effect. So wonderfully is the plant organized that in most cases only pollen from a separate flower of the same species can quicken the ovules into life. Plants closely allied, two species of violet, for instance, will occasionally cross, and the resulting hybrid forms are sometimes sorely puzzling to the botanist. Such seldom produce seed, and thus the confusion of types is checked at the outset.

Moreover the insect has his preferences and partialities. The butterfly flitting from flower to flower has passed into a proverb for fickleness, but, though he soon quits, and forgets the individual, he is not unfaithful to the family. The rose-beetle is indifferent to all save the queen of flowers, and many moths taste no other nectar save that distilled by one chosen species of blossom. Wasps bestow their attentions on one or two varieties and ignore all the rest. The bee has many flower friends, but she is particularly careful not to mix her drinks. In a meadow she goes perseveringly from clover-head to clover-head, with daisies, buttercups, and wild carrot blooming all about her.

The flowers, it seems, have their preferences also, for each caters to the tastes and adapts itself

to the needs of its own insect friend. Some have donned purple robes to gratify the bee, which has, as Sir John Lubbock has shown, a royal taste in colors. The busy little insect is fond of magenta, and has a decided preference for blue, but never can resist the purple, which is as dear to her as it was to Julius Cæsar. The flowers which wear this imperial hue are generally rich in honey, and their sweets are kept for their friend, the bee, at the bottom of a cup so deep that smaller insects cannot reach and rifle it.

Some deeper-throated flowers still are reserving their nectar for the butterflies. Some blossoms open at twilight, and they are visited and fertilized by night-moths. These nocturnal flowers are usually very fragrant, and the sweetness which they shed abroad is at once a lure and a guide to their desired insect guests. They are always white or light yellow, and the glimmering of their pale corollas helps the moth to find the blossom which she seeks amid the thronging shadows.

Some tropical flowers have tubes so long and narrow that no moth or butterfly can reach into the depths where the nectar is stored. The sweets in such exceedingly deep and slender cups are reserved for the humming-birds. If we examine a

collection of these winged jewels, we shall see that the species differ greatly from one another in the length and form of the bill; the bills of some are straight, or very nearly so, those of others curve slightly, and those of others still are very strongly curved. Each, during its short glad life, feeds mainly on insects and nectar from one sort of tropical flower, and its bill has just the curve which enables it to reach with the utmost ease into the bottom of the flower-tube. But just in proportion as a flower is fitted to the requirements of its own friends it is unfitted for miscellaneous society. Its tube, exactly long enough for its chosen visitor, is too deep for some insects and too shallow for others.

The flower friends of the night-moths begin to receive company about the time when the butterflies are going to bed. The butterfly and bee blossoms unfold at dawn, when the moths are seeking retirement in secluded corners. The flower comes just at the season when its own winged friends are numerous, and it thus avoids many insects whose attentions it does not care to accept. So Nature takes care that the flower's messages are not carried to the wrong address.

The study of the interdependence of the flower and its winged friend is as yet a comparatively

unexplored realm of science. Enough only is known to stimulate curiosity and to show how vast is the field for further discovery. Old philosophy tried to account for everything under heaven on the supposition that all was created for the use, pleasure, or discipline of mankind. The deep and patient nature-study of this generation has taught us greater humility. Nature has myriad children which live and rejoice, and suffer and die, utterly without regard to sovereign man; yet each is provided for in ways suited to its tiny desires and needs.

A spring walk by a brookside may be spoiled for us by the odor of skunk-cabbage, abhorred of our outraged olfactories. No doubt, however, it is pleasing to the little flies, which hover over the offending vegetable, and probably act as its pollen-carriers. A tropical flower attracts to it the insects by which it is fertilized by exhaling an odor like that of putrid meat.

The cases, however, in which flower-scents are unpleasant to us are few. Most blossoms attract their winged visitors by tints and odors in which we, as well as bee and butterfly, delight. With the bee we love the deep blue of the sage-blossom and enjoy the scent of clover. The night-blooming cereus, which furnishes the perfumer with his

choicest extract, is also the moth's delight. In almost all cases the colors and scents which give pleasure to the insect's tiny nerves give similar, but probably far keener, pleasure to ours.

The question of the development of the senses in animals affords the naturalist wide field for speculation. Some insects, as the botanist knows, possess a sense of smell far keener than ours. "Our world," says Grant Allen, "is a world of sights and sounds. The ant's world is one of sounds and smells."

The bee hovering about a cluster of blossoms pauses an instant over each before plunging into it in search of nectar. She seems to perceive, besides the fragrance which we can enjoy with her, an odor which tells her whether the nectar is still in the tube of the flower, or whether it has been extracted by a previous comer.

The night-moth distinguishes the odor of the nocturnal flower even when mingled with many other scents, and perhaps borne a long distance on the breeze. She also seems, like the owl and the bat, to distinguish objects where all would be blackness to our eyes; for on moonless nights, and in shadowy thickets and groves, she is able to thread her way to the night-blooming flower she seeks.

III.

BUDS.

FIG. 11.—EXPANDING BUDS OF THE TULIP-TREE, BIRCH, AND ALMOND.
(From *The Vegetable World.*)

MOTHER NATURE'S SPRING PARCELS.

THE few sunny days which March vouchsafes us, at once a foretaste and a pledge of the many which are to come, soon begin to quicken the bare boughs, which all winter have looked so lifeless. The golden-green willow twigs and rose-purple blackberry branches show by their brightening tints that they have not been dead, but sleeping,

and buds have grown large enough to appear clearly silhouetted against the soft grays of spring clouds.

The most ultra-expensive French maid never packed her mistress's finery with half the skill which Mother Nature has shown in the folding of baby blossom and tender leaf. The Arabian Nights wonder of a gigantic genius rising out of a little jar is equalled, if not excelled, by the budding hedgerows every spring. Some of these lilac-buds, as small as the tip of a woman's little finger, contain a snugly-folded branch with all its leaves, and from others, no larger, will soon burst forth the twin spires of purple bloom. The sticky buds which tip the boughs of the horse-chestnut will open to let out into the sun several spreading compound leaves surrounding a pyramid of flowers.

Sometimes Mother Nature does up leaves and blossoms in the same parcel, sometimes separately. Flowers will issue from some buds, leaves from others, and from yet others both leaves and flowers. The stems on which these buds rest are stored with rich nourishment which was laid away last summer, in the wood and bark. The lilacs, for instance, put forth their blossoms last May, and

by August their clusters of seeds were completely formed, fully grown, and only needing for their perfection what sun and frost could accomplish. The prudent plants then turned their attention toward providing for the wants of the future. The leaves drank in the late summer sunshine, the eager roots soaked up the late summer rain, and the nourishment thus gathered, no longer needed to support a showy and expensive family of blossoms, could be stored away beneath the bark, for next year's buds.

"It is owing to this forehanded way of hoarding nourishment," says Professor Gray, "that plants are able to shoot forth so vigorously at the first warm breath of spring. The food which now nourishes these swelling buds, expanding leaves, and suddenly awakened flowers was collected and stored last summer. Everything was prepared, and even formed, beforehand. The short joints of the stem have only to lengthen and separate the leaves from each other, the leaves have only to unfold and grow."

Not only is provision made for the time when the awakening bud will need food to sustain its growth. In its winter sleep it is carefully protected from sudden chills and from rotting damp.

When the buds are quite small, they are often sunk in the bark, as are those of the sumach; or as in the honey-locust, partly buried in the wood till they begin to grow. So long as Jack Frost is abroad the locust branches "play dead" and do not suffer a bud to appear. The baby leaves are kept safely hidden away in those humps or knobs of wood and bark, from which the thorns appear to spring.

The young hickory and lilac leaves are protected by a water-proof and down-lined covering, formed of many overlapping scales, or, to speak strictly, imperfect leaves. These scales are often coated on the outside with a sort of varnish which keeps out wet. The buds of the horse-chestnut are so thickly varnished over as to be quite sticky to the touch, and they shed water like—a rubber overcoat. Indeed, we may say that the baby horse-chestnut leaves wear a fur-lined water-proof, for the bud-scales are thickly clothed inside with down or wool. This will not really keep out the cold of winter, which will of course penetrate the bud in time; but it protects the tender leaves within from sudden changes from cold to warmth, or from mildness to frost.

Scaly buds are borne on trees and shrubs native

to northern climates. Buds of tropical plants, which need no protection from frost, are naked.

Winter boughs are studded with countless buds —one for each of the many leaves which fell the preceding autumn. If every one of these were to live up to its possibilities, and expand into a cluster of foliage in the spring, the trees would have much ado to bear up under the weight of their adornment. But many of the buds do not grow. They do not necessarily die, but they remain for some time, perhaps for years, in a dormant state.

When foliage has been stripped off by insects, or shrivelled up by forest fire, a growth of tender leaves will presently appear, partially covering the poor denuded boughs. Mother Nature seems to have stretched a point and given a green robe at midsummer, though the ladies of the wood generally receive new dresses in spring and are expected to "make them do" all summer. A short time ago, the tree, like Cinderella or Miss McFlimsey, had nothing to wear. Now she stands in glistening green robes, and dances with her beautiful companions to the music of the breeze. Buds, formed perhaps several seasons ago, and till now kept in abeyance by the lustiness of their fellows,

have at last got a long-waited-for chance to grow.

The spring landscape recalls a beautiful meaning which the German philosopher, Max Müller, has found in the fairy story of the "Sleeping Beauty in the Wood." The earth in winter, lying still and apparently lifeless under her covering of snow, is the sleeping princess. The prince is the sun, strong and joyous; and the first warm spring sunshine, which makes the bud swell and the blossom blow, and arouses all Nature to life and gladness—this is the prince's kiss.

IV.

HIDDEN TREASURIES.

IN the first mild days of spring a casual robin generally comes to tell the dwellers in my garden that the sun and the breeze are on their way back to us from the South.

The trees pay no heed to his news, having learned by much hard experience that one robin does not make a spring, and that discretion is, after all, the better part of valor.

But the flowers are more buoyant, and a lovely company, hearing the red-vested herald's tidings, venture betimes out of their underground houses to meet and greet the spring. There are the jonquil and narcissus, and the brave-hearted

> ". . . Daffodils,
> That come before the swallow dares, and take
> The winds of March with beauty.

This cheerful sisterhood are able to don their festal array thus early because they practise virtues which we seldom associate with the blossoms of the field—prudence, industry, and economy.

After the flower faded last spring the daffodil began to provide for the needs of the future. The leaves drank in the sunshine and dew of latter spring and of summer; the roots gathered food from the soil, and the nourishment thus collected was hoarded up for future contingencies. By the fall there was a rich store of starches and gums securely packed away underground in a solid bulb. The bulb was covered by overlapping horny scales, a protection against cold and rotting damp. At its very heart, closely folded and snugly hidden away from frost, were the leaves which have ventured above ground lately in answer to the persuasive voice of the robin.

The food in the bulb has supported the daffodil all the time it was forming its flowers, and will afford it a comfortable living till the blossom withers and the seed is formed. By that time the hoard will be exhausted, and the bulb which used to be so firm and white will have dwindled to a mere dry bunch of papery scales. However, the roots will then be long and strong, the leaves will be able and ready to work, and, all together, can collect enough not only to supply all present needs, but to lay by another capital for next spring's business.

My daffodil blossoms are very young, and they must be guileless or they would neither have trusted anything so fickle as April sunshine, nor yielded such ready credence to the traveller's tales of one possibly vagabond robin. It is consoling to think that, after all, they are the children of roots which have seen several seasons, and are fully alive to the advantages of having something laid by—perhaps literally *in the bank.*

The snowdrop, the crocus, the narcissus, the hyacinth, and the jonquil were equally thrifty and industrious last summer, and they, too, profit by their prudence this spring. When they began to prepare their pretty new dresses, they found themselves already in possession of plenty of material ready for use (Fig. 12). So the dainty costumes are fashioned betimes, and the wearers can steal a march upon less thrifty flowers, and secure the first attentions of the bees. The gladiolus has also laid by a hoard of rich gums and starches, and these will sustain the plant, while it bends all its energies upon decorative work. The savings of the gladiolus will go, partly to build up a spire of flowers, and partly to support the plant while it bends all its energies upon decorative work.

The iris, the tulip, and most lilies owe their

splendors to the industry and economy of last year's leaves and roots. The pond-lily root hides

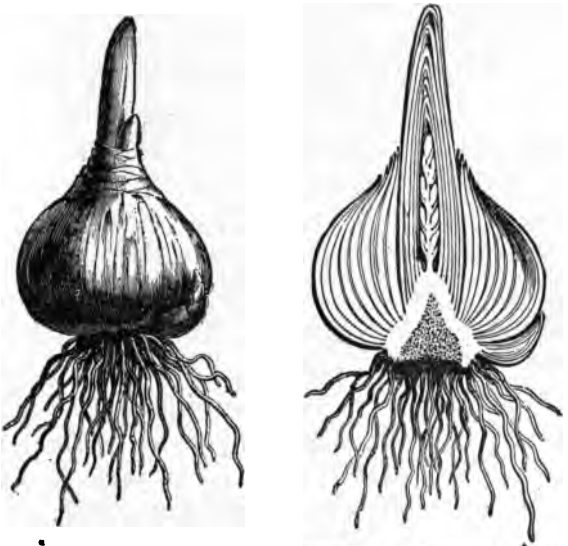


FIG. 12.—*a*, BULB OF THE HYACINTH. *b*, VERTICAL SECTION OF SAME.
(From *The Vegetable World.*)

materials down in the depths, which, at midsummer, are fashioned into white robes for her beautiful daughters.

The little anemones and spring beauties of the woods, small though they are, understand good management, and they have also made provision

for the needs of this spring's flowers. During early spring these bulbous plants are all prodigals, bent only on spending their capital and making a show in the world. In latter spring, when the flowers have faded, and when the precious seed is set, they go to the other extreme, and become misers, living only for their hoard.

The carrot, parsnip, radish, beet, turnip, and oyster-plant, and the odoriferous and prosaic onion seldom get a chance to show what they can do in the way of decoration. During the first summer of their life these provident vegetables bend all their energies to the gathering together of a store of nutriment, which is stowed away underground for future use. If the carrot were left undisturbed till a second summer, its red, sweet flesh would then be transformed into several broad flat clusters of delicate white blossoms. The turnip, if it had been let alone, would have made itself fine this summer with a number of pale blue flowers, in the form of the Greek cross. Even the onion would have surprised us with the beauty of its delicately-tinted blossoms, for, though we may think meanly of this plebeian vegetable, it is a member of a most ancient and honorable family, being a cousin to the famous Golden Lilies of

France, and also to those Eastern lilies which are arrayed in more than kingly splendor. But the vegetables proposed and the gardener and the cook disposed. The savings of gum and starch which they had intended to transform into flowers were changed into human flesh, blood, bone, and nerve. Man, who robs all creation, stole and ate their hoard, as he steals and eats the summer harvest of the honey-bees.

The wild carrots which sleep under the snow all winter, with no one to molest them, are going to appear in holiday dress this summer as a reward for their hard work and economy last year. But the fate of the garden carrots shows that habits of thrift cannot always ward off misfortune. However, habits of thrift enable the daffodil to come forth again in beauty and vigor from the spot where blossom and foliage faded last year, as if the plant arose from its grave. The Greeks called it "asphodel," or "flower of life," and perhaps saw in it a symbol of immortality. This joyous-looking flower grows wild in the woods and thickets of northern Europe, and as Shakespeare mentions it, it must have been cultivated in England three centuries ago.

Its cousin, the graceful narcissus, is the subject

of the old Greek tale of Narcissus, the youth, son of a river-god and a nymph, of exceeding beauty and very vain. Since there were no mirrors in those long-ago days he was always leaning over the brink of some calm river or pool admiring his reflection in the water. Nemesis, to punish his vanity and coldheartedness, caused him to fall desperately in love with his own mirrored form. He died of this love-sickness, and from the spot where he perished sprang this flower, which in its natural state grows along the margin of calm waters, and leans downward, as if it were gazing on its own reflected face.

V.

WILLOW-PUSSIES AND ALDER-TASSELS.

ABOUT the time the robins and bluebirds are singing the opening strains of summer's great concert, the red maples burst into bloom. Then the birch puts forth a few tremulous tassels in token of rejoicing that tyrant Jack Frost is dethroned at last; and in moist sheltered meadows alders flower and the downy willow-pussies appear.

The floral efforts of the trees attract little notice from an unappreciative public. All trees bear flowers, but they are often green and inconspicuous. Those of most sorts appear in early spring when we are looking for the bursting of the leaf-buds, and they are apt to be mistaken for half-unfolded leaves. The red-maple flowers, however, attract notice by their rich color and lavish abundance. "Pussy-willows" are well known to every country child, and a stroller by the brook-sides in early spring could scarcely fail to observe the blossoms of the alder and the birch, conspicuous in the general colorlessness of the thickets.

If we gather a branch of red maple and examine the garnet-colored blossoms closely, we shall find that what looked at first like single flowers are, in reality, little floral communities. Each is a group of four or five very small blossoms, crowded closely together and walled about with a ring of red scales. Some of these minute flowers have many long slender yellow stamens, but no pistils. In the centres of others we find a two-forked red pistil, but no stamens. Others still are fully equipped and contain both stamens and pistils. The flowers with stamens only must give all their pollen away—easy generosity, for they have no use for it at home. They will intrust it to some of the bees and other insects which are already busy among the branches, doing their own errands and those of the flowers too. The flowers with pistils only will have to set their seed by aid of pollen brought from another blossom. Such seed is apt to be large and strong, and the young plants which spring from it begin life with fine constitutions.

The flowers which are doubly endowed, having both stamens and pistils, might be sufficient to themselves, one would think, asking no favors from sister-blossoms or from insects, but they greatly prefer imported pollen to that of home

manufacture. They will send away their own pollen by some winged messenger, and the pistil will get little or none of it. But the pistil's wants will be supplied by gold-dust brought by zephyr or insect from another flower, or even perhaps from another tree. If these flowers are slighted by bees and breezes, the pollen which cannot be bestowed elsewhere may be used up at home. The stamens will give it to the pistil, and the pistil will have to do the best it can with the goods the gods provide. It may manage to form seed and prove its independence to the bees. However, the young plants which come from those seeds will be but weaklings, and in the struggle for life, which is constant and pitiless in both the animal and the vegetable world, they will very probably get the worst of it.

For every country meadow is in sober truth a battle-field. Every species of plant "wants the earth," and might soon get it were it not for the active competition of other species. The green growing things about us are fighting for territory, and their law is that of savage communities all the world over:

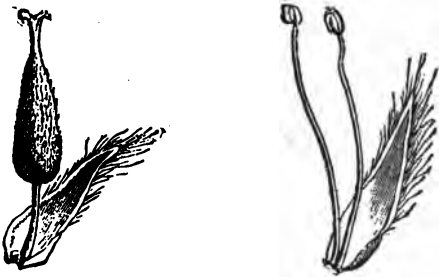
> That they should take who have the power,
> And they should keep who can.

It is the stern law of the survival of the fittest laid alike upon the lower organism and the higher.

The law by which the offspring resembles the parent is also laid upon all created things. If the little maple is child of a tree which bore stamens and pistils in separate flowers, it will arrange most of its blossoms on the parental plan. So each successive generation of maples is more disposed to bear what botanists call "divided flowers." Even now comparatively few of the flowers are, in botanic language, "perfect" (containing both stamens and pistils). The maple-trees which shall shelter the coming race will probably bear no perfect flowers at all; the production of such blossoms will be a lost art to the maple family.

In a moist corner of my garden two swamp-willows shake out their pale tassels or "pussies" in the early sunshine (Fig. 13). Those on one are silvery green, and these are composed of a number of pistils, each partly covered by a fringed scale. The tassels on the other willow bush are yellow, and these consist of countless clusters of gold-tipped stamens, each cluster overlapped by a scale. These scales have been making themselves very useful earlier in the season. They have now be-

a. The Silvery Tassel. *b.* The Golden Tassel.



c. A Pistil with its Covering Scale. *d.* Stamens and Fringed Scale.

FIG. 13.—WILLOW FLOWERS.
(From *The Vegetable World.*)

come separated by the lengthening of the tassel, but during the winter they were crowded closely

together, and their overlapping furry fringes made a soft, warm covering for the young stamens and pistils.

Though the willow blossoms make little show in the world, they succeed in attracting the notice due to modest merit. Their delicate prettiness, their faint perfume, and the hope of honey have already attracted a number of bees. These, after getting powdered with the pollen from the golden tassels, will fly with the precious dust to the silver-green ones, and thus enable the willow to set its seed.

The stamens of the birch are huddled together in loose clusters five or six inches long, and as soft as bits of wool chenille. The pistils are also closely clustered, and, small as they are, we can readily find them, for they are as red as the richest coral.

Long tassels of pale gold dangle from the alder bushes. These are dense clusters of stamens set closely together. The alder pistils, each protected by a scale, grow close together in a head, like a pretty tiny cone. The alder and the birch avoid much inconvenience by their thrifty habit of bringing out their blossoms betimes, before the leaves unfold. Foliage would be sadly in the way

of pollen, as it blew from branch to branch, or from tree to tree, and would interfere with its access to the pistils. The pistil in both these trees is forked and hairy, so that it may readily catch the life-giving dust as it flies by on spring breezes. When stamens and pistils grow in separate blossoms on the same tree we generally find that the stamen-bearing flowers are more abundant on the topmost boughs, and that the pistils are borne nearer to the ground. The pollen as it blows will drop a little, and so, flying and falling, it finds its way to the pistil, set low on purpose to catch it.

The red-maple blossoms adopt the same plan, though they mainly depend upon early roving flies and bees for their pollen-carrying.

On every red-maple tree there are some blossoms which a botanist would call "perfect," because they have both stamens and pistils. But the great majority of the flowers are specialists, some producing stamens only, while others put forth pistils only. The trees are endeavoring to be specialists too, for some bear staminate flowers almost exclusively, while on others all the blossoms are either pistillate or perfect.

But here and there is a "general utility" tree,

bearing the three sorts of flower simultaneously. We can readily distinguish between the staminate and the pistillate maple-blossoms even when they grow high overheard. The pistil-bearing flowers are of a deep coral-red, while the numerous yellow stamens lend a paler hue to the blossoms which produce them. On a tree which bears both sorts we can see great numbers of pale thread-like stamens drooping from the upper boughs, and the ruddier blossoms which grow nearer to the ground hold each a waiting pistil in its heart.

When the bee comes, she makes her rounds as methodically as the postman. She always works from the ground upwards. She visits the lower branches first, and as she has been calling on other maple-flowers already, she comes to the pistil-bearing blossoms well powdered with pollen. As she soars higher, visiting flower after flower, she is lightened of her yellow load, and by the time all the powder is rubbed off her jacket she has scaled the tree to the place where the pollen-bearing flowers are borne. Here she takes on a fresh supply, and when she hums off, well content, to another maple, she carries her load of life-giving powder to the lower branches, where the pistils grow.

So the placing of the blossom on the bough, though it seems a very trifling matter, is not a mere affair of luck and chance. It is controlled by law, which regulates everything in nature, from the setting-on of a midge's wing to the motions of the stars through space.

VI.

A WREATH FOR THE MAY-QUEEN.

HEPATICA, ANEMONES, DANDELIONS, AND VIOLETS.

EACH spring the hapless "poet of spring" receives his annual dose of ridicule. A gainsaying public never tires of contrasting poetic descriptions of bird-songs, sunshine, and "balmy breathings from the South" with prosaic realities of nipping blasts, flying dust, frozen pumps, red noses, and aching fingers and toes. The poor May-queen is portrayed as she appears the day after the festival—discouraged, sneezing, and with throat tied up in red flannel.

We forget that most of the well-known songs of spring are by English singers. They describe the season in England, where it is earlier than in our northern and middle States. We also forget that the "first of May" of the older English poets is in reality about the twelfth of the month; and twelve days at this time of year work a wonderful change in the landscape.

On the other hand, our best-known and best-loved American spring poem was written of chill and bleak New England. Lowell's "June" in the country around Boston describes rather latter May in the neighborhood of New York or Philadelphia, and early May in the vicinity of Norfolk or Cincinnati.

Such local differences render it somewhat difficult for a writer, eminent or otherwise, to treat of the season and its flowers. In each section of country, also, will be found pretty blossoms which are peculiar to the locality.

Many of our late summer and autumn flowers have settled the country from Maine to California. Go where we will in August or September, golden-rod will wave its plumes to us from roadside banks and field borders. Clover, red and white, boneset, mullein, asters, bitter-sweet, the brown and golden daisy, and many other old friends will greet us wherever we may wander. But, as a rule, what is peculiar to the locality appears early, and the student of botany will find his greatest interest among the first flowers of the year.

Those of us who are not students will feel, for different reasons, that of all the children of summer the first-born can least be spared. They are,

it is true, mostly small and pale, and would be effaced beside the rose or among the regal splendors of iris, poppy, geranium, and cardinal-flower. But these gorgeous ladies do not deign to visit us till the world is well warmed, decorated, and perfumed for their reception. They are the "grand toilettes" which come to the ball late, when the musicians are playing and the festivities are in full blast. But the spring flowers have braved stern skies and nipping winds to give us greeting, and to tell us that, in spite of appearances, "winter is over and gone, and the time of the singing of birds has come" indeed. They look appealing, shy, and tender, in their simple dresses, and seem in truth what Herrick quaintly calls the violets, "maiden posies."

When the streams are just leaping in recovered freedom and the robin sings his wooing song, in a wooded hollow sheltered from the north wind we find hepatica, first-begotten of spring. "Youth and age" it might be called, for the opening flowers are in the midst of a clump of leathery leaves wearing autumnal tints of brown and purple. They have weathered the winter, and look decidedly used up after their rough experience but will stay at the post of duty till the plant gets

reinforcements in a new set of leaves which will appear after blossoming-time. The flower-stalk is fuzzy, for the discouragement of ants, which might try to climb up it after pollen or honey. Just under the flower is a green collar which simulates a calyx, but it is "nothing but leaves," out from among which the flower is lifted on a little stalk. The real sepals are petal-like and conspicuous, white or very pale shades of purple, blue, and pink. There are no petals. The family are from Europe, and, like some other immigrants, look so simple that one wonders how they have been able to roam so far.

In damp thickets and under hedge-rows we will find the pretty, shy wood or true anemone (Fig. 14). Three-toothed leaves surround the tender stalk about midway between the root and the single drooping flower. The five—or rarely six—white flower-leaves, flushed and tipped with pink, are called, not petals, but sepals. Many of our first wild flowers are dressed in this economical fashion, with but one row of leaves around the flower.

"Anemone" is from a Greek word which means the wind, and also a spirit or a breath: perhaps because the breath is the life, or because there was

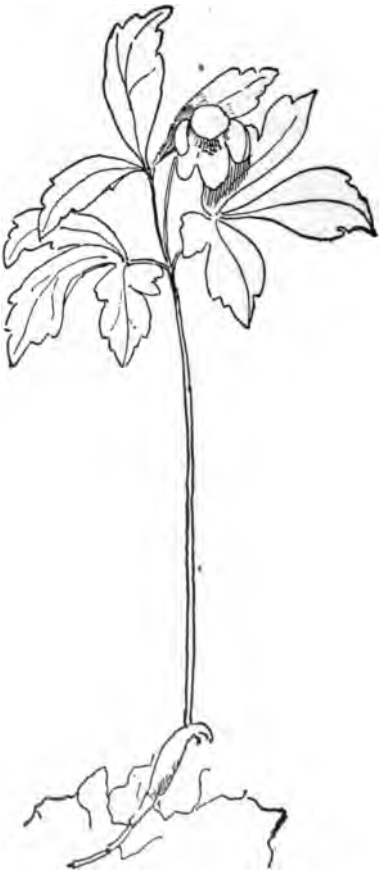


FIG. 14.—WOOD ANEMONE (*Anemone nemerosa*).

the dim thought, even in heathen minds, that the soul of man was given by the breath of God. This pretty woodland thing is called "wind-flower" because it ventures forth while the high winds of early spring are yet abroad; or, according to another explanation, because it is so frail that the rose-tipped sepals fall at a breath.

Its distant cousin, the rue anemone, is much easier to find, and is very common everywhere in open woods, rising from among last autumn's drifted leaves. This child of spring has no bashful tricks of bending its head, but stares at the sky boldly. The flowers are borne at the top of the slender stalk, often in a cluster of three or more, and, like those of true anemone, have conspicuous sepals and no petals. The wood anemone is a good arithmetician, and almost always wears five of these; but rue anemone seems to have forgotten how to count, and decks herself with any number, from four to seventeen.

Those of us who rail at the dandelion as a vulgar weed will not be disenchanted by hearing that its botanic name is *taraxacum*, and the bitter medicine of that name is extracted from its root. Though at the first glance it looks like one flower, it is really an assemblage of from one to two hun-

dred tiny blossoms. In fine weather they stand open, but at night and during rain they close completely, and thus save their pollen and honey from being washed away.

The stigma is shaped like the letter T, and if no insect callers bring it pollen, it after a while twists its two arms in among the stamens and gathers pollen for itself; for these florets, unlike most blossoms, can set seed by their own pollen. The honey, however, is so abundant, and rises so high in the wee blossom, that it is very accessible to insects, no less than ninety-three sorts of which have been known to visit this flower.

The stem of the dandelion is a hollow column, which, as every engineer knows, unites the utmost strength with economy of material. The seeds, when ripe, will be provided with a little silken parachute apiece, and they will thus compel the wind to blow them far and wide.

Truly this *gamin* of the fields is wonderfully fitted to the conditions of its life. All "common weeds" are, and it is for this very reason that they are so common.

The violet is another highly organized flower, fitted to profit to the utmost by visits of insects,

if they come, or to do without them if they stay away.

On the two upper petals of the violet and of the pansy are delicate dark lines, running downward and inward. Such markings occur in many flowers, and are called "honey-guides" because, at the point to which they converge, the hidden sweets of the blossom may be found.

In a flower laid out on a circular pattern, one in which the halves are alike, or nearly so, no matter where a bisecting line is drawn, these honey-guides will be faintly marked or altogether absent. In a rose, a water-lily, or a buttercup we will look for them in vain. An insect, even of the most limited experience, will readily understand that the honey in this case must be called for at the centre of the flower. The more lopsided and irregular the shape of the blossom, the more difficult it is for the insect to find the honey, and the more plainly, therefore, these markings appear. The odd mask-shaped flowers of the snapdragon sort owe their beauty, in great measure, to the bright golden dots or rich dark lines which indicate the whereabouts of their stored sweets. In the common garden geranium, a flower but slightly irregular in form, the honey-guides appear as a very few faint dark

lines on the two upper petals. In the rose-geranium, which is less regular in pattern, they are much darker and more numerous, and in the "Lady Washington" geranium, the most lopsided blossom of the two, they appear as broad velvety stripes on the two upper petals, and add greatly to the beauty of the flower.

Inside the violet is a tuft of soft fine hairs. What are these for?

Bees are welcome visitors, but ants and such small crawlers are not. They would eat the honey, and perhaps the pollen also, but as they are not large or strong enough to shake the stamens, would not carry away any of the golden dust on their bodies. So they might rifle flower after flower without doing any fetching and carrying to pay for the unearned sweets.

So the violet tries to keep the rascals out, and effects this object by the tuft of hairs in its throat. To the ant this is an impenetrable jungle.

The violet is cousin to the pansy: indeed, our gorgeous garden heartsease is developed by culture from the wild pansy-violet of Europe and northern Asia. This lovely stranger has settled in a few places in our Southern and Middle States —a wanderer from the Old World, or, perhaps, a

truant from the garden-plot of some immigrant who loved this gentle reminder of spring at home. This pansy-violet will be known by the size and striking beauty of its velvety petals.

"It is strange," says Darwin, "how long the flowers of heartsease may be watched without seeing one being visited by an insect. During one summer I repeatedly watched some large clumps of heartsease, many times daily for a fortnight, before I saw a bumblebee at work. Then I saw a dark-colored bumblebee visit almost every flower in several clumps; and after a few days almost all the flowers suddenly withered and produced fine capsules. A certain state of the atmosphere seems to be necessary for the secretion of nectar, and as soon as this occurs it is perceived by various insects, I presume by the odor emitted by the flowers, and these are immediately visited."

Besides the showy-colored flowers with which we are all familiar, most sorts of the violet possess minute flowers, which, however, bear abundance of seed. These appear later in the year, and are not only much smaller than the others, but almost without petals. The bright-petalled sort is dependent on the visits of insects, especially of bees. Opening as it does in spring, when there is not

much sunshine to tempt insect rovers abroad, it may not receive a single call, and thus be unable to set its seed. But the plant has not staked all its fortune upon these; better things may be looked for from the second set of flowers, which habitually fertilize themselves, and thus the violet "has a heart [and is prepared] for any fate."

Other spring flowers might find it to their advantage to adopt the same plan. But the violet, as its whole structure shows, can boast a long pedigree, and comes of a family which has had countless generations wherein to become adapted to its way of life. The purple dresses of most of the members of this family are worn on purpose to please their chosen visitor, the bee; for bees are most attracted, as Sir John Lubbock has proved, by blue, purple, and magenta inclining to purple.

The drooping attitude of the blossom is also not without its reason, as this prevents rain and dew from getting in to wash away the pollen and honey. Many cup-shaped flowers have learned the same habit, for the same reason.

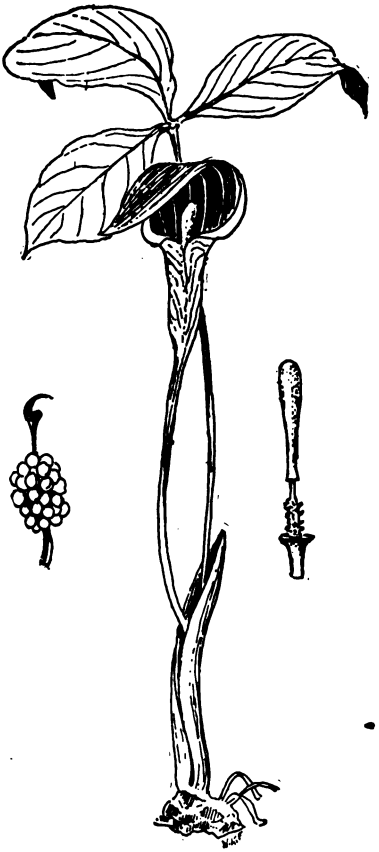
The hyacinth droops, and so do the "lily of the valley," the fuchsia, bluebell, snowdrop, and a score of others. To some old French botanist the droop of the pansy suggested the fancy that the

flower was pondering on its stalk, and so he called it *pensée*,— thought,— whence our word pansy. "There is pansies," says poor mad Ophelia, "that's for thoughts."

VII.

THE CALLA'S POOR RELATIONS.

EVERY country child knows "Jack-in-the-pulpit," and can tell just where it will be found amid the woods in spring. It grows in moist shady ground, and is a poor relation of the stately calla. At the heart of the calla is a tall golden column, and one great cream-white leaf is wrapped about it. "Jack-in-the-pulpit," also called "wild arum" and "Indian turnip" (Fig. 15), is like the calla in form, though quite unlike it in coloring. The central column in wild arum is green, and the large enfolding leaf is also green, sometimes decorated with dark brown stripes. It is curled into a sort of cornucopia, and one corner droops over the column, so that "Jack" has a sounding-board over his head as well as a pulpit to stand in. But in spite of his clerical attitude and surroundings, he is by no means above reproach, and the pulpit, however ecclesiastical in outward seeming, is but a trap for the detention and ultimate destruction of guileless and hapless flies.



Ripened Pistils.

Central Column of a Staminate Flower.

FIG. 15.—INDIAN TURNIP (*Arisæma triphyllum*).

Let us gather an arum and strip off the enfolding leaf, take "Jack" out of his pulpit, in fact, and see just what he is like. He or it is a glossy column, supported by a short and slender stalk. Around the base of the column in this flower there are a number of green pistils growing close together in a broad compact ring. Just above these in one "jack" out of a dozen we find a few round white anthers with no filaments to speak of, but most likely the stamens will be found deep down inside another arum, growing, perhaps, at some distance from the first.

When the anthers ripen and open, they shed a quantity of mealy pollen, which drops to the pulpit floor. But it is utterly useless here, while the green pistils shut up in the other pulpit need it sorely and cannot mature at all without its aid. So the Jack that has the pollen sends some to the Jack that wants it, and a gnat or a marsh-fly is employed as a messenger.

In almost every young staminate arum we find two or three small insects. They are destined to a career of usefulness, though they have come in without the least idea of seeking employment. They have crawled in to look for honey, or because the overarching leaf "spathe," like a green tent,

shelters them from rain and wind, and, once in, they cannot get out. There is no room in the narrow space between the central column and the enfolding leaf for the fly to spread his wings. After he has tried the experiment many times, only to tumble back with a bumped head, he attempts to crawl out. But this is impossible also; the inside of the pulpit is as smooth and slippery as ice. On the most highly polished window-pane there are spots of dirt and roughness invisible to our eyes; a fly catches hold of these with his clawed feet, and thus he can crawl up the perpendicular glass. But he can get no foothold on the shining inner walls of the arum. His gymnastic exercises and fruitless efforts are comical to witness, and remind one of the old English sport, where a leg of mutton was stuck up on top of a smooth pole which had been well greased, and the country lads attempted, each in turn, to clamber up and secure it. The meat was sometimes won, we hear, so the country lad must have occasionally surmounted the pole and all its difficulties, but an entrapped insect never succeeds in clambering out of the arum.

Among the stamens he can find a little honey—dainty fare for a prisoner—and this keeps him

alive for many hours. Meantime the anthers ripen and open, and the imprisoned flies are thickly dusted with pollen. Now they have received what they are to deliver, and they may go. They suddenly find that there is a door in their jail, and it stands ajar so that they can slip out. The edges of the enfolding leaf have separated and curled backwards, leaving an opening at the base of the flower by which a small insect can easily escape, and he goes, carrying a load of pollen with him.

Before this is all rubbed off, the fly seems to conclude that after all it is a good thing to have a roof overhead, and he again seeks shelter in an arum. If this chances to be one containing the undeveloped berries, he is indeed a welcome guest, for he comes bringing the very quickening powder which they need.

But "Jack-in-the-pulpit" is not only a deceiver, but an ingrate. The flies have served his turn, and now he has no further use for them and is indifferent to their fate. They get no honey here, and soon begin to feel the pangs of hunger. They strive to get out in vain. There is no doorway here opening out to sunlight and liberty, but shining prison-walls shut the captive in on every

side. If he is very adroit and persevering, he may manage to squeeze out between the overlapped edges of the spathe. But it is evident that most of the prisoners die of starvation, for among the ripening pistils I generally find several bodies of insects that have perished that a future generation of arums might be born.

There is something terrible in this sacrifice of the sensate to the insensate, of the higher to the lower being. It is consoling to know that floral traps, such as this, are rare in nature.

Most flowers employ insect messengers to carry the life-giving pollen, but most flowers are just and generous in their dealings, and dismiss their little employés in safety, well paid in pretty shows, rich feasts, and sweet odors.

A near relation of our Jack-in-the-pulpit abounds in England and is called by the country children "lords and ladies," or sometimes "cuckoo-pint" because it unrolls its single green and purple streaked leaf about the time the cuckoo's first notes are heard. "O cuckoo-pint," says the glad little birthday-keeper in the first of Jean Ingelow's "Songs of Seven," "toll me the purple clapper that hangs in your clear green bell."

The greenish-white water-arum or marsh-calla,

FIG. 16.—ARROW-ARUM (*Peltandra virginica*).

another humble cousin of the stately Easter lilies, grows in cold bogs in the Northern States, and flowers in June.

The summer rambler may not care to venture into its soggy and oozy abiding-place, but he or she can scarcely fail to find another humble cousin of the stately hot-house callas, the arrow-arum (*Peltandra virginica*). This plant is very common everywhere, in moist fields and around the margins of ponds.

Amid a dense cluster of lustrous arrow-shaped leaves is a blossom bearing a general resemblance to "Jack-in-the-pulpit," but the spathe, or enfolding leaf, is thick, narrow, erect, and pointed at the upper end. After the seed is set the flower-stalk doubles over and grows downward, and this point acts as a sort of auger by which the spathe gradually bores its way into the ground. Then, having served its purpose, it withers away and the seeds ripen in the warm mud, secure from hungry enemies.

VIII.

CHERRY-BLOOM AND COTTONWOOD.

WHATEVER Nature is going to make, she always begins in the same way.

Whether the completed and matured form is that of a bird, insect, reptile, man, fern, beast, or tree, the very beginning is, in every case, the same. Dr. Oliver Wendell Holmes compares creative Nature to a glass-blower, who always commences with a little vesicle or sphere, no matter what he is going to make.

From a single cell originated the great cherry-tree now towering before my window. The tree made its appearance years ago, as a tender seedling.

Before it was a seedling it was a tiny germ, folded and packed away within a cherry-stone. The cherry which contained the stone was the ripened ovary of a cherry-blossom.

When that flower unfolded its petals in the sunshine of a long-vanished spring, there formed, at the top of the ovule, or baby cherry-stone, the tiny

cell whence this great tree originated. If no pollen had reached the stigma of that blossom, the cell would have perished when the flower faded, and this tree would never have existed.

However, the golden dust was brought by an insect, for the conspicuous petals of the cherry-blossoms show that they are insect-fertilized. Directly a speck of pollen adhered to the sticky stigma it began to do its appointed work there (Fig. 17). The microscopic tube from its interior pierced the loose tissue of the pistil, till it reached the cell within the ovule, and broke into the cell-wall.

Then the minute drop of liquid which had been kept in the pollen-grain against this contingency flowed down through the fairy hose into the cell so tiny yet so full of possibilities. The cell at once began to enlarge, dividing and subdividing itself till it became many cells instead of one. After growing for some time in this way, the mass of cells began to take the form of a little plant. As if moulded by fairy fingers from without, instead of by the wonder-working life-principle from within, a little stem and two delicate folded leaves appeared.

The old alchemists sought long and eagerly for

the elixir of life; it was the dream of the middle ages.

The botanist might think to have found the

FIG. 17.—POLLEN-GRAIN EMITTING THE POLLEN-TUBE (magnified).
(From *The Vegetable World.*)

reality, in minute drops, in the golden pollen-grains.

A cherry-blossom has but one pistil and one ovary. This ovary, which ripens into the cherry, contains only one seed, the cherry-stone.

A very few grains of pollen will meet all the blossom's needs—just how few nobody knows.

Botanists believe that more than one pollen-grain is needed for the development of each germ. One authority places the number required by some ovules as high as seven. Even if the little cherry-pistil does its work with the utmost disregard of economy, seven grains of gold will meet all its requirements. But around it stand a ring of stamens, from fifteen to twenty of them, each with a whole pocketful of pollen-grains,—more than seventy times seven. Equally lavish supplies of gold-dust have been furnished to the anthers of other flowers. We are almost inclined to doubt the saying that "Nature never wastes," in view of her prodigality in filling the anthers with pollen. The purpose of this apparent extravagance is to insure enough vitalizing dust for Nature's needs, even after its quantity has been greatly reduced by various mischances.

Much pollen is blown away, or dropped by insects elsewhere than on the stigma, and so wasted; some is eaten by ants and other crawling intruders. Thus we see that the supply of golden dust shed by the stamens of flowers is not so over-abundant as one might at first suppose.

We have seen that when the pistil is fertilized by pollen brought from another blossom, or, better still, from another plant, stronger germs are formed. Some plants, like the oak and the pine, make sure of cross-fertilization by bearing two sets of flowers; some with stamens only, and others with pistils only. Such are called "divided" or "separated" flowers. The blossoms with stamens only are called staminate or sterile; while those with pistils only are called fertile or pistillate (Fig. 18).

The begonias of our green-houses and garden-beds grow in this way: On one branch we find flowers, the delicate shell-like petals of which inclose a cluster of stamens, and no pistils whatever. The pistils will be found in other blossoms, somewhat different in form, growing on other branches of the same plant.

The castor-oil bean also bears two sorts of flowers; one consists merely of a great cluster of stamens, while its companion-blossom, close by, is a group of three-forked and curving pistils. The most familiar plant bearing separated flowers is the Indian corn. Growing sidewise from the stalk of the plant, wrapped in shining leaves, is the pistillate flower, or, in every-day language, the

G. 18.—DIVIDED FLOWERS OF THE OAK AND PINE.
a, *a*, STAMINATE; *b*, *b*, PISTILLATE.
(From *The Vegetable World.*)

young cob. The white grains ranked on its surface are immature ovaries, and connected with each is a very long slender glossy style. These hang out in a cluster from the top of the green sheath, ready to catch any passing breeze, freighted with pollen-grains. They are the familiar "corn-silk." The stamen-bearing flowers grow in a cluster on the top of the plant, and form the "tassel" of the corn.

Both groups of flowers are so inconspicuous that we see at once that tassel and corn-silk are accustomed to employ the wind as their go-between. As the pollen blows it falls somewhat, and were the pistils set higher than the stamens, or even on a level with them, they might never receive the fertilizing grains at all. Thus many of the ovaries might never ripen into grains of corn, and men and animals would suffer for lack of one of the great food-products of the world. But Creative Wisdom has set the stamen-bearing flower above its pistil-bearing mate. The pollen, blowing and falling, reaches the waiting stigma below, and so there is seed for next year's planting, and grain enough besides to feed millions of hungry mouths.

Sometimes the separation of stamen and pistil

is still wider, and they grow not only in separate flowers, but on separate plants. This is the case with aspens and poplars.

The pollen of these trees must often be blown long distances to reach the pistils, and in transit much of it has a chance to get wasted. Hence the stamens must shed enough not only to supply the pistils, but to compensate for all that is blown away by wanton winds or dropped short of its destination by idle ones. The staminate flowers of the silver poplar or "cottonwood" shed such quantities of pollen that, on a breezy spring day, it may be seen blowing from the branches in light clouds.

Insect-fertilized flowers get their pollen-carrying done by shedding abroad perfumes, by offering free lunches of nectar, and by hanging out attractive advertisements in the form of dainty or brilliant petals. Wind-fertilized flowers need be at no such pains, but, on the other hand, must produce great quantities of pollen to compensate for waste. Almost all our native trees bear "divided" flowers, and many of them rely on the wind as their go-between. This is why the blossoms of so many sorts appear in early spring, before the young leaves unfold. Foliage would be seriously

in the way of pollen blowing from branch to branch or from tree to tree.

So if there really were tongues in trees, and if the cherry and the cottonwood could argue on the comparative merits of their different modes of procedure, we should have to acknowledge, as we do about so many other debated points, that "there is much to be said on both sides of the question."

IX.

SPRING'S YOUNGER CHILDREN.

"THE bees," says Grant Allen, "have their calendar." It begins with willow-pussies and crocuses, goes on with wild hyacinths, columbine, apple-blossoms, clover, and thistles, and ends in the imperial splendors of goldenrod and asters. For on the one hand the bees must have a succession of blossoms all the year round (except in midwinter) or they could never get on at all; while on the other hand the flowers themselves need each a time when they can depend upon receiving their fair share in the attention of the insects, or they might never set their seed at all.

The crocus is a bee flower, and by getting her dainty cup ready so betimes she is able to secure the attentions of the insect before they are engrossed by the less enterprising beauties of later spring. The buttercups divide the season between them for their mutual benefit. Before the anemones have shed their delicate sepals, the earlier

sort show their welcome sunny faces. These are the bulbous buttercups, and are first on the field of action just because of the bulb. After these have set their seed, the meadow buttercups put in an appearance, with daisies and red clover, having been busily occupied meantime; first, in forming long and strong roots, and then in collecting raw material for the flowers. Thus the little pollen-carriers which are partial to buttercups have time to bestow due attention upon both. Buttercups are called king-cups or gold-cups by English children; Shakespeare calls them "cuckoo-buds of yellow hue," and tells us that they "do paint the meadows with delight."

Before the bee has time to miss the willow catkins, her friends the violets are here. These are soon followed by her yet dearer friends the wild hyacinths, which in May beautify moist meadows and river banks with great clusters of blue or lilac bells. It is a pity to inflict on them the ugly name of squills. They rise from white bulbs large and well filled with rich gums and starches for the sustenance of the flowers. All this provision was collected and stored last year by the grass-like leaves; and by its aid the hyacinth is able to "steal a march" on less thrifty plants, and bid

for the early attentions of her chosen visitor, the bee.

As in the garden hyacinth, the pretty bells droop; for if they stood erect they would soon resolve themselves into little water-jars, and thus the pollen and honey would be spoilt, and the bee, when she called, would get nothing but disappointment.

The hyacinth has six blue (or purple) flower-leaves, of which three must be calyx and three corolla. But which is which? It is well-nigh impossible to tell, and botanists elude the question by calling the whole circle of blue leaves the "perianth."

For flowers, though they look as if they had nothing to do with a subject so dry as arithmetic, are generally constructed on a regular numerical plan. The hyacinth has six "divisions of the perianth," which shows that its ancestors had three sepals and three petals. It has six, or twice three, stamens, one stuck to each blue flower-leaf, and in the middle a single pistil; but if we cut this pistil across the middle with a sharp penknife, we see at once that it is in reality, or rather it once was, three. The crocus, the trillium, and all the many sorts of lily are organized on the same plan,

and, unlike the dunce of the nursery rhyme, seem to have mastered, for they certainly practise, the rule of three.

Sometimes the parts of the blossom are in quartets: four sepals, four or eight petals, four, eight, or twelve stamens, and a seed-vessel splitting when ripe into four parts. Stone-crop, geranium, "lady sour-grass," and some others are organized on the plan of five. But almost all flowers follow a regular numerical plan, or, where there is irregularity, something in the structure shows that there once was such a plan, though it has been partially abandoned and forgotten.

In the wild hyacinth, the six parts of the flower draw closely together and form a deep cup with a drop of honey glistening at the bottom. This form, like the blue or purple color of the flower, is designed to win the approbation of bees, for in a deep blossom like this a bee can be comfortably sure of a drop of honey for her pains. A smaller insect cannot reach down so far. In the garden hyacinth the union of flower-leaves has gone still further, and they have actually grown all together into a tube.

The trillium, which one finds in rich moist woods, is a sort of distant cousin to the hyacinth,

and both belong to the very large and important lily family. The "tri" in the name of this plant means three; it occurs in tri-ple, tri-dent, and tri-une, and trillium is so called because it faithfully follows the rule of three throughout. Even the green leaves are in a cluster of three on the summit of the stalk, and in their midst is the one large flower, with three sepals, three petals, three stamens, and three pistils. The petals in some sorts of trillium are white; in others, dull dark purple; and in others again, white tinged with pink or green.

The hyacinth belongs to an old branch of the lily family, and must have had many generations wherein to become so wonderfully adapted to the needs of its life. But trillium represents a younger branch; sometimes it forgets how to be a flower at all, and relapses into a mere cluster of leaves. The first flowers which appear on earth, unfolding in the shade of those great pines and tree-ferns which Nature's forces have since made into coal for us, were members of the lily family, and probably resembled this trillium. The old English name for this flower is wake-robin, for flower and bird appear at about the same time.

Another pretty member of the lily family,

erithronium, adder's-tongue, or dog-tooth violet, displays its nodding flowers everywhere in woods and copses. Two smooth, shining leaves, sometimes curiously blotched, sheathe the base of the flower-stalk, and from between them rises one white or yellow drooping blossom, with its curving petals pointed like a dog's tooth.

On rocks, especially in northerly aspects, nods the columbine (Fig. 19), sometimes unkindly called "jacket and breeches." The flower is scarlet outside, yellow within. The sepals are as brilliant as the petals, which are in the form of hollow spurs and point backward like little red tails. At the end of each of these five spurs or long pockets is a drop of nectar. The stamens and pistils grow all together in the midst of the flower, in a little tuft.

When the bee comes for honey, she has to reach down for it into the very ends of the long red pockets. In trying to do so she is apt to alight in the middle of the flower and twist about there, rubbing continually against the tuft of stamens and pistils. In so doing she will get well dusted with pollen with which to fly to another columbine. The honey-pockets are so long that few insects can reach down to the end of them; so the

FIG. 19.—THE COLUMBINE (*Aquilegia canadensis*).

columbine entertains only a small select circle, and the cultivated sorts often bespeak the good offices of the bee by wearing her blue and purple.

Columbine means two doves.

> "O Columbine, open your folded wrapper
> Where two twin turtle-doves dwell,"

says Jean Ingelow in "Songs of Seven." If we pull off from the flower two sepals with the long pocket or petal between them, the three together bear some resemblance to a bird with partly expanded wings. This remarkable fowl, it is true, pokes his wings out before him in a manner never before attempted except by a pasteboard bird on the operatic stage. But fanciful as the resemblance may seem, the Romans saw it ages ago. To them the bird suggested the national eagle, and hence the columbine's botanic name, *aquilegia*, from *aquila*, an eagle.

In the more northern States, in latter spring rocky woods are gay with rosy clusters of wild pinks. Further south, and somewhat earlier, the no less beautiful scarlet pinks appear. These flowers are of the shape which their cousin the garden carnation was before it was changed, not to say deformed, by culture. The English name for

the wild pink is "catch-fly," and whoever picks one will find out why. The flower-stalk just below the flower, and the calyx are covered with gum; and in this unhappy crawlers seeking pollen and honey get clogged and killed. Sixty-two pathetic little corpses were counted by a naturalist on one single stem of a viscid kind of pink.

The stamens of these blossoms ripen first, and protrude from the slender throat, waiting for a chance to intrust their powdered gold to some winged messenger. Having done this, they withdraw into the flower-tube, and then the pistil comes up and spreads two arms abroad to receive a donation of pollen from some insect friend. In this way the pink is certain to set its seed by pollen brought from some other pink; in botanic language it "insures cross-fertilization."

The garden petunia, like the pink, has gummy stems, and many insect prowlers come to grief thereon. A writer in the "Popular Science Monthly" is of opinion that the petunia is not content to merely murder these unfortunates. The little corpses, she says, are actually digested by juices which flow from the plant. In fact they are not only slain but eaten. "About sunset," says this writer, "the petunia breathes forth a

sweet and powerful odor, and at the same time the gum on the stalks becomes more abundant." This is the fateful hour when many little insects are beguiled and ensnared.

This is a dreadful accusation, and it is a wonder that the petunia is able to hold up her head when such aspersions on her character are abroad. It is to be hoped that the pinks, so pretty and merry-looking, only use their insect trap in self-defence, and do not help out their diet of dew and sunshine with food obtained in such a questionable way.

In May and June, flowering laurel, "fresh and fair," spreads over shady hillsides its lovely mingling of white and rose.

The laurel of the swamps beautifies herself with lilac-purple flowers at about the same time, and by latter June has resumed her workaday dress of shining green. This swamp laurel grows only one or two feet high, while "calico-bush," or mountain laurel, will sometimes attain a height of twenty feet.

The flowers of the varieties differ only in size and color, and are all constructed on the same plan. Ten little humps are ranged in a circle around the outside of each pretty bud. When the flower opens and spreads out as it does into the

form of a saucer, we see that on the inside of the corolla the ten humps (as an Irishman might say) are ten hollows or dimples. Ten stamens with long slender stalks surround a yet longer pistil. But these stamens, instead of standing erect as in most flowers, are bent downward and outward, and each has its head fixed into one of the hollows of the corolla.

The inside of the flower looks something like an open umbrella turned upside down. Ten stamens spread out like the ribs, while the pistil stands up in the midst like the handle. Around the base of this pistil the honey is stored, and the bee in extracting it circles about over the corolla, thrusting her proboscis in from every side. Hovering there she is almost certain to jostle successively each stamen so as to dislodge it from the little pocket into which its head is fixed. As if resenting the disturbance, the stamen flies up like a spring-board, suddenly and elastically, and throws at the bee a little shower of pollen. "Then flying to another blossom, the insect brings its pollen-dusted body against the top of the pistil, and revolving around it, as if on a pivot, while it sucks the nectar in the bottom of the flower-cup, liberates the bowed stamens and receives fresh charges of pollen

from that flower while fertilizing it with the pollen of the preceding one. When a cluster of laurel flowers is covered with fine gauze so that insects are excluded, no stamen gets free of itself, and no seed sets." *

Open woods and field borders in latter May and early June are lavishly adorned with the common wild geradium (*Geranium maculatum*). Only botanical analysis shows its relationship to our garden variety. The conspicuous flowers are more than an inch broad, widely opened, and of a rosy purple color. Three or more grow together in a loose branching cluster. The green leaves are broad and beautifully cut, and the seed-vessel is long and pointed like a beak, whence the English name for the plant, "crane's-bill," and the German name, "stork's-beak." This plant can be useful as well as ornamental; for from its roots, rich in tannin, gargles and other medicines are extracted.

In most geraniums the stamens ripen first and have their pollen prepared before the pistil is ready to turn it to account. But their charity does not begin at home, and the welfare of the pistil is not the object in view. The golden dust is to be shed on the fuzzy jacket of some bee,

* Prof. Gray.

which will soon chance by and be lured by the purple so dear to her heart. Then the pistil will mature and spread forth five eager little arms of welcome to winged callers. We have several varieties of wild geranium; some smaller sorts bear in flowers and foliage a strong family likeness to the garden rose-geranium (Fig. 20).

In rich woods we find the little yellow and white dicentra, called, from the odd shape of the blossom, "Dutchman's-breeches." The green leaves of this plant are so finely cut as to look like little ferns. Another variety of dicentra has heart-shaped flowers, white tinged with rose, and breathing a fragrance like that of hyacinths. They dangle all in a row along the under side of a curved stalk five or six inches long, and in general get-up bear a resemblance to those of their more showy relative, our garden "bleeding-heart." In Dutchman's-breeches and in bleeding-heart the stamens are gathered about the pistil in a close-fitting ring, and all are shut up together between the spoon-shaped tips of two odd-looking petals. One would say that such blossoms were purposely arranged to exclude insects and do without them. Yet they produce nectar and are visited by bees. Indeed, if the blossoms are covered with gauze so as to keep away insects, little or no seed is formed.

FIG. 20.—A COMMON VARIETY OF WILD GERANIUM (*Geranium robertianum*).

How wonderfully Nature clears away all litter and ugliness! We know how prolific many little wild creatures are; and because there are not more of them about we must be sure that many die each year. Yet how seldom, on a country walk, one finds a dead bird or squirrel or snake or even a dead beetle. And flowers, when their days of beauty are over, vanish in the same mysterious way. The fruit-blossoms shed their petals, a slow-dropping fragrant snow, but soon the patch beneath the tree is as green as any other part of the meadow. The petals of the rose, the buttercup, and a score of others are wafted away by the breeze. Literally, "the wind passeth over them and they are gone."

How few flowers, dying, leave—so to speak—a dead body. The iris withdraws into its green sheath like a bud. The water-lily after a day or two of glory goes back into the cool depths whence it arose. Even the leaves which rustle around our feet as we seek spring flowers are but few compared with the millions which fell last autumn. Where are the rest?

Nature is called a kind mother, a good economist, a careful provider; we must acknowledge that she is also a marvel of tidiness.

X.

FIELD-DAISIES.

The daisies gay
The livelong day
Are gathered here together,
To play in the light,
To sleep in the night,
To abide through the sullen weather.
—*Old Rhyme.*

THE fields so lately white with snow grow white once more with daisies which dance and swing in the south wind by myriads and myriads. Their joyous antics are regarded with cold disfavor by the farmers, who speak of the intruders in the singular number and in a dissatisfied mood as "that pesky" or even "that durned white weed."

The little pink-tipped garden-daisy, which we cultivate with such care, is considered an interloper when it shows its bright face on the trim lawns around English country-seats, and its boldness is punished—as high treason was in the good old days—by decapitation. The gardener acts the part of executioner, and cuts off the poor, pretty

head with the lawn-mower—the guillotine of the flowers.

Yet, though American farmers and English gardeners have but a poor opinion of the daisy, and though there are many flowers in summer's garland more gorgeous, delicate, or sweet, this is the pet of the poets. Chaucer quaintly says :

> "Of all the flowers in the mede,
> Than love I most these flowers white and rede,
> Soch that men callen daisies in our toun."

Shakespeare speaks of them lovingly, and puts them into the hands of poor Ophelia. Wordsworth and Burns write beautifully to them and of them, and Goethe's Margaret is immortalized in poetry and in art as she picks the last white leaf off the daisy with the triumphant words, "He loves me!"

Even the flower's name is a poetic thought, for the day's eye is the sun. The English folk who gave the name centuries ago saw in the flower a tiny copy of the sun at which it gazes. There was the golden disk, and, shooting out from it in every direction, the white and flashing rays.

The sunflower owes its name to a like comparison. The legend that the flower turns towards the sun was invented in later times, to account for

the name, and like many other pretty stories, it is not true.

Far-fetched as the idea may seem in these prosaic days, a similar thought occurred to the early Scandinavians. Balder was the Norse god of the summer. To these Northern people, accustomed to endure the rigors of extreme cold and the desolation wrought by frost for the greater part of the year, the brief summer was very sweet. Its coming was longed for, and its fading away lamented. The beloved Balder was the best and most beautiful of all the gods, and the very embodiment of gladness. And to a flower which is first cousin to the daisy, and like it in shape and color, they gave the name of Balder's brow; the shining centre was the eye of Balder, and the outshooting white rays the light which streamed from it.

This fancifully named flower is distributed quite generally through the northern United States, and grows abundantly along sandy roadsides (Fig. 21). The foliage is finely cut, and in general appearance the plant resembles the garden feverfew. It exhales a pungent odor like that of the hothouse daisy.

It is convenient to speak of the daisy as one flower, but in reality it is a floral community.

FIG. 21.—DAISIES.

The yellow centre is an assemblage of hundreds of little trumpet-shaped flowers set as close together as possible. Those on the outside of the disk open first; those near the centre, in early summer are still tightly folded little greenish buds. In a ring around the disk we see what botanists term the "ray-flowers" and what non-botanists call the "white leaves" of the daisy. These, too, are distinct flowers, having a pistil apiece, but no stamens, and with their large white corollas split open all down one side. Indeed, they look as if their "clothes were almost torn off them."

If we examine one of the central florets and look into its little yellow throat, we see that it contains what looks like a second bud still closed. Are there a series of corollas one inside another like Chinese boxes? But what looks like the top of an inner bud is really a ring of stamens, with their heads all joined together so as to form a sort of lid shutting the pistil in. Under this lid, as we find by investigating with a pin, is a quantity of pollen, shed from the lower surfaces of the anthers.

The stamens, like protectionists, seem to have literally laid their heads together to keep the pistil in restraint, and to prevent it from using

any pollen except what is made at home. But the pistil wants sunshine and liberty, and stretches itself in its little golden prison, pushing the mass of pollen up before it, till the prison-roof bursts. Then out springs the pistil, driving the pollen before it in a little cloud. If a fly has alighted close by, or if one of those flat-pattern crawlers, of which daisies are, unhappily, full, chances to be near, he receives a liberal sprinkling. With this unexpected and rather overwhelming donation he creeps or flies to another floret, or, better still, to another plant.

The pistil has two little arms, which are at first pressed close together and raised upright. Each terminates in a brush of hairs. These, in coming up the tube formed by the stamens, sweep out before them every grain of pollen, as a chimney-sweep's broom clears soot out of a chimney. This clearance effected, the arms of the pistil separate and take a horizontal position, like the cross-pieces of the letter T. They are now waiting for a donation of pollen, and the upper sides of the arms are sticky, on purpose to catch and hold it. Till now these gummy surfaces have been pressed together so closely that not a grain could get in between them (Fig. 22). And thus the daisy

floret makes sure of setting its little seed by imported pollen only. The "ray-flowers," or white outer florets, have no brushes of hairs, for they have no stamens; consequently there is no pollen to be swept out, and a brush would be useless.

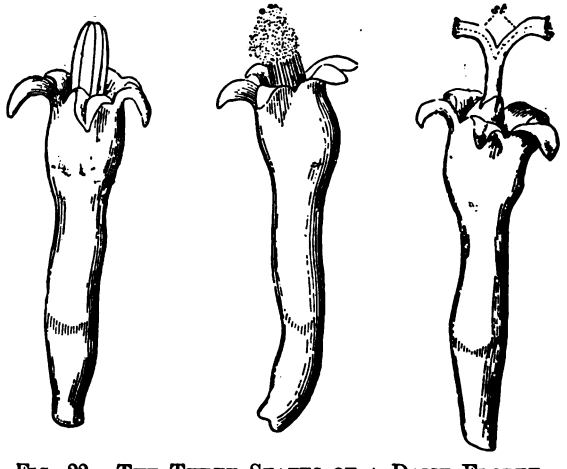


FIG. 22.—THE THREE STATES OF A DAISY FLORET.

Besides the daisy, the sunflower, aster, chrysanthemum, thistle, lettuce, marigold, ironweed, goldenrod, boneset, and many other so-called "flowers" are, in reality, close masses of tiny blossoms. The flowers thus joining forces make a much braver show than they would if they were scattered, and are thus more likely to attract in-

sects. The chance of gathering honey from so many flowers at once, instead of having to roam here and there in search of it, is greatly appreciated by insects; and their visits are more likely to be effectual, since the chances are that one alighting will touch many florets. No wonder, therefore, that "composite flowers," as these are called, are a very wide-spread and successful family.

They have put into practice in their floral mutual-benefit society the division of labor, without which no society can thrive. The outer rank of blossoms have been detailed off to do the advertising of the firm, and have developed conspicuous corollas, while the more quietly dressed sisters within furnish the pollen, without which no daisies would be produced to gladden the fields next summer. By culture, the little inconspicuous "disk-flowers" forming the daisy's centre can be developed into strap-shaped "ray-flowers," such as form its white border. Thus "double" daisies, sunflowers, and asters are produced, and thus garden dahlias, chrysanthemums, and marigolds have been developed from flowers of the daisy pattern.

When culture shall have changed all the disk-flowers of the chrysanthemum and the aster into

ray-flowers, no seed will be formed, for the ray-flowers of these plants have no stamens and produce no pollen. The double asters of the present have at the centre some few disk-flowers unchanged by culture, and by the pollen from these some of the ovaries are matured. The double asters of the future will have to be propagated entirely by cuttings.

The old rhyme at the head of the chapter says that the daisies "sleep through the night." This is both truth and poetry. Soon after sunset the white rays close gently over the flower's golden eye, so that in the twilight the daisies look as if they had all become half-opened buds again. All day they have gazed at the sun and loved him, and made themselves as much like little suns as they possibly could, and now that he has withdrawn his glorious face the world has lost all its interest for the daisies till daylight comes again.

XI.

TWILIGHT AND JUNE IN A GARDEN.

A SLEEPING garden, so it seems, could exist nowhere save in fairyland. It must surround the palace of the Sleeping Beauty. We can fancy that the gardener is napping and snoring while his idle tools lie rusting behind a great dusty cobweb. The spider dangling in it is dreaming of fat flies. The grasshoppers, crickets, and katydids are all silent. The butterflies hang motionless on the plants, like brightly colored leaves, and the usually busy ants and bees have gone home to slumber away a well-earned vacation. The peacock on the balustrade sits motionless beside his motionless shadow. The birds' little heads are all tucked under their wings and filled with visions of ripe cherries.

But the flowers—what do they do? And what goes on in the kitchen-garden? Can one see, even in fairyland, slumbering bean-vines or dozing onions?

Strange to say, we need not journey to enchanted

lands to find such things as these. I can see garden-beds (well named) full of sleeping plants any summer night in my suburban garden of plainest prose, where ill weeds flourish, and mosquitoes bite, and the tax-gatherer troubles, and street Arabs break through and steal.

The portulaca drowses first. Its saucer-shaped flowers close at sunset, taking the aspect of opening buds. They worship the sun as devoutly as any Parsee of old, and have no real life except in his presence. To-morrow morning, if his face is hidden, the portulaca will not have the heart to unfurl a single blossom, but as soon as he appears the despondent plants will cheer up and don festal array to do him honor. After the portulaca flowers are settled for the night the leaves grow sleepy, and gradually they take their nocturnal position. They raise themselves upright, nestling close to the stalks of the plant and to each other. "Pusley," the portulaca's disreputable and vulgar cousin, also keeps early hours. Shortly after sunset it, too, is asleep, with its leaves cuddled together in little bunches, and thus it recuperates its dreadful energies for another onslaught on my flower-beds.

When dusk begins to gather, it is bedtime for

the clover-leaves (Fig. 23). The two side leaflets of each cluster approach each other face to face, till they take the position of the covers of a closed book. Then the upper and central leaf bends for-

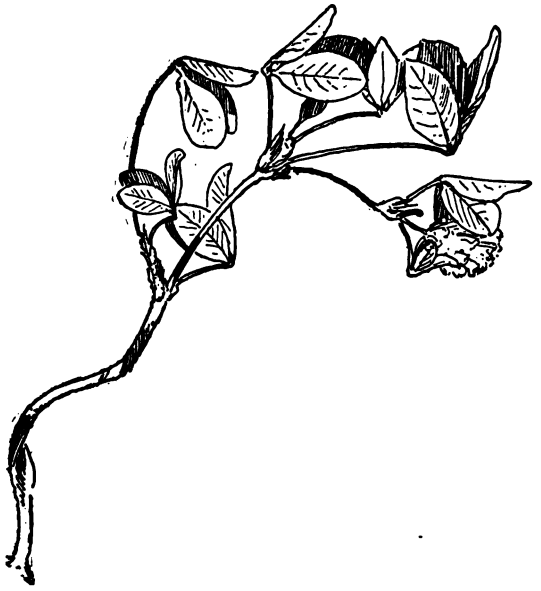


FIG. 23.—SLEEPING CLOVER.

ward till it touches the edges of the other pair. The attitude of the little sleepy-heads seems to express devotion rather than repose, for they look as

if they were offering vesper prayers, with their heads bowed low over their folded palms.

All through the summer we may see belated dandelions lingering in the grass, but at nightfall they vanish. Each flower has closed and has drawn its green outer garment over its yellow inner dress. They now look like buds, and are undistinguishable from the surrounding grass and leaves. Though they have contrived to gather so much gold to deck themselves with, they do not follow the proverbial rule for becoming wealthy. They are early to bed to be sure, but by no means early to rise. The blossoms are not fairly awake and open before eight o'clock, even in sunny weather, while on stormy mornings they are—we must confess it—scandalously late. It is a pretty sight to see a field full of dandelions wake up under a bright spring sun. They twinkle out, one after another, as stars do at nightfall. The daisies, too, close at dusk, but they waken at sunrise.

The grapevine and the wistaria are late up o' nights. Perhaps, living in towns so much, they have learned dissipated city habits. They scarcely begin to take their nocturnal positions before nine o'clock, and they are not fairly settled for the night till much later. The grape-leaves in sleep

are raised at the edges and depressed in the middle, so that they form shallow saucers. As we look up at the boughs of the vine, after the foliage has taken its nocturnal position, we see only the white under surfaces of the leaves, gleaming like silver in the moonlight. Wistaria leaflets droop in slumber as they do in excessive heat. One expects them to feel as wilting leaves do—soft and limp—and their crisp firmness is a surprise. They crackle like stiff paper when bent, and they refuse stubbornly to be twisted into any other position but that which they have themselves chosen to take. This curious stiffness seems to be a characteristic of all sleeping foliage.

The common locust settles down early. The end leaflet of the long cluster hangs like a plummet, and the side leaflets turn their points towards the ground and dangle in two rows back to back.

The foliage of the beans in the vegetable bed assumes a like position.

The leaves of the little Oxalis (Fig. 24), which children call "lady sour-grass," also sleep with their backs to one another and their tips pointed toward the earth.

But some of the dwellers in my garden wake and watch while others are fast asleep. The

honeysuckle grows more alive and alert as dusk closes in. The fresh flowers open soon after sun-

FIG. 24.—SLEEPING OXALIS.

set. They are slender vases, filled to the brim with perfume, which is shed forth upon the night air.

Their sweetness is a mute invitation to the humming-bird hawk-moth, and while twilight yet lingers we may see him among the flowers, beginning his night of revelry. He feels reasonably sure of a good supper. The cup of the flower is so slender and so deep that few insects can reach down to rifle its sweets, so that even the older blossoms may have saved their store for him, and the fresh buds, expanding to-night, contain nectar enough to satisfy any reasonable moth. Those which are neglected by him will remain open all day to-morrow, and bid for the attentions of the sunshine-loving butterflies.

The white "day" or "Japan" lilies (*Tunkia japonica*), like the honeysuckles, open at evening, and live for a night and a day. Many, indeed most, deep-throated flowers are nocturnal. Their nectar can be drained only by insects with very long proboscides. Such insects are large and conspicuous, and if they flew by daylight they would soon fall a prey to birds or other enemies. The day-lily's lover, like Romeo, must pay his addresses by night for fear of the Capulets, who would impale him if they could catch him—not on a sword, but on a beak or a big pin.

"Adam's needle and thread," or *Yucca fila-*

mentosa (Fig. 25), conspicuous in many gardens in later June and July, is another night-flower.

The aspect of this plant is probably familiar to most readers. From a bristling clump of erect sword-like leaves rises a smooth stalk bearing a great pyramid of cream-colored flowers.

FIG. 25.—YUCCA.

Throughout the day these blossoms are scentless, and they dangle from their stalks half-shut, like silent fairy-bells. If the night is cold and rainy, its coming fails to awaken the yucca, but in fine warm weather the plant shows a marked change with the gathering of twilight.

It begins to breathe forth an odor, not sweet, but fresh, pungent and peculiar, and this grows more and more noticeable as night settles down.

The flowers, which have hung half asleep all day, change their attitude and aspect. The petals draw backwards, the blossoms open widely and become great six-pointed stars. The yucca has an air of alert expectancy which is more

than life-like—almost human. We cannot help regretting the disappointment that we fear awaits her. The friend for whom this southern fair one listens and longs is probably a thousand miles away, enjoying himself among the Mexican beauties. She wakes in vain for that great tropical night-moth. We can fancy that she shivers a little in our chill northern dawn, and says to herself, like Mariana, "He cometh not"—and then as sunrise reddens all the east, "He will not come." As the night wanes the blossoms lose their star-like form, and daylight finds them drooping bells once more, dangling in limp dejection. They are not always thus disappointed. Last year a few capsules formed and ripened, probably by aid of pollen brought to the pistil by some large and rare nocturnal moth. But in some seasons no seeds form at all.

Not every one has a garden, still less a yucca in the garden. But every one can find our commonest nocturnal wild flower, the evening primrose (*Ænothera biennis*) (Fig. 26). It grows everywhere—in fields, in waste places, along country roadsides, and around the edges of woods, and it blossoms from June to September. The plant is a sturdy, upright affair from two to eight feet high,

FIG. 26.—EVENING PRIMROSE (*Ænothera biennis*).

having the aspect of a weed. By day the flowers, which grow on a leafy spike, are all of the past or of the future. Towards evening, however, the buds begin to swell. A few moments after sunset they grow so fast that the increase is visible to any one who may be watching. Little starts and thrills go through the expanding blossom like the slight stirring and long breaths of an awakening child. Then the four yellow petals draw back, revealing the flower's heart.

This pretty sight may be seen on any country roadside any bright summer evening. The garden evening primrose celebrates the appearance of its gay new flowers with floral fireworks, for each blossom expands with a little pop like that made by drawing a small but stubborn cork.

As twilight falls, the primrose begins to breathe forth a fragrance which grows stronger and sweeter as darkness closes in. By this, and by the glimmering of the yellow petals, the night-moth is lured to fertilize the flower. Let us notice that the pollen is very abundant and somewhat sticky. It even hangs from the stamens in long, gummy threads; so that a visiting moth is sure to carry some away on her velvety body. Sunrise finds the flower as pale and "used up" as any belle the

morning after the ball. But the limp petals, fading in the growing light, have done the work which Nature gave them.

It was a pretty idea of one of the early botanists to plant a garden which should tell the time; an idea sportively used by Jean Paul Richter in one of the most charming passages in his "Flower, Fruit, and Thorn Pieces." Each hour was to be marked by the opening or by the closing of some blossom. One might have a garden which should present frequent and lovely changes, but the flowers are not accurate time-keepers. It would be disastrous to regulate dinner by the clock-garden, or to try to catch the train by it. The sleeping and waking of the flowers is governed by many other causes besides the flight of time. The state of the atmosphere, the amount of dew-fall, the brightness or dimness of the skies, may all affect that beautiful mystery—the sleep of plants. Yet darkness is not its cause, for the twilight which lulls one blossom to repose rouses another into intense life. As the butterflies go to rest moths begin to flit, and beetles come droning out of a thousand holes and corners, lighted to their revels by the fireflies.

Through the still air there may drop down to us

the soft calls of migrant birds. Guided by their God-given instincts, they are travelling on, league after league, between the dusky tree-tops and the stars.

After all, it is a mere figure of rhetoric to speak of the "sleep of the earth." Mother Nature has no sooner hushed one set of children to rest than she begins to attend the needs and to superintend the labors and frolics of many more.

Night is full of life as beautiful and intense as that of the day, and as unknown to many of us as that of another planet.

XII.

WATER-SIDE AND POND FLOWERS.

LILIES, CAT-TAILS, SPEEDWELL, BLUE-FLAGS, JEWEL-WEED, AND EEL-GRASS.

THE midsummer sunshine resting on still waters wooes the water-lily from the shadowy depths below into the brightness above. To a seeker after parables, the upward striving of the bud suggests the effort of a soul reaching out of darkness and the mire of sin, groping toward God's light, growing ever whiter and whiter, and at last attaining to purity and gladness. The blossoms, white and gold, recall the "fine cloth, white like flame," with the interwoven "golden threads," which Rossetti's "Blessed Damozel" and her companions wear in Paradise.

One wishes that the flower had a longer term of joy and beauty, and that it did not so soon withdraw into the depths again, having looked its last on the sun. But in this, as in most water-plants, the stem of the fertilized flower-head shortens, and

thus the baby seeds are drawn down to ripen in the dark.

The water-lily breathes forth fragrance and wears her fresh and lovely dress to attract the water-beetles, which, it is believed, act as messengers, carrying the pollen from flower to flower. The floating leaves are smooth and lustrous, as are those of most aquatic plants. To an artist's eye, the flashing of their polished surfaces seems to repeat the flashing of the waters around them. Push them below the ripples with an oar, and they "bob up serenely," as shiny, and, seemingly, as dry as ever. Drops roll off the bright surfaces of such leaves as they roll off oil-skin, and in fact the skins which cover them are actually oiled.

Every leaf consists, in the first place, of a fine network of branching tubes. We call it the "skeleton"; it would be far more correct to speak of it as the "venous system" of the leaf. Then in between these tubes lies leaf-tissue, which consists of countless cells set closely together. Over the whole is stretched a fine skin, quite transparent, very thin, and yet very tough. This, in water-plants, contains a little oil, and so sheds water easily; for though washing is good for foliage, soaking disagrees with it sadly.

The leaf's skin (botanists call it the epidermis) is full of holes invisible to the naked eye, and almost innumerable (Fig. 27). Through these the

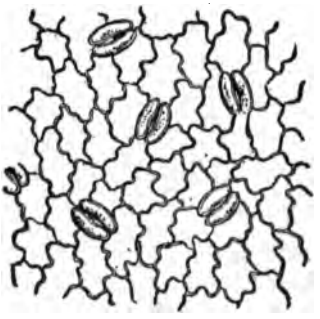


FIG. 27*a*.—STRUCTURE OF THE EPIDERMIS OF A LEAF.
(From *The Vegetable World.*)

FIG. 27*b*.—VERTICAL SECTION THROUGH ONE OF THE STOMATA OF A CYCUS (magnified).
(From *The Vegetable World.*)

plant breathes, and if they get stopped up with dust it cannot thrive. This is the reason why house-plants are so benefited by an occasional sponging or spraying with clean tepid water. But

a leaf which has all its little breathing-holes covered with water is as badly smothered as one that has them all clogged with dust. This is why the shining foliage of the water-lily, the arrow-head, and the pickerel-weed is so contrived as to keep dry in circumstances in which it has boundless opportunities to get wet.

The little breathing-holes, or "stomata," are usually much more numerous on the lower, or shadowed side of the leaf. If they were on the upper surface, exposed to direct sunshine, so much moisture would evaporate through them that the foliage would soon dry and wither. But in floating leaves this plan is reversed. The little mouths, if they were on the lower surface, would be stopped up by the water, and of no use whatever. So the floating foliage of water-plants has its breathing-holes on the upper surface, where fresh air is to be had.

But many aquatic plants bear leaves which are always submerged. These live, as fishes do, on the air which is in the water. They are always delicately cut and fringed. This is partly in order that they may not be torn by the currents, as broader leaves might be, and partly because the long, green fringes, washing this way and that way,

are able to gather up every floating bubble and find out every glint of light within a wide circle. Perhaps such foliage suggested the fabled sea-green hair of the mermaids.

Yet even these water-nymphs of the vegetable world, though they enjoy getting their leaves wet, often take extraordinary pains to keep their flowers dry. A soaking might spoil the pollen, or the golden dust might be washed away altogether. Sometimes the blossom is sheathed in horny scales which are transparent enough to let in all the light there is, yet water-tight as a new overshoe. Sometimes the sepals, like the leaves, have a glossy surface which sheds the drops, and the petals are wrapped in them with great care. When the bud has emerged into the sunshine it sought, the beauties hitherto so carefully guarded are daintily displayed to the marsh-flies and water-beetles.

A little nearer shore than the floating lilies, a circle of cat-tails, stiff and tall, stand like sentinels around the edges of the pool. Their thick heads, which suggest the tops of pikes or maces, are, little as one would think it, dense masses of small flowers. The top part, which grows fluffy in latter summer, consists of countless tiny stamens, which,

when they have fulfilled their mission and shed their pollen, blow away.

The cat-tail, beloved of home decorators, is a mass of innumerable pistils, or rather little ovaries, each crowned by a tuft of soft fine hairs. "Each ovary," says Grant Allen, "is so extremely small that you cannot distinguish them separately at all with the naked eye; if you cut the spike across, the only thing you can see is a thick mass of soft, brownish hairs, black at the tips, and paler inside toward the central stalk. How many hundreds of thousands of flowers are thus cribbed and cabined on a single stem, nobody has ever had the patience to count; a mere pinch pulled out between tl finger and thumb displays, under the microscope, an apparently infinite number of distinct florets, each with a single tiny ovary and a fluffy envelope of small hairs."

A little bare stalk sticks up at the top of the cattail. This used to support the stamens which have all ungratefully gone off and left it naked in the cold world. The winged seeds when they are ripe will go off also; and if our cat-tails are gathered late in the season, when the ovaries are nearly mature, they will soon come to pieces in the warm house. In that case we shall certainly be

duly impressed with the numbers of these tiny seeds, and with their enterprise as travellers.

The plant grows only along the edge of shallow waters; and since these are likely to dry up or shift their place from time to time, it requires great numbers of easily dispersed seeds to take advantage of every new spot which slight local changes may have fitted for its dwelling-place.

Along the edges of brooks, ponds, and ditches, all through the summer we may find the pretty veronica, brooklime, or water-speedwell. The flowers have four spreading petals, pale blue with purple stripes, and grow all along a common stalk, forming a slender spire of bloom. The common speedwell (Fig. 28) grows in fields or on open hillsides. The stem, bearing a profusion of leaves, crouches close to the ground, and from it rise erect sprays of little flowers as blue as heaven. They are not much more than a quarter of an inch broad, but stand close together on their stalk, and as we stroll across the meadow they catch our eyes by their lovely vivid color.

"Speedwell" is an old word used in bidding good-by to a friend who is going on a journey. It has the same meaning as farewell, and expresses a hope that the traveller will reach his destination

FIG. 28.—COMMON SPEEDWELL (*Veronica officinalis*).

soon and safely. We say it to this little flower because it is going to leave us; for the pretty corolla drops so soon after it unfolds, that if we do not take leave of it now, before it vanishes, we will not have the chance to do so at all.

A more serious explanation is attached to the flower's botanic name, veronica. Among the daughters of Jerusalem who followed our Lord on his sad road to Calvary, weeping and wailing, there was, says the legend, one Jewish maiden whose heart was stirred by the divine face marred with anguish. Her feeling could express itself only in one trifling act. She handed the Saviour a handkerchief that He might wipe from His face the wayside dust, the damps of suffering, and the blood flowing from the wounds made by the crown of thorns. When He gave it back it was found that the stains on the linen made a perfect likeness of His face.

A pictured square of linen said to be this very handkerchief is still preserved at St. Peter's in Rome. Long ago it was called *Vera Iconica*, the real likeness. Later monkish writers, growing hazy in church tradition, changed the name somewhat, and transferred it from the handkerchief

itself to the Jewish girl to whom it belonged. She was called St. Veronica.

The botanist who named the speedwell was thinking of the earlier version of the legend when he called the pretty flower veronica, "because its blue and innocent eye is the *vera iconica* (veritable likeness) of the pure heaven at which it gazes."

Midsummer finds the blue-flag, or wild iris, still lingering on the edge of sunny waters, or in low, moist fields. This is the famed lily of France, which was blazoned in gold on the banners carried to Cressy and Agincourt. Henry the Fifth, after this latter fight, quartered the arms of England, his by inheritance, with those of France, his by conquest, and took for his standard "three golden leopards (or lions) sporting in a ruby field, and three golden lilies blooming in an azure field."

In Ireland the iris is really golden, and blooms in a field, not of azure, but of emerald. Some yellow varieties are found in this country, but our common sorts are in various shades of purple and lilac. There are three erect petals, and three backward-curving sepals. The latter are adorned with a tracery in dark purples and gold, elaborate enough to have occupied an artist all day. And

all this beauty may be seen only by some wandering bee or marsh-fly.

A most complex and wonderful structure fits the iris to attract bees or larger insects, and repel crawlers, and prevents it from setting seed by its own pollen. All this is entertainingly described in Prof. Gray's "How Plants Behave."

Iris was the classic goddess of the rainbow, who, it was fabled, wore a robe radiant with many tints, as are these petals. Flower-de-luce, another name given to this blossom, is a corruption of the French *fleur-de-lis* (flower of the lily).

Growing near the iris, we shall probably find jewel-weed (Fig. 29) or wild balsam, which is very plentiful along the margins of brooks and rills. The flowers of the common variety are orange-colored, thickly spotted with reddish brown; a rarer sort bears pale yellow blossoms sparingly dotted with dull, deep red. The flowers nod and sway gracefully on slender stalks. They are in shape something like a cornucopia, with the small end doubled up into a little spur or tail. The plants are from two to four feet high, and bear a profusion of smooth, dark green leaves, which, like the blossoms, droop as soon as they are picked.

Jewel-weed is a sort of second cousin to the

FIG. 29.—TOUCH-ME-NOT, OR JEWEL-WEED (*Impatiens fulva*).

nasturtium, and a first cousin to our garden-balsam, or "lady's-slipper." Its botanic name is *impatiens* (impatient), because the ripe seed-vessel recoils from one's touch with a quick, petulant motion. The little pod suddenly bursts, and the elastic movement shoots off the liberated seeds in every direction. This trick earns for the plant its common names, "touch-me-not" and "snap-weed." The jewel-weed, like the violet, bears two sorts of flowers. Besides the showy ones we know, which are gotten up to lure the insects whose visits they need, there are small ones which are fertilized in the bud with their own pollen.

Some of our native plants have made their way eastward against the flood of emigration and the tide of empire. Like the potato, the Colorado beetle, the United States railway-check system, and—dare we say it?—the American belle, they have entered the Old World, and in their various lines achieved success. Among these importations from Uncle Sam's dominions is our jewel-weed, which has made itself quite at home along the banks of the Wey and other Surrey streams.

Of all the flowers which grow by the water or beneath it, the most wonderful are those produced by the vallisneria. This plant, better known as

"tape-grass" or "eel-grass," is common in sluggish streams and shallow lakes, and excites the execration of rowers by twisting its long, tough, grass-like leaves around the oar-blades and seriously impeding progress. Its organization fills the naturalist with delight, and supplies the poet with a theme.

The stamens and pistils grow not only in separate blossoms, but on different plants.

The pistillate flower is borne on a very long stalk, which rises through the water, corkscrew-fashion, in a beautifully symmetrical spiral.

The stamen-bearing flowers grow crowded together in a cone-shaped head, which is borne on a very short stalk, and grows under water, close to the bottom of the pond. When the staminate flower-buds are ready to burst, the cone-shaped cluster breaks from its moorings and rises to the surface.

Here in the sunshine the flowers expand, the anthers open, and the pollen is shed upon the face of the water. About the same time the stalk of the pistillate flower uncoils. The flower is now, as it were, tethered by a very long line, or anchored by a long rope, and sways over a large circuit at the impulse of wind or ripples. Soon it

floats in amid the scattered pollen, and receives upon its stigma some of the golden grains. Now the purpose for which the blossom rose into the air and sunlight is accomplished. The long stem coils itself up once more, drawing its spirals closer and closer, as a watch-spring does when the watch is wound. The fertilized flower-head is thus drawn down into the cool depth of the pond, and there the fruit is matured.

XIII.

UNBIDDEN GUESTS.

A SERIES of receptions, or rather one continuous reception, is held in my garden all summer long. The flowers are the hostesses, and they have put on glorious apparel in honor of their guests. They send out perfumes as cards of invitation, and these are carried hither and thither by the breezes. When the visitors arrive they are entertained with a feast of nectar. The invited guests are moths, butterflies, humming-birds, beetles, wasps, and, chief though last, the busy bees. A few flies also are favored with invitations. The hospitalities of the flowers are only too highly appreciated, and they are sponged upon by a host of undesired guests. Ants, and indeed all crawlers, are neither wanted nor welcomed. It seems that poor people who have to walk are regarded with some contumely even in the vegetable world. In fact, the ant is an extremely unpopular character in the garden, and the flowers have all laid their pretty heads together to circumvent and

thwart her. If they could speak, they would bring forward surprising accusations against that model insect, the embodiment of industry and thrift, the instructor of the sluggard, and the admired of Dr. Watts. They would tell us that she is an arrant thief. Every housekeeper knows how fond ants are of sweet things. When they have got into the store-closet, the sugar-jars and the cake-box must be closed with the utmost care. So among flowers ants are terrible honey-thieves. They are so small that they can slip down the throat of a flower, devour all its store of sweets, and clamber out again without shaking or even touching the stamens. They often come out as clean as they went in, and do not carry away with them one grain of the golden dust which the flower is so anxious to send to its neighbors.

The ill-used flower cannot employ a better messenger to do the work which the ant neglected to do, because its nectar is all gone, so that it has not the wherewithal to hire one. If we watch a bee among the blossoms, we shall see that she hovers for a moment over each as if undecided whether to stop and sip or not. Sometimes she seems to conclude that the blossom has been already visited and drained, and that there is

nothing there for her. It appears that the insect detects a delicate odor from the nectar in the flower, besides the stronger perfume which we can enjoy with her. So the robberies of ants prevent the really useful visits of bees, and thus not only impoverish the flower, but also spoil its prospects. Moreover, if the bee happens to call while the ant is within, her delicate proboscis may be seized in the intruder's nippers and shrewdly pinched, and after a few such painful surprises, the bee, if she be wise, will avoid the flowers in which she experienced them.

Moreover, when a crawling insect visits a flower and is dusted with its pollen it rarely carries the load where it ought to go—to another blossom of the same species. The wee pedestrian, after travelling down the stalk of one plant, clambers up that of whatever happens to grow nearest. Having visited and rifled the portulaca, for instance, she climbs with yellow legs among the flowers of the mignonette. These would be glad of gold-dust from another head of mignonette, but they have no more use for portulaca-pollen than the guests at a New York dinner have for chop-sticks. The ant, however, makes the mignonette pay for what it does not want, and helps herself to the honey with

great assurance. So for sundry, divers, and sufficient reasons flowers desire to exclude crawlers in general and ants in particular, and Nature has many devices to this end.

"Nothing," says Sir John Lubbock, "bothers ants like hairs, and it has been found that they are quite unable to climb up a table or a safe if a little old fur or a strip of flannel is gummed around the legs." This mode of excluding the crawling rogues has been generally adopted by plants. Stalks are rarely quite smooth, but are almost always clothed with fine soft hairs or tiny bristles. The geranium, the rose, the squash-blossom, and the petunia are thus protected from creeping marauders, which have more difficulty in forcing their way through the vegetable fur than we should have in penetrating a jungle. Sometimes the intruder finds her way as easy at the outset as the paths of sin proverbially are, but she meets insuperable obstacles just as she nears the goal of her hopes. The pansy and the violet have smooth stalks, easily climbed, but just in the throat of the flower, directly on the road to the honey, is a great tuft of silky hairs, to the ant veritable *chevaux-de-frise*. The pansy thus saves her honey for the bee, which can readily run her long string probos

cis through the silky tuft and into the bottom of the nectary.

Cyclamen, snowdrop, fuchsia, and lily of the valley, are protected by the droop of the blossoms. In vain do ants try to get into such flowers. The curved smooth stalks baffle them. They find themselves, like the wicked, set in slippery places, and when they come to the downward slope which leads to the blossom, they invariably tumble off to the ground again. In fact, such hanging flowers protect their honey from ants as the swinging nests of the weaver-bird and the oriole protect their eggs and chicks from snakes.

In aquatic plants the access of crawlers is prevented by the surrounding water. Some land-plants have secured to themselves the same advantage by preparing little basins in which to drown intruders. The lower leaves of the common road-side teasel are so arranged as to form a deep cup around the stem. Rain and dew collect in it, and are retained for some time, so that the basin is seldom empty, even in dry weather, and in the little pool float the corpses of deluded crawlers which sought sweets and found a watery grave.

Several sorts of plants have a series of such cups, one at each joint of the stem.

Sometimes the flowers are surrounded and protected by a sort of collar of leaves with recurved edges. "I have assured myself," says Kerner, a great German naturalist, "not only by observation, but by experiment, that wingless insects, and notably ants, find it impossible to mount upward over such leaves as these. The little creatures run up the stem, and may even traverse the under surface of the leaves, but the reflexed and slippery margin is more than the best climbers among them can get over, and if they attempt it, they invariably fall to the ground." The petals of the tiger-lily curl backwards at the edges, to the confusion of small insects which may try to crawl up the stem and into the flower.

An invention similar to the "sticky fly-paper" of commerce was brought out by Nature ages ago, for some flower-stalks are glutinous, and crawlers get hopelessly gummed down to them. The blossoms of some varieties of sweet-william and those of the campion, or "catch-fly," are thus protected, and a like plan of defence has been adopted by the common purple swamp-thistles. These flowers are rich in honey, and hence they attract much attention from insects.

One which blooms in a damp spot by the road-

side opposite, entertains butterfly and bee visitors from the moment when the flower "comes out." The ants sniff the dainties overhead, for their sense of smell is extraordinarily keen, and they too wish to share in the festivities. The ascent to the flower-head is toilsome and tedious, on account of the fuzz which clothes the stem. When the persevering insect has labored to its top, she finds herself before a formidable fortification which Nature throws around the blossoms, a close frill of small leaves thickly set with thorns. When she has somehow worried through this, and success seems secured at last, she meets and succumbs to a worse difficulty still. The slender-throated flowers, which compose the thistle-head, are set close together into a deep green cup. This cup (as all who have made the pretty thistle-balls know very well) is composed of many overlapping scales. In the centre of each scale is a whitish streak. Touch it with a pin, or finely pointed pencil, and you find that it is glutinous. The ant comes hopelessly to grief on these green scales, at the end of her toilsome journey and in full view of her goal. She is held fast on the gummy streaks, and her frantic struggles to get free only bog her more hopelessly. The gum, after a while, stops

up the little holes in her sides, through which she breathes, and thus she is smothered to death. I have seen more than twenty dead or dying ants stuck upon the head of a thistle which grew just above their nest.

It is certainly a little difficult to pardon the thistle for such wholesale slaughter; but after all, except in the estimation of patriotic Scotchmen, the thistle is only a vegetable gamin, without culture or social consideration, a tramp with no home but the wayside, an Ishmaelite waging war upon the community, which in turn wages war upon it. Such conditions can scarcely fail to be demoralizing even to a weed.

The snap-dragon protects itself after a manner less cruel but equally efficacious, and the same plan has been adopted by the familiar roadside linaria, which children call "butter-and-eggs." (Fig. 30).

This plant is very common, in latter summer, everywhere. It puts up stalks from one to three feet long, each bearing many smooth, narrow leaves, and above them a spike of flowers. The blossoms are of an odd, two-lipped form, like those of garden snap-dragon, and each has a pointed spur or tail. They are bright yellow, all except

FIG. 30.—TOAD-FLAX (*Linaria vulgaris*).

the little pouting lips, which are orange-colored. By pressing gently at the corners of the mouth we can force the lips apart, and then we see that the stamens and pistil are well inside in a position corresponding to that of the tonsils, while the honey—to continue the comparison—is down the throat. The lips close firmly over the pollen and honey, and a small creeping insect is quite unable to force an entrance between them. It is like the undesired guest of fairy lore, who finds the doors barred, and all the way beset with difficulties. The bee is the wished-for guest, to whom all barriers yield. When she comes to call, she alights upon the lower lip, and her weight causes it to drop. Then she sees two bright golden bands running along the palate of the flower. They guide her attention to the mouth of a deep horn-shaped pocket, in which the honey is stored, and in order to reach it she must jostle the stamens, which stand directly in the way. Then she flies off, pollen-laden, to another snap-dragon flower, while the lip, relieved of her weight, springs back, and closes as silently and as strangely as the door of rock did behind departing Ali Baba.

XIV.

WINGED BURGLARS.

HIGH up on the Alps, close to the eternal snows, there are wild gardens, wherein the laborers are wind, rain, frost, and sunshine. In these cloud-girt gardens, by myriads and myriads the blue gentians blow. The breezes perhaps carry the news of their beauty and sweetness down to the under-world, and the bees come up to visit them from far-off valley nests and hives. The bees' enterprise is more commendable than their honesty, for the honey in the gentians is not intended for them; the flowers are trying to reserve it for the butterflies, in cups so slender and deep that bees cannot reach it by straightforward methods. They know this, and they waste no time at the top of the blossom, but fly straight to the base, gnaw a hole through the blue corolla, and reach after the honey from the outside.

The gentians have guarded against thieving inroads of ants by various devices. At the en-

trances to the flower-tubes are fringes to entangle the marauders, or thickets of fuzz to baffle them, and one species has a little trap-door cunningly arranged to shut them out. But despite these contrivances, the flower is unable to save its sweets for the butterflies. It succeeds in baffling the ants, to be sure, but it is outwitted and defrauded by the bees.

The blossoms of my garden are not more fortunate, nor are the bees which visit here more honorable than their Swiss relations. The nasturtium is plundered and pillaged in a shameful manner. Its honey is in the base of the long horn, or spur, which projects below and behind the flower. This is a feast prepared for the butterflies. When one of them visits the nasturtium, he perches on the lowest petal, which projects forward and forms a convenient alighting-board for him. Standing there much at his ease, he can push his long proboscis into the bottom of the spur, and in so doing he must brush against the stamens, which, when ripe, project beyond the mouth of the flower tube. Some pollen adheres to his velvety head, and when he visits another nasturtium he will probably run against the pistil in such a way as to leave part of this load of gold-dust upon it. He thus acts as

messenger for the nasturtiums, and honestly earns the nectar which they bestow.

But the bee contrives to get their honey without doing a stroke of work for them in return. The sight of the great pocketful of sweets is a temptation too strong for her to resist, and she gets possession of the contents by ingenuity, coupled with fraud. The proboscis is too short to reach down to the honey, and the spur is so narrow that she cannot possibly crawl down inside it to gather the sweets stored in its depths. So she gnaws a hole in it from the outside and helps herself to its whole contents. Thus she at once deprives the flower of the means of hospitality and disappoints the butterfly of its luncheon. She has not touched the stamens nor the pistil. She has neither brought any pollen with her nor helped to carry any away. The nectar which she takes is not earned, but stolen. *Weigela rosea,* the pretty shrub which grows in everybody's garden, is robbed in the same manner by bumblebees. Each May the bush decks itself with a profusion of flowers in shape like those of yellow jessamine. When they open, they are creamy white, with touches of pink on the outside; as they grow older they turn deep pink inside and out. At this stage they generally

bear scars resulting from the abuse which they have received. If we gather a cluster of the flowers we shall see that three out of five are marked, at the base of the corolla, with one or two short brown lines, and on closer examination these prove to be cuts made by the bumblebees. Honey-bees have no temptation to deal thus unfairly with the *Weigela*, for they are small enough to go into the flower and get the honey in the correct way. When we see the honey-bees among the nasturtiums, however, we find that they are quite as guileful as their stouter cousins.

The honeysuckles are pierced and plundered after the same fashion. The fresh blossoms unfold about sunset, and breathe forth a fragrance which grows more and more sweet as dusk closes in. This is a mute invitation to the humming-bird hawk-moth, the vine's chosen messenger. Some flowers are yet unvisited when dawn puts an end to his night of revelry, and these remain open through the day, and bid for the attentions of the sunshine-loving butterflies. But the bee is a very early riser. She comes betimes to the honey-suckles' feast, though she is neither expected nor wanted, and the butterfly arrives only to find that the nectar has been emptied through a breach in

its delicate wall. Yet the honeysuckle stores its sweets in very deep and slender vases, on purpose to keep them out of reach of all insects save moths and butterflies.

All the flowers of which we have spoken are "highly adapted for insect fertilization," but Nature, it seems, has neglected to take a few last precautions, and for lack of these it sometimes happens that all her plans, pains, and contrivances are set at naught. The insects have learned roguery faster than the flowers have learned defence—as the burglars in the human world have become more proficient than the locksmiths.

These pillaged flowers present a problem to the evolutionist. How is it that, while every one of these blossoms has adapted itself in so many ways to the needs and tastes of its own insect friend, none of them has evolved any scheme to save itself from robbery and ruin at last?

The common geranium knows a trick worth two of the unprofitable allurements of these thriftless flowers, and keeps its store of honey securely guarded from all insect vagabonds. In the geranium the honey is at the bottom of a little well, sunk into the slender green stalk which supports

the flower. What seems the stem of each single blossom is really a combination of stalk and honey-bearing spur. "Pull off the two upper petals of a single geranium," says Grant Allen, "and you will see that behind them there lies a deep pouch or tube running along the top of the flower-stalk. Cut the stalk across, and you will find it hollow on the top; cut it down lengthwise, and if you follow up the tube throughout its whole length you will learn that it leads at last to a drop of honey."

Wild geraniums store their honey in five glands borne on an open disk, and any small insect can easily thieve it; but the garden-geranium plans more wisely and has secreted all its nectar in this deep pocket. The sensitive surface of the pistil turns down to meet the pollen on the insect's head, as it poises on level wings before the deep nectary, and this surface itself consists of five spreading fingers covered (under a slight magnifying power) with beautiful crystalline glands to which the pollen readily adheres. The irregularity in the petals is a guide to the insect, the upper pair being slightly raised on claws in order to let him get more easily at the mouth of the tube.

The nectar is so cleverly concealed that the insect cannot divine its whereabouts unless he calls, with proper ceremony, at the entrance to the blossom; then the irregularity of the petals serves as a guide to him. The upper pair are slightly raised on claws, in order to let him get more easily at the mouth of the honey-pouch. In reaching after the flower's sweets he is sure to rub against the stamens and receive a load of pollen with which to fly to another flower.

So the geranium never parts with her treasures except in just payment for services received, enforcing the apostolic dictum that if any one will not work, neither shall he eat.

A plundered flower has not of necessity lost forever all its chances of attracting other insects and getting its seed set. After honey has been abstracted from the blossom's cup, it begins to form again. In warm weather and under a bright sky this process goes on quickly. In cold, rainy weather it is slow, or perhaps checked altogether; yet there must be some moisture in the air, or the dainty work will not go forward at all.

An old flower when rifled may not find the energy to set about repairing damages; so that it is only now and then that a robbed flower is able

to set itself up in business again. Hence we cannot excuse the conduct of the usually exemplary bee when she thus plays the blossoms false. And while she is stealing the moth's supper or the butterfly's breakfast, she is surrounded by flower friends which offer her abundant dainty fare, asking only very moderate services in return.

XV.

OGRE-FLOWERS.

THE insects which eat plants are so many, so adventurous, and so insatiable that we know them only too well. The harassed gardener wages ceaseless and hopeless war on them all summer long. His happiest condition is only a sort of armed truce, and it may comfort his sorely-tried soul to know that there are plants in the world which avenge their fellow-plants and "turn the tables" by eating insects.

The commonest and the most wonderful of these ogre-flowers is the little sundew (*Drosera*), which Darwin thought a worthy object for long and patient study (Fig. 31). The plant is found in wet, sunny places. It grows in mossy bogs, and in moist sandy spots along the New Jersey and New England coasts. I have also met it quite unexpectedly when it was making itself very much at home on a mouldering log which lay at the edge of a stream among the Catskills.

The leaves of one sort are round and long-

stalked, pressed flat in a rosette against the ground, and rather red than green, even at the first casual glance. A stem which bends downward at the tip bears a number of buds and one white flower. Another less common variety of sundew has pretty rose-colored blossoms half an inch broad, and long, thread-like leaves which when they are young are coiled over at the tips like baby ferns. The flowers of both sorts open only in the sunshine.

FIG. 31.—SUNDEW (*Drosera rotundifolia*).

As they nod in the breeze and rejoice in the midsummer brightness, they certainly do not look very bloodthirsty or mischievous. Yet at this very moment they are lying in wait for living prey, for the sundew is one of the most marvellous of insect-eating plants. If we examine the leaves closely we see that their actual surface is green after all. They look red at first, because they are covered with living, movable, sticky hairs, each tipped by a ruby-colored gland no bigger than a pin-head. Some of the leaves have their edges

folded over or rolled inward; and if you open them you will find two or three decaying carcasses of flies.

When an insect lights on the leaf, attracted by the bright red glands with their honey-like gum, he gets clogged by the sticky hairs, and cannot drag himself free for all his frantic efforts. The hairs bend toward the prisoner till their glands touch his body, reaching after him from all sides so eagerly that the leaf itself is rolled by their motion. The more the fly struggles, the more it excites the living hairs to grasp it, while the sticky fluid pours from the red glands till the little legs and wings are so tied and plastered down that they can strive no longer. The gum stops up the tiny holes in the insect's sides through which it breathes, and it soon dies, strangled and exhausted.

When the game is lured, secured, and killed, the next thing in order is the banquet. The little victim is eaten and digested. The fluid, which has all this time been exuding from the rosy glands, continues to flow, but becomes somewhat changed in its nature. If a chemist examined it now he would tell us that it was like pepsin; and it dissolves the sundew's dinner just as the pepsin in the human stomach dissolves what has been

swallowed in the last meal. If you put a grain of sand or a little bit of wood on the leaf, the glands bend over it at first, but soon find out their mistake and let go again. And this wonderful plant, like gluttons who stand higher on the scale of creation, sometimes has to pay the penalties for greediness. Darwin experimented on the leaves with tiny scraps of raw beef, and he found that some which had feasted too heartily suffered, apparently, the pangs of acute dyspepsia. They changed color, refused all food, grew limp and dejected, and died miserably.

Sundew is not alone in its strange practices. The Venus' fly-trap (*Dionæa muscipula*) (Fig. 32), another dweller in the bogs, also catches insects and eats them.

"This plant abounds in the low savannas around Wilmington, North Carolina," says Prof. Gray, "and is native nowhere else. It is not very difficult to cultivate, at least for a time, and it is kept in many choice conservatories as a vegetable wonder."

At the end of each leaf is what looks like a smaller leaf, nearly circular in outline, about an inch in diameter, and edged all around with stout sharp bristles. This is the fly-trap. It folds

FIG. 32*b*.—LEAF OF VENUS' FLY-TRAP.

FIG. 32*a*.—VENUS' FLY-TRAP (*Dionæa muscipula*).

down the middle, as if it worked upon a hinge, and on its upper surface are six very delicate bristles.

If these are touched with finger or pencil-point, the open trap shuts with a swift motion, and after a considerable interval it opens again. When a flitting insect brushes against the bristles the trap promptly closes, generally imprisoning the intruder. "It closes at first," says Prof. Gray, "with the sides convex, and the bristles crossing each other, like the fingers of interlocked hands. . . . But soon the sides of the trap flatten down and press firmly upon the victim, and it now requires a very considerable force to open the trap. If nothing is caught, the trap presently reopens, of itself and is ready for another attempt. When an insect is captured it is held until it dies—is crushed to death indeed and consumed. The face of this living trap is thickly sprinkled with glands of elaborate structure under the microscope, but large enough to be clearly seen with a hand lens. These glands, soon after an insect is closed upon, give out a saliva-like liquid which moistens the body and dissolves all its soft parts. In a week or two the meal is digested, and the leaf opens for another capture and another feast. But its mo-

tions are now more sluggish than before, and after three, or at most four, orgies the trap loses its sensibility and the leaf decays.

Another familiar vegetable trap is the sidesaddle-flower, or pitcher-plant, which grows in bogs in our Eastern and Middle States. This strange plant is often shown in florists' windows as a curiosity. The hollow leaves are shaped like inverted horns, and are usually half full of water and drowned insects. A row of honey-bearing glands running up the outside of the hollow horn tempts the deluded fly to climb the wall of the ogre's castle. Having reached the top, he too often tumbles down into the hollow leaf. Here is a little well all ready to drown him; and if, being of a dauntless and persevering nature, he gets ashore and tries to clamber up the sides of the well toward sunlight and freedom, his escape is cut off by a row of stiff, curved bristles, pointing downward. These stand in a ring just inside the mouth of the hollow horn, and, like the withes around the entrance of a lobster-pot, make it easy enough to get in but impossible to get out.

"It is impossible," says Grant Allen, "not to feel a little thrill of horror at this battle between the sentient and the insentient, where the in-

sentient always wins—this combination of seeming cunning and apparent hunger for blood on the part of a rooted, inanimate plant against a breathing, flying, conscious insect. . . . These insect-eating plants grow in damp places, rooted in moist moss or decaying vegetation. In such situations they cannot get those materials from the soil which are usually supplied by constant relays of vegetable manure." Their ways of supplementing the rations gathered by their roots are certainly wonderfully like the actions of conscious, thinking beings.

And who can say positively that they are not conscious beings? Life, after all the nature-study of our times, remains as deep a mystery as ever. Those who try to define it only give it a new name.

In our own frames we seem to have two lives, one independent of the will and one controlled by it. Much of our physical life goes on without our knowledge and independent of, or sometimes in spite of, our will. We cannot add one inch to our growth, or retain one power or charm which age wishes to steal from us. Our hearts beat, our blood circulates, our food is changed to living tissue, without any exercise of our thought or

will. This mechanical life it is probable we share with God's humble vegetable creation.

But who can say positively that there are not some plants endowed with a fuller life than this? May not this wonderful little sundew, for instance, be closer to animal intelligences than we incline to suppose? Swinburne thinks so, for this is what he says of it in one of his poems, those poems which are like the image in Nebuchadnezzar's dream—part of fine gold and part of clay:

> "You call it Sundew; how it grows,
> If with its color it have breath.
> If life taste sweet to it, if death
> Pain its soft petal, no man knows:
> Man hath no sight or sense that saith."

XVI.

ORCHIDS.

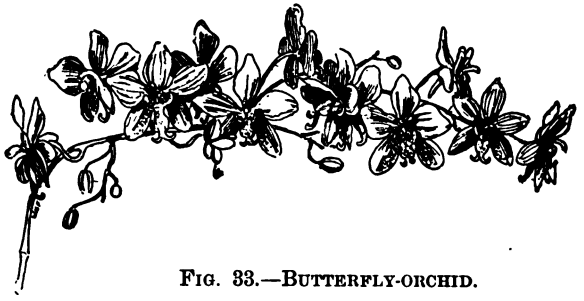


FIG. 33.—BUTTERFLY-ORCHID.

A DISPLAY of orchids is like a floral fancy-dress ball. The blossoms seem to be masquerading. The characters which they assume have been suggested by their insect friends and admirers, and they are gotten up in costume as bees, moths, and humming-birds.

Soberly speaking, orchids are the strangest-looking of flowers, and their outlines suggest the forms of living things. Fancy has followed out these hints, and thus the blossoms get credit for being better mimics than they are. The "spider" (Fig.

FIG. 34.—SPIDER-PLANT (*Odontoglossum cordatum*).
(After drawing in *Demorest's Magazine.*)

34) and "butterfly" orchids curiously resemble the insects after which they are called; but the "bee," "frog," and "lizard" orchids were named by some one very clever at tracing resemblances.

We can all see in the "swan-flower" the shape of a bird with long arched neck and partially expanded wings; but whose was the vivid fancy that found among the petals of the "owl" orchid anything like the round eyes and solemn face of Minerva's feathered attendant?

One member of this strange family is like a large, gorgeous, spotted butterfly. The "baby" orchid cradles at its heart the tiny image of an infant in long robes. Some blossoms have an elfish look of malicious shrewdness, yet close to their little mocking faces there may bloom, fair and ethereal, the flowers of the "Holy Spirit" orchid, with a snow-white dove in each flower.

The blossoms of some are held aloft like banners; those of others droop like chimes of fairy bells. One variety bears flowers several inches long; those of another sort are so minute that the cluster resembles a head of blossoming grass. The plants are adorned with royal profusion: one bore at one time three hundred and seventy-eight flowers, and we read of an Australian orchid

glorious with forty thousand blossoms! Every hue of the rainbow is found among them, and some that the rainbow has not.

The family is divided into two great classes. "Terrestrial" orchids are of the earth, earthy, and grub a living in the soil, like any humdrum cabbage. The second division bear the strange name of *Epiphytes*, a Greek word meaning growing upon other plants; these do not penetrate the bark of their vegetable hosts, nor feed upon their juices. They are not boarders, only lodgers.

They require no sustenance except what they draw from the atmosphere—gases, sunshine, and vapor. All they ask is a home. In their native climates they live on the branches of trees, forever suspended, like Mahomet's coffin, between heaven and earth. In the orchid-house they grow upon bits of bark or cross-sections of small trees, which hang from the roof by wires, and from these great sprays sweep downward, bearing dozens of strange and exquisite flowers.

But what is an orchid? Not a floral eccentricity, for some members of the family, to a casual glance, show no peculiarities to distinguish them from other flowers; not a plant living in and on

the air, for the terrestrial orchids would not thrive on such ethereal food any better than we would.

Orchids are members of one great family. At first they appear very diverse; but closer examination shows that they are all formed on a common plan, and they are all descended, naturalists think, from a common ancestor. The founder of the family, which lived ages ago, was a flower something like a lily, with three outer and three inner flower-leaves. Six flower-leaves are still worn by every member of the tribe, but one of these is always peculiar in form. Sometimes it is prolonged into a cornucopia, full of sweets for the expected moth or bee; sometimes it is like a pouch; and sometimes it projects in front of the flower, making a platform for the insect to alight upon.

The seed of the orchid can only be quickened by pollen brought from another blossom, or, better still, from another plant altogether. The undeveloped seeds will not be perfected at all by aid of pollen from the same flower; indeed, in some instances it blights them and acts almost as poison.

Insects are the messengers which carry the life-

giving dust from one orchid to another, and the strange forms and gorgeous colors of the flowers are worn to lure these desired visitors. The winged caller finds the domestic economy of the orchid different from that of other flowers. The pollen is stored in two long deep pockets, which botanists consider as one great double anther. The pistils appear as two gummy patches on the blossom's face. The pollen is not loose like meal, as in most flowers: it is collected into lumps, and a number of these lumps are tied together, by elastic threads, into a pear-shaped bundle, which is fastened to a sticky button. This button is placed just where it will be sure to adhere to the head of any insect that calls for honey.

All these peculiarities of structure can be plainly seen in the beautiful "greater green orchid" (Fig. 35), which grows wild along the shores of Lake Superior and in the Alleghanies. No bee or wasp can reach down to drain the honey-tube of this flower, for it is over an inch long. Indeed, we have hardly a butterfly which can extract the sweets from this deep cup which Nature fills and reserves for the night-flying sphinx-moths (Fig. 36). Some of these have been caught with a remarkable object on each great eye: the pollen-

mass of the orchid with its stalk and gummy button, the latter clinging fast to the moth's eye.

How did it get there? When the moth called for refreshments, she alighted on the lip which

FIG. 35.—GREATER GREEN ORCHID (*Habenaria orbiculata*).

projects before the entrance to the flower-tube, offering, like the roomy porches of the old inns, a mute invitation to the passing wayfarer. Standing there at ease she reached into the long pocket,

in the depths of which she hoped to find some honey. As she did so, her large, projecting eyes were pressed against the sticky buttons, which

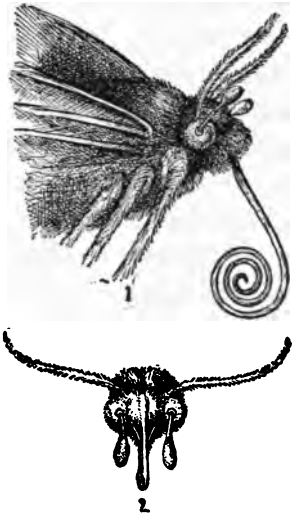


FIG. 36.—1, SIDE VIEW OF HEAD OF SPHINX-MOTH, WITH RECENTLY ATTACHED POLLEN-MASSES. 2, FRONT VIEW OF THE SAME, WITH PENDENT POLLEN-MASSES.

were in position, one on each side of the mouth of the honey-tube. When she raised her head and departed, the buttons, with their attached pollen-masses, were carried away bodily.

Were the moth's eyes like ours, a sticking-plas-

ter clinging to the organs of vision would seriously impede her future operations; but each of her great compound eyes is composed of thousands of smaller ones, so that even when some are temporarily blinded she has plenty left to guide her with her load of pollen to another flower.

It seems evident that the pollen-mass will only be pushed against the next pollen-pocket. How, then, can the life-giving grains reach the spot Nature has prepared for them? "This is effected," says Darwin, "by a beautiful contrivance. Though the sticky button remains firmly glued where it first took hold, the stalk which bears up the pollen-mass has wonderful powers of contraction." The pollen-masses of some varieties of orchids move downwards and outwards, those of other sorts hang like plummets, and those of yet other varieties move downward and at the same time converge like the sides of the letter V. They make these movements in about thirty seconds, and in every case they place themselves so that by the time the insect has flitted to another flower of the same sort the pollen-masses are exactly in position to strike the stigmas of that flower. "A poet might imagine," says Darwin, "that while the pollen-masses are carried through the air they

voluntarily and eagerly place themselves in that exact position in which alone they can hope to gain their wish and perpetuate their race."

So viscid are the buttons to which the pollen-masses are attached that they stick firmly to whatever they touch. Moreover, the gum has the quality of setting hard, like cement, in a few moments, so that when the insect withdraws her head after drinking her fill, one of the pollen-masses at least is firmly glued to her.

But why do not the button-shaped disks glue themselves to the spot where they grow? Nature has provided against this mischance also. As they rest in their birthplace in the flower, before the insect calls for them, they are set in a sort of bath which keeps the gum soft and prevents the disk from fastening itself to the place where Nature does not mean it to stay. When the insect carries the pollen-bundle to another flower and presses it against the stigma, some of the cobwebby threads which bind the golden grains together break. Perhaps the moth leaves but a small donation here and carries the rest of her load to another flower; so the mass of pollen is borne from blossom to blossom, and every grain is turned to good account.

A lifetime might be spent in studying this one family of plants; and a volume might be filled with tales of the many strange modes in which orchids compel insects to work for them. It has been said that "moth-traps and spring-guns set on these grounds" might well be the motto of these flowers. There are channels of approach along which nectar-loving insects are surely guided, so as to bring them exactly to the spots "where they will do the most good." There are adhesive plasters nicely adjusted to fit their proboscides or catch their brows so as to unload their pollen-burdens. Sometimes, exactly in the gangway to the honey, there are hair-triggers communicating with explosive shells that project the pollen-bundles, with unerring aim, upon their bodies. Lastly, in many species the petals project and form a pent-house which protects the pollen and the gummy stigmas from the rain.

Recently Fashion has interested herself in these fantastic flowers, and wealthy owners of hot-houses have grown reckless of the "almighty dollar" when a rare or new orchid can be secured. A plant valued at one thousand dollars has been exhibited in New York, and florists have none at a lower price than five dollars. One orchid cost a

wealthy lady three thousand two hundred dollars, and is surely the dearest flower on record since the days when the usually frugal Hollanders went tulip-mad and would expend a fortune for a root.

It is refreshing to learn that, after all, the cheaper varieties can be depended upon to furnish the most flowers; for they will bloom yearly with proper care, while some costly orchids flower but once in three or four years.

After reading of the toils, risks, and difficulties of orchid-collecting, one only wonders that the plants are so cheap. The regal flowers are natives of the tropics, and those who gather them must go into the most unhealthy parts of fever-breeding lands, and pursue their labors where food is scarce and where no comforts of civilization can be obtained. They are wet through day after day for weeks. One zealous searcher is reported to have waded for a fortnight up to his middle in mud. When we consider that these fatigues and privations are endured in moist forests, at the season when deadly exhalations are rising under a tropic summer sun, we cannot wonder that many orchid-seekers have lost their lives.

But to discover a new orchid is but the beginning of difficulties: it must be secured, packed,

and transported through the sweltering lowlands to a shipping-place. Before the plants start on their travels they are picked over, and damaged specimens or pieces rejected, as they would decay on the long, hot journey to the sea, and spoil the rest. The survivors are fixed with copper wire on sticks which are nailed across boxes for transportation. The exquisite South American varieties are brought down the Amazon on flat-bottomed steamers. The boxes containing them are piled on deck and covered with blankets, a thatch of palm-leaves is laid over these, and all day long the pile is soused with water.

Even when the precious cargo has at last reached the Atlantic in good condition, the collector's troubles are not over. Not unfrequently the plants which have cost so much time, money, danger, and fatigue die on the voyage. In one instance only two plants survived out of a consignment of twenty-seven thousand; and English importers of orchids have paid large sums for freight on cases which when opened were found not to contain a living thing.

Orchids imported in this manner are of course very costly. The cheaper and more familiar varieties are not immigrants, but Americans by birth,

FIG. 37.—"LADY'S-TRESSES" (*Spiranthes gracilis*).
(After drawing in *Demorest's Magazine*.)

having been raised in the hot-house from cuttings. Some pretty terrestrial orchids, northern cousins of these tropic queens, may be found in our country walks. The one who seeks them must be stoutly shod, for they are partial to peat-bogs, damp woods, and moist meadows. The little *Spiranthes,* or "lady's-tresses" (Fig. 37), is common in low-lying fields. The white flowers seem to have been strung into a chain and then wound, corkscrew-fashion, around a green wand. In latter May we may find the beautiful wild "lady's-slipper" (Fig. 38). "Our Lady's slipper" our English forefathers called it, while to the French it is "the Virgin's sabot," and to the Indians "moccasin-flower." One sort is pale yellow, another is rosy purple mingled with white. Both are so showy and lovely that the lucky finder can seldom resist the temptation to pluck them, and thus they grow rarer year by year.

Botanists tell us that orchids are the most highly organized of all flowers; florists say they are the costliest; our eyes assure us they are the most gorgeous; and thus they have a triple claim to the title of the "royal family of plants." Nevertheless one of their majesties is "in trade,"

FIG. 38.—LADY'S-SLIPPER (*Cypripedium niveum*).
(After drawing in *Demorest's Magazine*.)

—is, indeed, connected with the confectionery business, for vanilla, used in flavoring, is extracted from the seed-pod of a tropical climbing orchid.

XVII.

AMONG THE LATE WILD FLOWERS.

AN anecdote tells us of some one who, like Shelley, loved the skylark, but—he loved it *in a pie.*

Many persons love flowers with a like devouring passion, and pluck them so unsparingly that some of our sweetest and fairest sorts are being fairly appreciated off the face of the earth. The spoiler "makes a clean sweep" of them whenever and wherever they are found. None are left to go to seed, and the species will soon be killed off like the buffalo.

To the real lover of nature a flower loses half its charm when it is taken from among the lovely and appropriate surroundings which enhance its beauty as the setting of a gem shows off the gem. When the fair thing lives so short a time at best, he will not willingly hasten its death, and he knows that some flowers must be left to go to seed or we shall have none at all next year.

The insatiate picker, at thought of whom we

fancy the flowers must shake on their stalks and cower under their leaves, is fast exterminating the fairest of our autumn blossoms, the fringed gentian which Bryant loved and praised. We fear that there are now only a few favored localities in which it is still, as Professor Gray says, "rather common." But we may come upon it in some September ramble, growing in a meadow close to the border of a quiet stream.

It is of that color rare in vegetation, real blue. Most flower-blues incline to purple; but this is, as Bryant tells us, the tint of the upper part of a clear summer sky. The bell-shaped corolla is raised upright like a vase, and the edges of the petals are delicately fringed. The length of the blossom is about two inches. A smaller sort of gentian, with petals less deeply fringed, grows in moist meadows in the Northern and Western States; and these two varieties have a plainer cousin, the five-flowered gentian, which we may find in dry, hilly woods. This has several stems, each about a foot high, and smooth, shining, dark-green leaves; and about five pale-blue flowers, which are always partly closed and which never seem more than half-awake, are clustered on the top of each stem.

In August and September, country roadsides are gay with the blossoms of "bouncing-bet," or common soapwort. They are in shape like single pinks, and grow in large bunches. Their color varies from white, through delicate, faint shades of pink, to rose-color. Bet blushes so often and so prettily that it is rather hard to call her by that equivocal term "bouncing." The blossom is so deep that not even a bumblebee can reach the honey, which is accessible to butterflies alone. It is nearly related to our garden-pinks and carnations.

The leaves of the plant are dark and smooth. The stems contain a gummy juice which makes a lather when it is mixed with water, and this is why our English cousins have given the plant the unpoetical name of "soapwort."

It has crossed the Atlantic to us, faithfully followed us from Maine to California, and liked us well enough, on the whole, to wish to become a naturalized resident of the United States.

In rocky or mountainous country in late summer we find the lovely campanula (Fig. 39). It is often called bluebell, but it is in reality the harebell of the Scottish poets and another fair immigrant from the Old World. The branching

FIG. 39.—HAREBELL (*Campanula rotundifolia*).

stalks are very slender, and the leaves narrow and grass like. The plant swings its dainty blossoms from rocky ledges wherever it can find a cranny for its delicate roots. The purple-blue drooping bells nod provokingly just at that part of the cliff where one cannot reach them from above or clamber after them from below. They cling to the sides of those Catskill cliffs on which are perched the Overlook Hotel and the Old Mountain House. They fringe the islands and parts of the rocky shores of Lake Erie, growing where they are continually wet with dashing spray. It is wonderful to see them sustaining their frail lives there—dainty, slender little things!—where winds and waves often rage furiously and where many a boat has gone to pieces. They are visited, and probably fertilized, by great brown and golden butterflies, and rowers meet these enterprising honey-seekers flitting from island to island, across the open lake, and far from any shore.

This gorgeous visitor will find the honey he seeks at the base of the bell-shaped corolla. Perhaps we can secure a nearly-open bud without running too great a risk of broken bones or a watery grave. If we split it down lengthwise with a sharp penknife, we shall see that the stamens in

a close ring surround and clasp the pistil, which is no longer than they are themselves. In this position the anthers split down the inner side and shed their pollen, which remains sticking to the top of the pistil. Then the anthers, having done their work, shrivel away, and we shall find, even in a newly-opened flower, that they have shed their pollen and shrunk to mere little threads. It looks as if the harebell pistil, at least, meant to set its seed by the aid of pollen produced at home. But it will not use any of the golden dust which the stamens have bestowed upon it so liberally, and unless its wants are speedily and exactly attended to it will not set any seed at all.

On the inner surface of the corolla are little scattered, stiff hairs. "Insects visiting the flower for the sake of the honey," says Sir John Lubbock, "do not, as far as I have observed, generally walk on the petals, being deterred by the stiff hairs which are scattered on their inner surface. In any case, however, they are almost sure, sooner or later, to clasp the style, when they necessarily dust themselves with the pollen."

When the pollen has all been removed, and carried off to other flowers by the bees and the butterflies, the pistil separates at its tip into four

parts, and spreads abroad, in the form of a Greek cross, four sticky little arms. These have till now been all raised upright and pressed together, so that the sticky (or stigmatic) surfaces were inside and covered up. They had no use for the home-made pollen, and "studied to avoid" coming in contact with it. Now that it is all gone, the pistil spreads its arms abroad to receive by some winged messenger a gift of pollen from another flower.

The cardinal-flower, *Lobelia cardinalis*, is another beautiful autumn blossom which, we fear, will soon be exterminated, "loved," not into, but out of being. In fields around our town, where it was once plentiful, it is no longer to be found. The blossoms, of rich, deep "cardinal" red, grow on a long, leafy spike, and the lower ones open first. The corolla is curiously split all along the upper side, and through the rent an odd-looking beak pokes up: this is the group of stamens, all joined in a tube around the pistil. The long leaves are shaped like lance-heads and toothed along the edges.

The artist who makes studies from nature will do well to seek this glorious lobelia. A flower more effective for decorative work could scarcely be found, and being uncommon, except in a few

favored regions, it is seldom represented, and hence something of a novelty. It must be sought in moist, shady places and along the banks of brooks.

The great blue lobelia, a near relation, is fonder of the sunshine. The flowers of this meadow beauty are bright blue, touched with white, and are mingled with leaves and crowded down the sides of a sturdy, hairy stem.

In marshy meadows and along brackish ditches marsh-mallow opens its beautiful flowers. They are of a lovely rose-color, several inches broad, and in form like our garden hollyhocks. In August and early September they adorn Hackensack meadows in profusion. A recent writer prettily compares this flower to a rosy country beauty, glad in her innocent youth and glowing health, and loving to tell with smiles and blushes how she is admired. If we are shod so as to be able to secure a mallow without the discomfort of soaked feet, we shall see that the stamens and pistils have literally and metaphorically formed a club, for the many filaments and anthers are all united into one smooth, stout stalk. At the top of this is a tuft composed of the many stigmas and anthers. The whole affair is like the small brushes used to clean the insides of bottles. The hollyhock and the

rose of Sharon have the same peculiarity of structure. A gum extracted from the roots of the marsh-mallow is used in flavoring those soft white candies dear to our childhood.

"Beechdrops" will be found in beech woods. The whole plant, flowers, stems, and all, is in pretty delicate tints of cream-color, straw-color, and golden brown. Little scattered scales with yellow or brown edges take the place of the leaves with which the plant is no longer endowed. For, prepossessing though its appearance may be, this is a worthless character in the vegetable world—a mere idler and hanger-on, too lazy to support itself. It chooses rather to levy contributions from the beech-roots, and is at this very moment shamelessly robbing that much-enduring tree.

Botanists recognize nine or ten species of these "root-parasites," all alike destitute of green foliage. The most familiar of them, to non-botanists, is the Indian-pipe, called also "ghost-flower," "corpse-plant," and "pine-sap" (Fig. 40).

It is found in rich dark woods, often nearly buried in fallen pine-needles or last year's decaying leaves. The whole plant is white and waxy-looking; the six parted flowers, which bend down from the tops of stalks five or six inches long, are

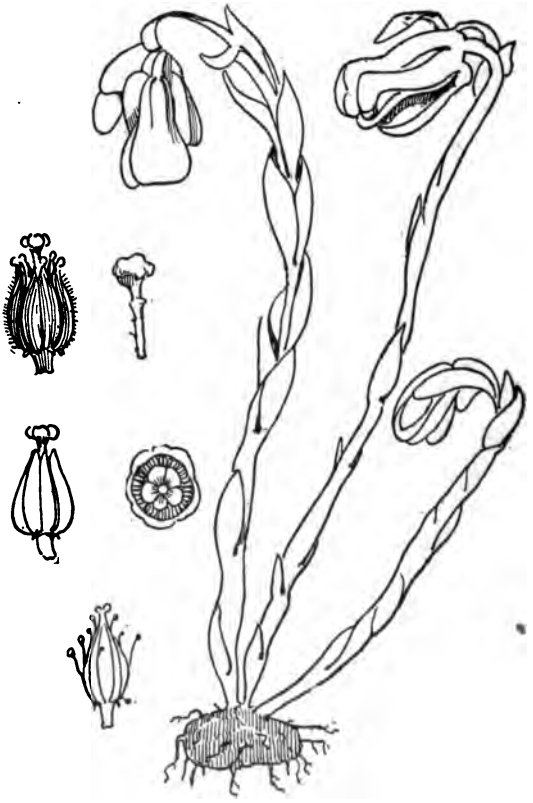


FIG. 40.—INDIAN-PIPE (*Monotropa uniflora*).

also white and waxy. They begin to turn black if subjected to the action of sunlight. Sometimes this plant lives, like a fungus, on decaying vegetable matter; but oftener it fastens itself to the root of a tree and sucks away its vital juices, as a leech sucks the blood of an animal. Well may the flower bend its head when it knows that its way of getting a living is so dishonest!—though the white, unwholesome look of the plant seems to show that, after all, it has not found dishonesty very profitable. On the stems are scattered scales, which are substitutes and apologies for leaves.

An honest, hard-working plant, which grubs for its own living, contains in stem and leaves a substance called chlorophyl. By this the plant is enabled to digest what it gathers from earth and air, and chlorophyl is ornamental as well as very useful; for to its presence is due the vivid green of leaves. But the lazy Indian-pipe, instead of making vegetable juices for itself, steals them already prepared from the tree-roots. So the chlorophyl which the members of this family once had and did not use has been taken from them. "From him that hath not shall be taken away" is as true in the natural as in the spiritual world.

Long ago the ancestors of these parasites forsook

the paths of industry and rectitude, and began to eke out their living with stolen food, sucked, ready prepared, from the tree-roots. The leaves, which are the plant's digestive organs, had less to do in consequence. Fewer and smaller ones were needed to do the plant's work, and so, through many generations, they dwindled and shrivelled, and the broom-rape and Indian-pipe became more and more addicted, partly from sheer force of necessity, to evil practices. Alike in the animal and in the vegetable world, unused organs shrivel away. Thus fish living in the dark pools of the Mammoth Cave have in the course of generations become blind.

The pretty eye-bright of our New-England States has, as we have seen, entered on a course of parasitism, and its roots already draw nutriment from the roots of whatever grasses and herbs happen to be near neighbors. "It does so little harm in a meadow," says Grant Allen, "that farmers scarcely recognize it as an enemy at all. But this we fear is but the initial stage of a downward course."

Evil tricks will become easy because often indulged in, and then they will be indulged in again because they are so easy. This is the devil's circle

which exists both in the natural and in the spiritual world; and thus in organisms, as in souls, the unjust are unjust still and the righteous are righteous still.

XVIII.

THE HAPPY AUTUMN FIELDS.

THE crowning labor of a plant is to form, vitalize, mature, and distribute its seed. For this end the buds form and the blossoms blow. The shape of the flower, its color, and its time of opening are all so arranged as to secure the fertilization of the tiny immature seeds. This object attained, the flower withers and falls.

The plant, however, has yet a work to do, for the seed must be nourished till it is old enough to be turned out on the world to shift for itself. When this is done the plant's summer labors are over; and the growing things fade through the autumn days, not so much because early frosts have nipped them as because their work is done.

If we take up a box full of the mignonette, which has bloomed all summer in the garden border, it will survive its outdoor companions and perhaps bear a few blossoms; but there will not be again such profusion of sweet flowers as we enjoy in July and August.

The strength of the plant has gone into its summer flowers and into the seeds stored in numerous little green and brown pockets. The apple-trees have put their energies partly into the flowers which whitened the orchards in spring, partly into the fruit "pleasant to the eye and good for food."

Now they lay aside their green robes and prepare for a long rest.

Every gardener knows that a plant cannot grow all summer, and all winter too, for many successive seasons.

Greenhouse plants screened from cold must have their time of rest, and florists artificially produce a dormant state in their charges by keeping them in semi-darkness and partially depriving them of water.

The dry season of the tropics, like our winter, prevents vegetation from exhausting itself by continuous effort.

Evergreens have a time of lusty growth and blossoming in spring, and for the rest of the year merely "hold their own."

The botanist's view of autumn is a cheerful one. He knows that next spring's leaves are already formed in the tiny brown buds which stud the denuded trees, and under the bark is stored nour-

ishment on which they will feed while they do their growing next spring.

The thrifty trees, before casting away their leaves, save from them some material to be "worked over" and used again. The frame or skeleton of a leaf is a network of delicate veins; the spaces between these veins are filled in with countless cells, set almost as close as those of a honeycomb, and full of clear jelly (Fig. 41). In

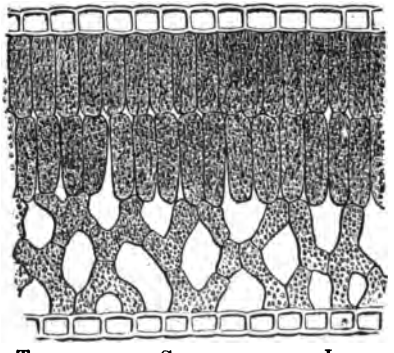


FIG. 41.—TRANSVERSE SECTION OF A LEAF, SHOWING THE STRUCTURE.

(From *The Vegetable World.*)

this float tiny grains of a substance called chlorophyl, numerous enough to give their color to the whole contents of the cell, as the grains in lime-water give their whiteness to the water. Then

over the whole leaf—veins, cells, and all—is stretched a very delicate, perfectly transparent skin.

The office of the chlorophyl in the economy of the plant is digestion. By its action dead or mineral matter is changed into living vegetable tissue. Thus the plant does its digesting in its leaves, which we may regard as so many little stomachs.

Chlorophyl is only formed under the action of sunlight. Leaves which have lived in a dark place have been able to make but little and hence are pallid. Celery leaves and stalks, grown partially under ground, are almost white. When a plant which has been struggling for life in a cellar is brought to the sunshine, chlorophyl at once begins to form in the numberless leaf-cells, and as this process goes on the foliage grows hourly greener.

We have all noticed the bright colors of newly unfolded leaves. When spring showers coax up the young beets, they appear with deep rose-red foliage, making their *début* in apparel as gorgeous as that of Lady Peony, whose first leaves are of much the same rich hue. Budding willow-leaves are golden green, almost yellow. Young maple-leaves are purplish red. Indeed, scarcely any of

the tender foliage which appears in April and early May is really green.

Even in latter July the tender tips of growing shoots are often purple, red, or pale yellow-green. These rich hues of young foliage are due to the absence of chlorophyl. As the unfolding leaves spread out more and more surface to the sunlight, green chlorophyl is rapidly developed within them, and they assume their true color and their active life. The tender leaves of spring, red, yellow, and purple, are leaves into which chlorophyl has not yet come. The red, yellow, and purple autumn leaves are leaves from which the chlorophyl has been withdrawn.

"What falls in autumn," says Grant Allen, "is not the living part of the leaves; it is only the dead skeleton, empty cells, and stringy fibre. The active protoplasm (that is, the jelly in the cells) and green chlorophyl from each cell of the leaf moved slowly out, with strange, groping, serpentine motions, at the first autumn frosts, and stored themselves up securely in the permanent tissues of the stem. All winter long these living principles of the dead leaves remain stored up within the trunk or branches, and when the sun returns to us again they are pushed up anew into

the bursting buds, and go to form the young leaves of the new year."

Of course, the material withdrawn and saved this fall will not by any means be sufficient to fill and color all next summer's leaves. Each leaf that drops this autumn leaves behind it a bud capable of unfolding into a pair or cluster of leaves. The spring leaves will be started in life with materials saved up for them by the thrifty trees, but will soon have to go to work to form more protoplasm and more chlorophyl for themselves.

Underground in bulb and root-stock rich food is laid by for next spring's flowers.

The iris, Solomon's-seal and trillium, and many varieties of lily have even formed next year's leaves. They lie curled up underground asleep, ready to issue forth as soon as the sunshine and the south wind shall come to awaken them.

But sad to relate, some spring flowers seem so eager to appear in their new dress that they cannot wait till the proper time to don it. Their materials are close at hand and their "spring styles" alter not. The autumn sunshine beguiles them, and some bright day they come too soon into a world unfit to receive them. I have found

yellow star-of-Bethlehem, a May blossom, in latter August, crocuses in October, and violets after Thanksgiving. Fall rains sometimes coax the dandelions to smile once more, and wild strawberries sometimes flower abundantly in late autumn. A few such mistaken blossoms, "born out of due time," and the gay denizens of our garden-borders which are not acclimated here, are the only flowers really killed by frost. Poetic fancy laments the fate of the beauties laid low by the pitiless north wind, but Nature does her best to prevent any such wholesale slaughter of the innocents. Our native plants are exactly adapted to the climate in which they live. Their programme is so arranged that each and all have time to finish their pretty performance before winter arrives to silence the bird and insect orchestra, dim the lights, and take away the decorations of earth.

Some plants—the "annuals"—never awaken from their winter sleep. One brief summer is their span of life. But these are only a small proportion of the vegetable world, and even these, before summer is ended, have attained their full growth, brought forth flowers, and set and ripened their seed. They have fulfilled the end for which they were created, and lived their life to its close.

They fade slowly through the bright early autumn days, not because the first frost has blighted them, but because old age has come upon them and their work on earth is done. Where each blossom died there is left a seed, or perhaps a little pocketful of seeds, each a prophecy and a pledge of the flowers that shall gladden the earth next year. The possibilities of sweetness and beauty are hidden under their small brown coats as surely as "the music of the moon sleeps in the plain eggs of the nightingale."

There will be many blossoms next summer for each that has faded this year, for, in the words of Hugh MacMillan, "Nature's graves have not more of ending in them than of beginning."

XIX.

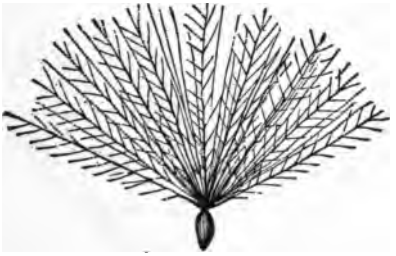
SEEDS ON THEIR TRAVELS.

The seed which dies
That it may live, laughing with lightsome blade
Death's dread away.—*Edwin Arnold.*

THE plant not only gives birth to the seed, nourishes it, protects it, and matures it: like a wise and loving parent it takes care to place its children advantageously in life, and screen them as far as possible from coming dangers. Some of the humblest plants act as if they knew all about the rotation of crops—which, indeed, was patent to the weeds long before it was discovered by the farmers.

Nature in many cases takes great care that the seed shall find its way to "fresh fields and pastures new," instead of dropping close by the roots of the parent plant into an exhausted soil. The thistle, milkweed, and dandelion provide their seeds with little tufts of down which fly before the lightest breeze and in autumn gales must travel fast and far (Fig. 42).

The seeds of maple, elm, and ash, of the trumpet-creeper, and of the pine-tree are made buoyant



Thistle.

Cotton.

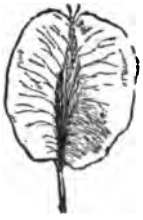
Valerian.

FIG. 42.—PLUMED SEEDS.
(From *The Vegetable World.*)

with papery, outspread wings (Fig. 43). These winged and tufted seeds are found only in fruits that split open at maturity. They are produced by a great number of plants, and every puff of

autumn wind carries along a mixed company of such tiny travellers.

Maple.



Elm.

Pine.

FIG. 43.—WINGED SEEDS.
(From *The Vegetable World.*)

By means of little claws and hooks some seeds are enabled to cling tenaciously to the hair of

cattle and dogs, the wool of sheep, and the clothing of persons forced to lend unconscious or unwilling help to the burs' or "stickers'" schemes for placing themselves in life. By the time we discover the imposition that has been practised on us by the weeds, we shall probably have gone some distance from the place where the shooting-coat or tramping-dress was utilized as a means of conveyance by the clawed pests. We pick them off, and probably throw them into fresh soil some distance from the spot where the parent plant grew, thus aiding nature's plans, and distributing the weed still wider. The "stickers" which cling to the coats of animals will by and by be rubbed off and dropped to the ground.

The garden-balsam, or "lady's-slipper," has yet another scheme for putting her children out upon the world. At the least touch the ripe seed-vessel curls up elastically, shooting the seeds away in all directions. The pod seems to jerk itself away as if it resented being meddled with. Hence the balsam has its Latin name *impatiens* (impatient), and its old English name "touch-me-not." The squirting cucumber, when ripe, shoots out, as from a syringe, streams of juice mingled with seeds.

Some plants insure dissemination by inclosing

hard or bitter seeds in a covering "pleasant to the eyes and good for food." The peaches, which make such wealth of beautiful color on the fruiterer's stalls, may have been brought a long distance for the sake of the luscious flesh around the "pip," or seed. When the peaches are eaten, the stones may be thrown to some spot where they can settle down and grow. Peaches have thus travelled "on their good looks" and sweetness all the way from Persia, where the family originated. The plum and the cherry have paid their way across Europe and the United States in the same manner.

Oranges, limes, and lemons are carried all over the country for their refreshing juices, and when the fruit is used the nauseous seeds are sure to be thrown away.

Apples, pears, and quinces surround their hard, uninteresting little seeds with a nourishing pulp overlaid with fair colors.

Rose-hips, the fruits of bitter-sweet and mountain ash, and all the pretty shining berries which bead the autumn hedgerows, are gotten up to attract the attention and please the fancy of birds with a view to getting their seeds sown. "Omnivorous birds," says the great French botanist

De Candolle, "often search for fruits containing little, hard, indigestible seeds, such as grapes, raspberries, strawberries, asparagus, etc.; it appears that small seeds can traverse the alimentary canal without alteration. When these birds are migratory, which is often the case in temperate and northern regions, they carry the seeds to a great distance, particularly when in autumn they leave northern climates to seek the sunny south."

In all the modes of seed-distribution already mentioned, nature assists. They are, as it were, regular routes, or modes, of vegetable travel. Besides these there are a number of curious accidental ways by which a species may be spread over a wider and wider area. Seeds may be contained in the little balls of earth which often cling to the legs of birds. Darwin raised eighty-two plants from one ball of dry mud which had clung to the leg of a partridge. "With such a fact before us," he says, "can we doubt that the many birds which are annually blown by gales across great spaces of ocean, and which annually migrate—for instance, the millions of quail across the Mediterranean,—must occasionally transport seeds in dirt adhering to their feet and beaks?"

Nuts growing near river banks may fall into the

stream, float out to sea, and be washed up by currents on other shores. The cocoa and cashew nuts, and the seeds of the mahogany tree, are known to have made long voyages in this way. Estimating the average rate of Atlantic currents at thirty-three miles a day, Darwin calculated that many sorts of seed would still have life in them after floating across nine hundred miles of sea. Several sorts, he found, survived soaking in salt water for a hundred and thirty-seven days. On the Hebrides and on the northwest coast of Scotland Charles Kingsley found plants which he thought must have grown from seeds brought across from America by birds or ocean currents. Waifs from the western world are every year washed up by the gulf-stream on the shores of Ireland, Scotland, and Norway. Seeds have also floated long distances lodged in the crevices of driftwood. Many of these will wash up on barren sands or on coasts where the climate gives but a cool reception to a wanderer from the tropics; but of the number of seeds which take voyages each year some will surely get a chance to grow.

If the voyage is but a short one, and if the change of climate is not very great, the chance to grow is of course all the better. Seeds from a

wide area are every autumn washed or dropped into the great lakes, and carried down the stream of the Niagara River. Some settle down and grow on the islands just above the falls, but in this much-visited neighborhood every pretty or conspicuous blossom is sure to be plucked as soon as it expands. But down the river's gorge, below the falls, there is a happy hunting-ground for botanists, where the picnicker ceases from troubling and where the excursionist never comes.

Plants also travel far by the unconscious agency of man. They may be brought over seas in the clothing, among the bedding, or clinging to the tools of emigrants. Some of our most troublesome weeds are from Europe, and may have effected an entrance into the country in these ways; or perhaps their seeds accidentally got mixed with those of vegetables and grains brought by the first settlers. Ballast-heaps near seaport towns are favorite hunting-grounds for botanists, and in these spots introduced plants are often found.

At the edge of the river Lez, near Montpellier, in France, American wools are cleaned before they are sold to the cloth-makers. Seeds of American plants which have been brought in these fleeces have sprung up in the environs of Montpellier; so

that botanists have found, in this small place in South France, many flowers belonging to the landscapes of Mexico and Buenos Ayres.

A little island in Tierra del Fuego was found to be almost covered with a growth of "shepherd's-purse," a weed well known to English farmers. It seemed impossible to account for the presence of this green stranger. A naturalist at last found that the weed had its headquarters around the grave of an English sailor who had died aboard a passing vessel and been buried by his messmates on this lonely island. The weed must have descended from a seed or seeds which had clung to the spade used in digging the solitary grave.

Seeds may be carried from place to place mixed with the earth used in making roads or railway embankments. Wherever a certain sort of gravel has been used, for instance in making repairs on the Cincinnati, Hamilton, and Dayton road, the edges of the track are each spring decked with a very pretty spurred violet not to be found in any of the adjacent woods and meadows.

The movements of armies are apt to have the result, unthought of by commanders-in-chief, of spreading plants. Some fresh species were introduced by the Germans into France; and at least a

dozen kinds, notably the scarlet poppy, were brought by Roman invaders into Britain.

New plants are apt to enter a country, as human immigrants do, by the railroad. Seeds may be raised by the wind the train makes in passing, and may then cling to the platforms of cars. They may be mingled with the litter on the floors of freight and cattle cars, and brushed out when (if ever) the cars are swept; or they may cling to freight and be dropped when it is deposited at its destination. This is why new flower-faces smile provokingly at us as we look and long from the window of a rushing train. They may be new settlers which have not yet spread far from the track.

They never seem to grow near the depot, unfortunately, because that "other" who gets so many of the good things of life has picked any that were within easy reach.

There is a natural rotation of crops, as yet little understood. Where a pine forest has been cleared away, oaks come up; and a botanist can tell beforehand just what flowers will appear in the clearings of pine woods. In Northern Ohio, when a piece of forest-land is cleared, a particular sort of grass appears. When that is ploughed under, a

growth of the golden coreopsis comes up, and the pretty yellow blossoms are followed in their turn by plebeian rag-weed, which takes possession of the entire field. In Central California a "complementary crop" of wild oats comes up of itself where wheat has been grown the previous summer.

Sometimes a plant will appear in a certain section of the country, occupy the land for a while, and then vanish as mysteriously as it came.

A piece of forest land in the Adirondacks was swept by a devouring fire. In the luxuriant vegetation which after a while sprung from beneath the ashes was a great growth of young wild cherry, though there was no tree of the sort within thirty miles, and had not been, the natives said, for years.

Recent discoveries go to prove that a plant takes in from rain, air, earth, and sunlight more nourishment than it needs. This waste matter, which is hurtful to the plant, is constantly being cast away by the root. Soil in which one sort of tree has been growing for years becomes, after a while, unfit to support that particular tree, though well able to sustain one of another sort. In ground where wild cherries have long grown, for instance, the minerals which wild cherries especially re-

quire have been largely used up, and this exhaustion of the soil, with the waste from the roots, has unfitted the earth for supporting other trees of the sort, while an oak or pine might grow and prosper there.

The young trees which appeared so unexpectedly after the Adirondack fire probably sprung from seed which fell long before on soil which had supported growths of wild cherry till it was unable to nourish any more trees of the sort. They lay latent, biding their time. "All things come," says the French proverb, "to the man" (or the vegetable) "that knows how to wait." Slow natural processes restored the lost elements to the soil, fitting it to meet again a wild cherry's needs. Then fire "made a clean sweep" of the green things in possession of the field, and there were air and sunshine and "elbow-room" for the seeds which had waited so long.

There is something almost magical in the appearance of new plants in a spot which circumstances have fitted for their reception. A pond is made in a meadow, or the surface of the land is artificially altered so that there is a wet spot caused by drainage. Before many seasons have passed away, the new body of water is surrounded by

those flowers which love to keep their feet wet, iris, jewel-weed, bur-marigold, and loose-strife. The seeds of these plants were probably dropped into our meadow just the same when the ground was dry and unfit to nourish them. Then they must have perished, as countless thousands of wandering seeds do every year.

The pretty *Primula mistassinica* or drip-primrose grows always and only on broken shale, under slowly-dropping water which trickles over limestone and brings down a little lime in solution. If the water oozes too slowly, the flower perishes of thirst.

If it drops too fast, the primrose is washed away altogether, and without its tincture of limestone the little plant cannot thrive at all. There are only a few spots in the country where *Primula mistassinica* can find all the conditions necessary to its well-being.

These spots are widely separated, but in every one of them we find the flower.

Some plants, like some birds, seem to love people, and are never found far from human homes. A sparrow is rarely, if ever, seen half a mile from a dwelling-house; and when we see the goldenrod we may know that human habitations are near.

The common plantain, or rib-grass, is called by the Indians "the print of the white man's foot," and follows the Caucasian race around the world.

The natives of Ceylon have a popular saying to the effect that "the cocoanut-palm will not grow beyond the sound of the sea-waves nor the human voice."

Burdock, nettles, thistles, plantain, and the despised "pusley" are social in their tastes, and only cling to us more faithfully for all the merciless beheading and uprooting they get at our hands and hoes.

When a remote piece of forest land is cleared, and becomes at first a hunter's, miner's, or logger's camp, afterward a settlement growing into a town, the faithful burdock, pusley, docks, and thistles, so different from the surrounding forest growth, will presently appear. How do they get there? Where do they come from?

How did it get rumored among the parent weeds that out there through the forest towards the west there was literally an opening for their offspring?

We are as unable to solve the mystery as was the Adirondack guide of whom we read in Dudley Warner's charming *Summer in a Garden:*

"We were lying under the tent of spruce-

boughs," says Charles Dudley Warner, "talking, after supper, when Phelps (the guide) suddenly exclaimed, with uncommon energy, 'Wall, there's one thing that beats me!'

"'What's that?' we asked, with undisguised curiosity.

"'That's pusley,' he replied, in the tone of a man who has come to one door in life which is hopelessly shut and from which he retires in despair. 'Where it comes from I don't know, nor what to do with it. It's in my garden, and I can't get rid of it. It beats me!'

"About pusley the guide had no theory and no hope.

"A feeling of awe came over me as we lay there, at midnight, hushed by the sound of the stream, and the rising wind in the spruce-tops.

"Then man can go nowhere that pusley will not attend him.

"Though he camp on the Upper Au Sable, or penetrate the forest where rolls the Allegash, and hears no sound save its own Allegations, he will not escape it. It has entered the happy valley of Keene, although there is yet no church there, and only a feeble school part of the year. Sin travels faster than they that ride in chariots."

XX.

FOES AFIELD.

PLANTS POISONOUS TO THE TOUCH.

SHAKESPEARE says that the most perfect blamelessness does not save one from calumny; and this truth holds, it seems, even in the vegetable world. Unjust suspicions attach to our most beautiful wild vine, though it looks quite unlike the poisonous clamberer with which it is confounded, and thus it avoids the very appearance of evil.

English ivy is honored by poets, who have written charming things in its praise; and our graceful American ivy, or Virginia creeper, is equally deserving of honorable mention. It is fertile in resources: it clings to the rock, if it can lay hold of one, with a number of stout little "suckers"; but if no rock or wall be near, the suckers turn into delicate tendrils which clasp boughs and twigs, and thus the vine adapts itself to any station in life, and makes the utmost of its opportunities.

It covers the blank wall or gaunt dead tree with a living curtain, luxuriantly green all summer, and glowing at the touch of frost with a wealth of color which would put the most gorgeous tapestry to shame. Yet no poet writes a sonnet to this charming ivy of ours; the unbotanical public are inclined to shun it, and slander says that it is poisonous.

American ivy and poison-ivy are not even akin, but belong to wholly distinct botanical families; for the Virginia creeper is first cousin to the grape, while poison-ivy is closely related to the common sumach. The leaves of the American ivy are long and tapering, like lance-heads, and their edges are cut into points like the teeth of a saw. They grow in groups of FIVE, the leaves of each quintet clustering around the top of one long stalk, which is the common support of all. Botanists regard the whole cluster as one "compound leaf." They compare the five members of the group to the outspread fingers of a hand, and hence the compound leaves are called digitate, from the Latin *digitus*, a finger. From the same comparison the vine is sometimes called "five-finger."

The very young leaves are coral-red; those a little older are pink, and when the five small leaf-

FIG. 44.—VIRGINIA CREEPER (*Ampelopsis quinquefolia*).
(After drawing in *Demorest's Magazine.*)

lets are only partially unfolded, they might suggest rosy baby hands half closed.

The Virginia creeper (Fig. 44) bears juicy, shining black berries, which grow in flat, spreading clusters on rosy stalks and ripen in October. The vine is slender and clinging. Its main stem is seldom two inches in diameter, and its boughs are short, slender, and drooping. When it scales a tree it often throws out no boughs at all, but wraps itself about the trunk and limbs almost as tightly as their own bark. Sometimes a consumptive tree is smothered in this close embrace; and this is the worst misdeed ever committed by the Virginia creeper, which is not in the slightest degree poisonous, "any way you may take it."

Our real foe afield, the poison-ivy (*Rhus toxicodendron*) (Fig. 45), is, unhappily for us, exceedingly common everywhere,—on rocks, along stone walls, in fence-corners, or clambering up tree-trunks in thickets and moist meadows. It only needs sunshine and a little dampness at its roots. It puts out no tendrils, but clings to its support with a great number of short, woody threads or "aerial rootlets." These sometimes grow from the trunk and larger branches in such

FIG. 45.—*a*, POISON-IVY (*Rhus toxicodendron*). *b*, ENGLISH IVY (*Hedera helix*).
(After drawing in *Demorest's Magazine*.)

numbers that they almost hide the bark and give the limbs of the vine a mossy appearance.

The main stem of a mature plant is a sturdy affair, sometimes thicker than a man's wrist. It throws out vigorous horizontal branches, and when the vine scales a tree its boughs are often as long as those of its host and victim. The leaves grow in groups of THREE. The middle leaf is raised on a stalk an inch or two above the point at which the pair of side leaves are joined to each other and to the long stem which upholds the whole trio. The leaves are oval, and each narrows to a slender point at the tip. When full grown they are generally from four to six inches in length and from three to five in breadth. They are thin, glossy on the upper surface, and somewhat downy on the under side. Their edges are sometimes rudely scalloped and notched, and sometimes irregularly cut into large, jagged points, but usually entirely plain and unadorned. The young foliage is highly lustrous and of a brownish-red color.

The flowers appear in latter May or early June. They are of a pale greenish-yellow color, and they grow as grapes do in long, drooping clusters. They exhale a delicate fragrance, like that of

white clover, and receive much attention from flies and bees. On the vine we may see clusters of last year's fruit. These are dried up by winter winds, and are stony, silvery in color, and about as large as grains of barley. They made their *début*, late last summer, as little, pale brown berries. Poison-ivy is often simply and vaguely called "poison-vine." In early youth it sometimes stands erect, like a shrub, and then it is known as "poison-oak."

There is only one other native plant which we shun. This is a near relation to poison-ivy, the poison-sumach (*Rhus venenata*) (Fig. 46). It is a fine instance of the truth of the copy-book axiom, "Appearances are deceitful"; for it is the most beautiful shrub of the swamps and virulently poisonous. Poison-sumach grows in marshy spots, often rooted in a pool of water. It is a compact bush, generally from eight to fifteen feet high, though occasionally it grows into a small tree from twenty to thirty feet in altitude. The wood is remarkably smooth, very brittle, and covered with satiny, ashen-gray bark. The main stem is from two to five inches in diameter.

The leaf-stalks are of a beautiful rose-purple color, deep yet vivid. Each bears nine small

FIG. 46.—*a*, POISON-SUMACH (*Rhus venenata*). *b*, NON-POISONOUS SUMACH (*Rhus typhina*).
(After drawing in *Demorest's Magazine*.)

leaves or "leaflets," one at the tip of the stalk, and the remaining eight ranged along its sides in pairs. Their upper surface is richly lustrous, and they are pale green on the under side. The blossoms open in June. They are very small and of a greenish-yellow color, and grow in slender, loosely branching clusters, from eight to fourteen inches long. In latter summer they give place to little greenish-white berries, sometimes marked with delicate purple lines. The clusters of flowers and fruit spring from the points at which the leaf-stalks join the boughs.

In general appearance poison-sumach resembles its near relation, the "smoke-plant" of the garden. With its shining bark, lustrous foliage, and rich red leaf-stalks it looks like a stranger from the tropics, rather than an aboriginal of the soil. It may be found in any fresh-water swamp in the United States, from Canada to Louisiana. Like other bad characters it has more than one *alias*. Indeed, it bears a different name in almost every State of the Union, and is variously known as "poison-wood," "poison-ash," "poison-elder," "poison-alder," "swamp-sumach," and poison-tree." In Massachusetts it is known as "dog-wood," though that name really belongs to a tree

of widely differing species, which bears large, conspicuous, white flowers.

There are four non-poisonous varieties of sumach. Three of these are very common everywhere. They differ widely from the poison-sumach in their choice of residence, for they are found in dry, barren soil, on mountain slopes and stony hillsides. Their foliage takes on gorgeous and varied hues at the first touch of frost. The leaves may be gathered with impunity, and as they do not fade when pressed, they are the chief delight of the collector of autumn foliage. The blossoms of these hillside sumachs are green and pallid, like those of the scapegrace of the family, but they differ entirely from the poisonous flowers in their mode of growth. They are borne in upright, dense, compact, pyramidal clusters, and the fruits which follow them in latter summer are velvety, and of a very rich and beautiful scarlet. They grow darker with age, so that the fruit-cluster often presents a lovely gradation of color, the older fruits at the base of the pyramid being deep garnet, while the young ones at its apex are the color of scarlet coral.

The fragrant sumach (Fig. 47), a rarer non-poisonous variety, also grows in dry, rocky soil, so

FIG. 47.—FRAGRANT SUMACH (*Rhus aromatica*).
(After a drawing in *Demorest's Magazine.*)

that any sumach found in swampy ground must be regarded as an enemy. The flowers of fragrant sumach are very small indeed, and they come out before the leaves unfold. They grow in close, slender spikes, like catkins, and the fruits which follow them are scarlet and velvety.

Thus the smooth whitish or dun-colored fruit is a distinguishing mark of the unworthy and disreputable members of the family *Rhus*.

Poison-sumach is far more noxious than its clambering cousin, but it does less mischief, on the whole, as we are not so liable to meet with it. The virulent properties of both plants are most active when the sap is stirring and the leaves unfolding in spring. They are also especially to be shunned at flowering-time.

People are more apt to be affected by the poison if they are exposed to its influences while in a state of perspiration. Some persons can gather flowers and foliage of both plants with impunity. Some can even rub, chew, and swallow the leaves of the poison-sumach without subsequent unpleasantness. Others are badly poisoned even by the breath of the plants if it is brought to them by the breeze. Such susceptibility as this, however, must be quite exceptional, for poison-ivy is very common along

country roadsides, where people pass it frequently.

The *Rhus* cousins, doing their worst, cannot kill their victim; but they can make life a heavy burden for ten days or a fortnight. The trouble does not begin till several hours after exposure to the noxious influence of the plant. The symptoms of poisoning are swelling of the parts affected or, in aggravated cases, swelling of the whole body. Sometimes the swelling is so great that the eyes are closed, the face shapeless, and the features almost obliterated, as in malignant small-pox.

The skin becomes much inflamed, and itches and burns intolerably; and sometimes gatherings or blisters form. The distress reaches its height on the fourth or sixth day after the luckless encounter with the *Rhus*, and then the skin peels off the inflamed parts, and the soreness and swelling gradually subside.

There is probably a remedy in nature for every physical ill, if we only knew where to find it. The antidote for ivy or sumach poisoning is sugar of lead, which may be bought from any apothecary in the form of a dry powder. Explicit directions as to its use should be obtained at the same time. It is dissolved in water and sometimes a little tincture of opium is added to the solution.

Cloths are dipped into the liquid and then applied to the inflamed parts. Sugar of lead is itself a poison, and the two foes of mankind, *Rhus* poison and lead poison, fall to fighting each other, like the Kilkenny cats, till both are destroyed, or at least rendered incapable of mischief.

Unhappily for those who are susceptible to the *Rhus* poison, it is not like the proverbial lightning which "never strikes twice in the same place." "A gentleman residing in the country," says an excellent authority, "told me that he had been seven times poisoned to the most violent degree." "I have known individuals badly poisoned in winter," says the same writer, "from the wood of poison-ivy accidentally burned in the fire."

These foes afield are not foes always, for they have occasionally rendered service to mankind. The juice of poison-ivy, at first yellowish and milky, becomes black by exposure to the air. It has been used as marking-ink, and on linen it is indelible. A decoction of the bark has given relief to asthmatic and consumptive patients, and an infusion of the leaves has been used with success for the cure of paralysis. An extract of the plant has also been of great benefit to persons suffering from dyspepsia.

Poison-sumach, too, may have its redeeming qualities; for it is believed to be identical with the *Rhus vernicifera,* which yields the much-admired black varnish of Japan.

* Though not strictly poisonous, the nettle might be classed among our foes afield, as all will agree who have inadvertently come in contact with it. The genus *Urtica* (from *urere,* to burn) consists principally of herbaceous plants supplied with stinging hairs, each terminating in an exceeding sharp, fragile point which breaks off after entering the skin, allowing an irritating juice, contained in a bulb at the base, to flow into the wound. If the plant be grasped roughly, these points are broken before entering the skin, and little or no inconvenience results: hence the value of the advice to grasp a nettle firmly. The small nettle (*Urtica urens*) (Fig. 48) is familiar to all, and is found near dwellings. It usually grows from eight to twelve inches high, and has comparatively few stings. The common nettle (*Urtica dioica*) is more liberally endowed with stings, so much so that it has been quaintly said, "it may be found by feeling on the darkest night." It grows from two to three feet high.

* The description of the nettle is by M. I. Findley.

FIG. 48.—SMALL NETTLE (*Urtica urens*).
(After drawing in *Demorest's Magazine.*)

Several common wild plants produce berries or secrete juices which would play the very mischief with us if they were taken into the stomach. Hence little ones should be earnestly cautioned against the common childish habit of munching unknown leaves, stems, and berries gathered out of doors. But poison-ivy and poison-sumach are the only plants, among all the green inhabitants of wood and field, to be avoided on account of being really poisonous to the touch; and these are so easily recognized that we can all learn to know and shun them, and thus enjoy our summer rambles with quiet minds.

XXI.

FOES AFIELD.

PLANTS POISONOUS TO THE STOMACH.

"FLOWERS preach to us if we will but hear," says Christina Rossetti; and there is a whole democratic sermon against family pride in the fact that no plants are better connected than the poisons.

Aconite, which contains the most death-dealing vegetable juices known, is closely related to our pretty columbine and larkspur. English belladonna and henbane, which are sometimes seen along our own waysides, possess deadly narcotic properties, but nevertheless they belong to the *solanum* family, which includes among its members the egg-plant, the tomato, and the indispensable potato. But these worthy vegetables are no worse off, in the matter of relatives, than are the carrots and parsnips growing in the next bed. Those guileless attendants upon the corned beef belong to the parsley family and are closely akin

to water-parsnip, poison-hemlock, and fool's-parsley, all exceedingly poisonous herbs, but all nevertheless first cousins to celery, lovage, and the plant which yields caraway seeds.

At times, however, the disreputable members of honorable botanical families prove themselves not unworthy of their kith and kin.

> "There is some soul of goodness in things evil,
> Would men observingly distil it out,"

and this is especially true of things evil in the vegetable world. Some of the most valued remedies in the pharmacopœia are the expressed and concentrated juices of poisonous plants. Ordinarily these juices are the very essence of death and pain, but used at the fitting time and with scientific knowledge they become bestowers of life and comfort; hence plants which are poisonous if taken internally are all described and portrayed in works on medical botany in company with boneset, catnip, and camomile.

The list of our flora conveys the idea that every living thing has its dearest vegetable foe. There are bugbane, cowbane, dogbane, henbane, and fleabane, fly-poison, beaver-poison, and lambkill. Some of these names are merely memorials of old

superstitions; nevertheless it is true that plants poisonous to the animal or human stomach are far more numerous than those which are poisonous to the touch. Indeed, they abound on every side; but, luckily for us, neither the children nor the cows are likely to kill themselves, though the summer fields afford them great facilities for doing so. However some old-school theologians may quarrel with the doctrine, God's creatures are so rightly as well as wonderfully made that, in the main, they do like what is good for them and dislike what is hurtful.

To our palates most poisonous plants are biting, acrid, or nauseous; and animals are even more clearly warned against evil by beneficent Mother Nature. Indian tobacco, for instance, is poisonous, but it sets one's mouth and throat on fire, and one taste of it suffices for a lifetime.

Buttercups in quantities would be poisonous to the cows, but they are so acrid that grazing cattle generally let them alone, even in closely-cropped pastures. A few buttercups mixed with the grass act as a condiment and digestive: it is only in large quantities that they are mischievous. It has been proved by experiment that their expressed juice, when taken into the stomach, is highly poi-

sonous, and a small quantity of it has been known to kill a dog. It contains a chemical called *aconitia,* the most virulent vegetable poison known.

This murderous substance abounds in the pretty monk's-hood, or aconite, which may be this moment growing and blowing in the reader's garden. It is an enemy within the gates. "Any parent who suffers it to grow within reach of his children," says Bigelow, "is either ignorant, foolhardy, or florist-mad; and any amateur not willing to adopt some of the finest larkspur as a substitute deserves to be condemned for a season to regale himself on docks and dandelions." Every part of the common garden *Aconitum napellus* (monk's-hood) (Fig. 49) is poisonous in a green state, root, stem, blossoms, and foliage. When the leaves are chewed they cause a tingling and a curious numb sensation in the tongue and mouth.

This funny feeling might induce children to munch the foliage, though it is not pleasant to the taste, for boys, and girls, too, sometimes, enjoy games in which the strife is to see who can longest endure discomfort. A person who had foolishly eaten some of the leaves of aconite became maniacal. The poison excites great gastric irritation, which may be followed by stupor and death.

FIG. 49.—ACONITE (*Aconitum napellus*).

The monk's-hood which bears blue flowers is believed to be much more mischievous than those species which get up effects in yellow or in white. This is truly discouraging to the gardener. Real blue flowers are so beautiful, and Nature offers us so few of them, that it is grievous to part with one. But even the blue aconite is not the worst member of its family; a still more deadly species grows wild in the Nepaul Mountains, and is used by the natives to poison their arrows.

The pretty foxglove (*Digitalis*), which is becoming popular in gardens, is also poisonous to the human interior.

It contains "digitalin," which has a peculiar action upon the heart, slowing it down and making its pulsations irregular. Other effects of it are pain, vomiting, and purging. All parts of the plant are hurtful if taken internally, but the seeds are especially mischievous.

The *Datura stramonium* or thorn-apple, popularly known as "Jimson" or "Jamestown" weed (Fig. 50), and opprobriously known as "stinkweed," is so familiar everywhere that a description of it may not be unnecessary.

It is a rank, vigorous weed, very common in waste ground around dwellings, and along road-

FIG. 50.—JIMSON-WEED (*Datura stramonium*).

sides. The plant branches freely and grows from two to five feet high.

The shining leaves, described as "tooth-edged," are dark green upon their upper surfaces.

The flowers are funnel-shaped, deep-throated, large, and white, and plaited around the border into five ridges. The fruit, about the size of a walnut, is covered with sharp spines. The plant is a native of Asia, and has been introduced here by the gypsies, who use it as a medicine.

Like most medicines it can harm as well as heal. No small number of cases of poisoning have occurred among children from eating thorn-apple seeds. All parts of the plant, and especially the seeds, are narcotic-poisonous.

The leaves and roots of the May-apple (*Podophyllum peltatum*) are drastic and poisonous.

English or green hellebore (*Helleborus viridis*) (Fig. 51) has somehow entered the domains of Uncle Sam, and has settled in the vicinity of Brooklyn, and in Bucks County, Pennsylvania. Its lush foliage may tempt grazing cattle with consequences very grievous to the farmer. Pliny states that horses, oxen, and swine are killed by eating "black hellebore," which is supposed to

be *Helleborus viridis,* or a closely-allied species. The plant is an acrid narcotic poison.

FIG. 51.—GREEN HELLEBORE (*Helleborus viridis*).

In man it causes singing in the ears, vertigo, thirst, a feeling of suffocation, swelling of the

feet, slowing of the pulse, and it may be collapse and death. Green hellebore is sometimes grown in gardens, as an ornamental annual, but its poisonous qualities should not be forgotten.

The many shining lush leaves are borne upon stalks which rise directly from the root. Each stalk supports five leaflets which diverge like the points of a star or the toes of a bird's foot. Botanists would call the foliage "palmate" or "pedate." Slender stalks rise out of its glossy abundance, each upholding one or two large greenish-yellow flowers, which, at first sight, bear a strong family resemblance to their cousin the buttercup.

On closer examination we find that the five golden-green decorations, which at first appeared to be petals, are sepals. The real petals, eight or ten in number, are very unostentatious affairs and will not be seen till one looks for them. Insect rovers know where to find them, for Nature has fashioned them into little pockets which contain honey.

Indian-poke, itch-weed, or American hellebore (*Veratrum viride*) is a native of the soil, much commoner than its European namesake and hence more mischievous.

It may be found anywhere, in damp ground, from Canada to the Carolinas.

The appearance of this plant is prepossessing. It is an erect spire-shaped perennial, from three to five feet high, with curiously plaited leaves regularly alternating up the stem and overlapping each other at the base. The yellowish or greenish-white flowers are borne in numerous dense spikes on the top of the stem, the whole forming a pyramidal cluster. Each blossom is composed of six separate and spreading sepals.

The root is exceedingly poisonous, and has killed children who dug it up and ate it, mistaking it for its innocent neighbor, sweet-flag root.

The vigorous leaves are among the first green things to appear in spring.

This juicy foliage has tempted browsing cattle tired of dry winter diet and eager for a change in the bill of fare, and the gastronomic experiment has been productive of disaster both to cows and to proprietor.

XXII.

FOES AFIELD.

MORE PLANTS POISONOUS TO THE STOMACH.

THE most mischievous of poisonous plants are those disreputable cousins of the carrots and parsnips, fool's-parsley, poison-hemlock, water-hemlock, and water-parsnip. Their appearance is attractive and they strongly resemble worthy relatives of unimpeached respectability.

Poison-hemlock, water-hemlock, and water-parsnip are not refused by cattle, and are highly injurious to them. Fool's-parsley is said to produce palsy in horses if they eat it in quantities, and it has also done much injury to persons who have been deceived by its close resemblance to garden-parsley. Poison-hemlock has sickened and killed children who ate its roots, supposing it to be "sweet-cicely." All these herbs are exceedingly common, and, as so many crimes are proved against them, it is advisable that we should all learn to identify and detect them.

Poison-hemlock, or *Conium maculatum* (Fig. 52) grows in old gardens and waste grounds. Its main stem is erect, hollow, stout below and much branched above. It is perfectly smooth, bright green, mottled with irregular stains of wine-color, and covered with a white bloom which is very easily rubbed off. The leaves are very smooth and of a uniform deep green. The lower leaves are very large, sometimes over two feet in length, and are borne on long stalks. The upper leaves have scarcely any stalks whatever. They are broadly triangular in general outline, and are finely cut and fringed. Each scallop, or tooth, of these lace-like leaves is tipped with a little sharp white point.

The white flowers grow like those of the wild carrot, in a flat circular cluster which is composed of many similar, but smaller, clusters massed together. There are "wheels within a wheel" of bloom. The seeds are small and of a dull greenish gray, and up and down them run toothed or wavy ridges. By these oddly decorated seeds poison-hemlock may be distinguished from some cousins which resemble it closely. It can also be recognized by its imposing size, by the claret-colored blotches on its large smooth stalks, by the

FIG. 52.—POISON-HEMLOCK (*Conium maculatum*).
(After drawing in *Demorest's Magazine*.)

luxuriant green of its foliage, and by a very offensive, "mousy" odor which its leaves emit when they are cut or bruised.

One would think that this last characteristic would discourage children or animals from pursuing acquaintance with poison-hemlock; but it has often been eaten with grievous results. Cattle turned out to pasture in spring, after being shut up all winter, are liable to eat this plant, and to be seriously injured or even killed by it. They sometimes obscurely show the symptoms and evince a stupor which is mistaken for stomach trouble, or an excitement and fury which are supposed to be madness.

Winter does not kill the poison-hemlock, which comes up the second spring lustier than ever, and often attains a height of six or eight feet—a living illustration of the truth that "ill weeds grow apace." "Mowing close to the ground," says an excellent authority, "will destroy it in two seasons."

Conium maculatum is an unwelcome immigrant from the Old World. Europe presents it to us in return for many similar favors received. It has been noted as a poison from remote antiquity. The Athenians gave a cup of hemlock to those who were condemned to death by the council of

the Areopagus, and many distinguished ancients, among them Socrates and Phocion, suffered death by the agency of this destroyer. Plato describes the famed hemlock of antiquity, which, it seems, looked exactly like our common *Conium maculatum.* But the vegetable murderer of Socrates differed somewhat from the common *Conium* in its effects: the dying sage suffered no pain, only a great and growing numbness, which crept gradually from his feet to his heart. The poison-hemlock of our fields may differ slightly from the Greek species, or it has adapted itself to the enlightened age of dynamite and the "Woolwich Infant": our hemlock can not only kill its victim, but it can make his death exceedingly distressful.

Some botanists think that the slayer of the Greek sages was the too common *Cicuta maculata* (Fig. 53). This plant is variously known as American hemlock, musquash root, water-hemlock, snakeweed, and beaver-poison. It grows in wet meadows and along the banks of ditches, ponds, and streams. It often abounds among the grass in low-lying fields, and is frequently cut with hay. Fortunately for farmers it is not, in a dry state, very injurious to cattle. Its fresh leaves act upon them as a violent poison, and hence

FIG. 53.—AMERICAN HEMLOCK (*Cicuta maculata*).

another of the plant's popular names, spotted cowbane. Any of it within reach of a farm ought to be exterminated.

The plant may be identified by its root, which is composed of a number of fleshy tubers diverging from the base of the stem and about as long as one's finger. It looks like a cluster of small parsnips tied together as hucksters tie them. The root has a strong, penetrating smell and a warm, acrid taste, and when it is pressed it emits a yellowish juice with a pungent flavor.

The stem is smooth, branched at the top, hollow, and marked with little grooves and little ridges running lengthwise. *Generally it is strongly streaked with purple.* Spotted cowbane grows from three to six feet tall. Its leaves are much cut, their edges are toothed like a saw, and the *leaf-veins terminate in the notches, not at the points of the foliage.*

The white flowers appear in July and August. They are borne in a compound wheel, or umbel, as they are in all the members of the parsley tribe. In most of the numerous parsley cousins the head of tiny, five-petalled blossoms is encircled by a full ruche, or collar, of slender leaves; these leaves grow at the bases of the little stalks which uphold

the little wheels of bloom, and they form what botanists call the "general involucre." But spotted cowbane follows a recent fashion and goes all collarless: it has no "general involucre," and only occasionally an apology for one in the shape of a single leaf. The little circles of bloom are not numerous, and *instead of crowding together,* as they do in the wild carrot, *each keeps at an unsocial distance from the rest.*

There are many recorded cases in which children have eaten the roots of *Cicuta maculata* with fatal results. In western Pennsylvania it destroyed several persons who ate the root, mistaking it for angelica. Three little boys in Dutchess County, New York, went in search of sweet-flag root, and dug up and ate roots of the spotted cowbane by mistake. Two died in convulsions about an hour after having swallowed the poison. "Many cases like these," says Bigelow, "must have happened unrecorded. The plant is extremely common in many parts of the United States, and I believe its true character is not generally suspected. A very respectable physician informed me that it was much used in his vicinity as a gargle by people unsuspicious of its qualities."

Though this plant is poisonous to cows, it is eaten with impunity by sheep and goats. It comes up year after year from the same root; mowing the ground, therefore, will not exterminate it, and only thorough ploughing will rid us of it.

Mowing will, however, destroy fool's-parsley (*Æthusa cynapium*) (Fig. 54) for the summer is its span of life. Fool's-parsley is a slender herb, with a small, branched, tapering root of a pale brownish-white color. Its erect stem is from six inches to two feet high and has many ascending branches. It is perfectly smooth, hollow at the base, solid above, and of a bright apple-green color tinged with red. Stains and streaks of red and purple brand most of the evil-doers of the parsley tribe.

The lace-like leaves of *Æthusa* are broadly triangular in general outline, very smooth on both sides, and *of a rich dark green, often tinged with dull red.* Except for these criminal marks the foliage of *Æthusa* resembles that of the straight-leaved garden-parsley so closely that the poisonous plant has often been mistaken for the worthy vegetable with disastrous results. Curled parsley can be at once distinguished from its dis-

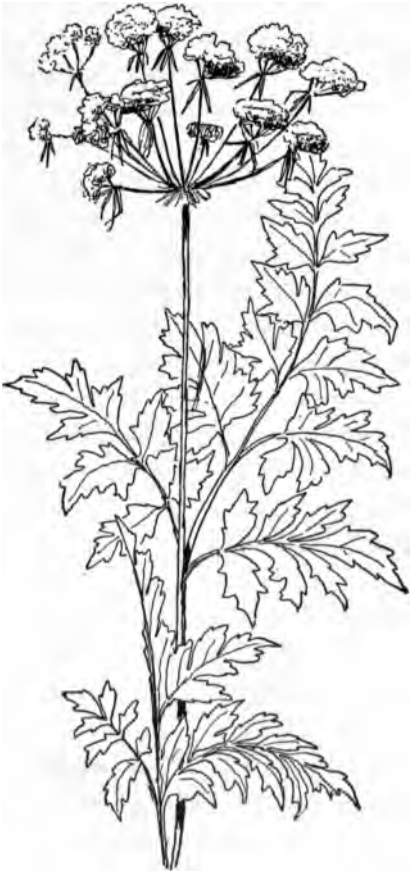


FIG. 54.—FOOL'S-PARSLEY (*Æthusa cynapium*).
(After drawing in *Demorest's Magazine*.)

reputable relative by its crisp leaves, and it is recommended that curled parsley only should be cultivated, to avoid mistakes. No mistake could arise were the plants compared when in blossom, for the flowers of fool's-parsley are white, while those of garden-parsley are yellow.

The whole plant of *Æthusa* has a burning taste, and when the leaves are bruised they emit a peculiar disagreeable odor altogether different from that of garden-parsley. Fool's-parsley is a common weed about cultivated ground in the Northern and Eastern States, and it abounds in the vicinity of Boston. It blossoms in July. In all recorded experiments this plant has had a poisonous effect upon animals.

Water-parsnip (*Sium*) (Fig. 55) also blooms in later summer. It grows in swamps and marshy meadows and along the banks of streams and ditches. Often it is found rooted in water with some of its leaves submerged. This floating foliage is lace-like, and the leaves which rise into the sunshine are also delicately cut and toothed. The white flowers resemble those of *Cicuta*, but they are surrounded by an involucre of several tiny leaves.

Cowbane, another water-loving member of the

parsley family, is also poisonous. It, too, has compound, or divided, leaves and a wheel-shaped

FIG. 55.—WATER-PARSNIP (*Sium cicutæfolium*).
(From *Demorest's Magazine.*)

mass of delicate white flowers; but its individual characteristics are so obscure and so variable that

it would be almost impossible to describe them, even by resorting to crabbed botanical terms.

Those parsley relations, or *umbelliferæ,* which are amphibious in their tastes and aquatic in their habits need not be distinguished one from the other. They can all be included in one sweeping condemnation. It is a rule sanctioned by the observations of medical botanists that all *umbelliferæ* growing in and about water are poisonous. There are very few exceptions to this rule; so every plant growing in a wet place and bearing lace-like leaves and blossoms closely resembling those of the wild carrot must be considered guilty till it is proved innocent.

The baneful juices of these poisonous *umbelliferæ* are called, in medical language, acro-narcotic poisons. They act chiefly on the brain and spinal marrow, producing dizziness and stupor, and sometimes a sort of intoxication, delirium, and convulsions. There is generally much nausea, and Nature's effort to rid the stomach of the hurtful stuff should be assisted by a dose of sulphate of zinc or of tartar emetic: the first is preferable on account of its speedy action. Hot lemon-juice and hot vinegar should be given, but they must on no account be administered before the poison

is expelled from the stomach. Strong coffee and strong tea are the best antidotes for the stupor, which is sometimes almost overpowering. The patient must not be allowed to yield to it, but his attention must be aroused by every possible means.

But as an ounce of prevention is worth many pounds of cure, children should be earnestly cautioned against eating unfamiliar roots, seeds, and berries. "Sweet-cicely" and angelica differ but slightly in appearance from violently poisonous members of the parsley family; most disastrous mistakes have thus occurred, and hence "sweet-cicely" and angelica had better be forsworn altogether.

The plants described are injurious only when they are taken into the stomach. None of them is in the least degree poisonous to the touch, and if any one of them has made its home in our territory, we need not fear to grasp it boldly, pluck it up, and cast it out.

INDEX.

TWO OUT-OF-DOORS BOOKS.

WITH THE WILD FLOWERS, FROM PUSSY-WILLOW TO THISTLE-DOWN. A rural chronicle of our flower friends and foes, describing them under their familiar English names. By E. M. HARDINGE. 16mo, cloth, illustrated. $1.00.

This book is a delightfully chatty volume, carrying us through the whole season with the wild flowers as they make their appearance. It is intended for those who love flowers as flowers, and who like to read about them without getting into too close contact with technical terms and classifications.

The author is well known as a writer for the New York "Evening Post" and the magazines, and her articles are gladly welcomed by those who like both nature and literature.

THE AMATEUR AQUARIST. By MARK SAMUEL, Aquarist to Columbia College, New York. 16mo, cloth, illustrated. $1.00.

An American aquarium book indispensable to every one who wishes to start an aquarium or who already has one. It contains complete instructions for making a new self-sustaining aquarium requiring change of water but once a year, and tells how, when, and where to find suitable water-plants and fishes. With over fifty new illustrations from life, by which to identify the specimens.

Sent, postpaid, on receipt of the price, by

THE BAKER & TAYLOR CO., PUBLISHERS,

5 AND 7 EAST SIXTEENTH ST., NEW YORK.

TWO BOOKS ON ART.

CRAYON PORTRAITURE. Complete Instructions for Making Crayon Portraits on Crayon Paper and on Platinum, Silver, and Bromide Enlargements. Also, Directions for the Use of Transparent Liquid Water-colors and for Making French Crystals. By J. A. BARHYDT. 12mo, cloth, illustrated, revised and enlarged edition; paper, 50 cents; cloth, $1.00.

A carefully prepared hand-book for professional and amateur artists, written with special reference to giving such full explanation of details as to furnish to those who desire to take up crayon work a full knowledge of all the materials required and their use and manipulation, together with all the methods and processes employed. The coloring of photographs, engravings, and photogravures with Liquid Water-colors and the making of French Crystals are also fully treated.

The author's successfully accomplished intention is to furnish a manual that will enable the student to undertake the making of crayon portraits for a livelihood or to gratify his taste as an amateur.

AMATEUR PHOTOGRAPHY. A Practical Guide for the Beginner. By W. I. LINCOLN ADAMS, Editor of "The Photographic Times," "The American Annual of Photography," "The Photographic Instructor," etc., etc. Illustrated. Paper, 50 cents; cloth, $1.00.

A treatise for the amateur, by one whose experience of, and immediate contact with, the wants of those who are using the camera in and out of doors especially fit him to prepare a hand-book that will both serve as a guide to the ordinary work, and will introduce the reader to new fields of interest.

CONTENTS.—I. Apparatus. II. In the Field. III. In the Dark Room. IV. Printing and Toning. V. Portraiture. VI. Instantaneous Photography. VII. Flash-light Photography. VIII. Orthochromatic or Color-sensitive Photography. IX. Composite Photography. X. The "Fathers of Photography." APPENDIX, Tables, Formulæ, etc.

Sent, postpaid, on receipt of the price, by

THE BAKER & TAYLOR CO., PUBLISHERS,

5 AND 7 EAST SIXTEENTH ST., NEW YORK.

PRESIDENT THWING'S NEW BOOK.

WITHIN COLLEGE WALLS. By CHARLES FRANKLIN THWING, President of Adelbert College and of Western Reserve University; Author of "American Colleges: their Students and Work," "Reading of Books," "The Working Church"; Joint-Author of "The Family: an Historical and Social Study," etc. 16mo, cloth, gilt top, $1.00.

CONTENTS:—I. The College and the Home. II. The Good of being in College. III. The College Forming Character. IV. Certain College Temptations. V. College Government. VI. Play in College. VII. Simplicity and Enrichment of Life in College. VIII. The College and the Church. IX. The College Fitting for Business. X. The Pre-eminence of the College Graduate.

For fifteen years President Thwing has been writing constantly upon College subjects; his first work having borne the title of "American Colleges." The present book discusses, in a liberal spirit, those topics which are uppermost in interest to the students themselves, as well as to their parents and others concerned in their work and welfare. Dr. Thwing is, perhaps, the most prominent scientific student of college and university statistics, and the results of work before and after graduation. This carefully and entertainingly written presentation of conclusions drawn from his personal experience and observation as college student and president has a distinct value as guide and encouragement to those within college walls, and as an enlightened statement of college aims, tendencies, and possibilities to their friends without.

"An earnest, eloquent, and convincing vindication of the value of a college education, not only as a means of ennobling and enriching the individual character and thus indirectly benefiting the community, but also, from a utilitarian point of view, as the best means of fitting a man to succeed in whatever calling in life he may choose."—*Cleveland Leader.*

Sent, postpaid, on receipt of the price, by

THE BAKER & TAYLOR CO., PUBLISHERS.
5 AND 7 EAST SIXTEENTH ST., NEW YORK.

TWO FAMOUS AMERICANS.

TALKS WITH RALPH WALDO EMERSON. With a hitherto unpublished Portrait. By CHARLES J. WOODBURY. 12mo, cloth, gilt top, $1.25.

The writer of this book had exceptionable opportunities for access to and intercourse with Mr. Emerson, and has furnished the latter's admirers, and lovers of culture generally, a service of the highest value in preparing this faithful record of the poet's opinions, freely and spontaneously expressed in conversations on current thought, literature, philosophy, and criticism; his views as to what knowledge and culture are most worth; and his thoughts about contemporary writers and workers.

"No lover of Emerson can afford to overlook this book. He pervades it. The man himself is there."—*New York Sun.*

GREELEY ON LINCOLN. With Mr. Greeley's Letters to Charles A. Dana and a Lady Friend; to which are added, Reminiscences of Horace Greeley Edited by JOEL BENTON. With a photo-sculpture portrait of Mr. Greeley, and a fac-simile of a part of his MS. 12mo, cloth, $1.25.

The treatise which gives the title to this volume, shows Mr. Greeley's mind in contact with the questions and the personality which, perhaps, were most prominent in the course of his own career, and to a certain extent epitomize it. The Letters to Mr. Dana, and those to an intimate lady friend, not only cover rare periods and incidents in Mr. Greeley's life, but they show the naïve, unconscious motions of a mind never tempted to dissimulation, and (in the privacy for which they are intended) without motive to be other than sincere.

"A valuable addition to American literature."—*Chicago Times.*

"The contents of this volume are among the most interesting that have ever been offered to American readers."—*Washington Evening News.*

Sent, postpaid, on receipt of the price, by

THE BAKER & TAYLOR CO., PUBLISHERS,

5 AND 7 EAST SIXTEENTH ST., NEW YORK.

ing
ingto,

Sent, p

THE L