10. *Earthquake in the Mississippi Valley.*—On the 17th of last August, at 9 o'clock A. M., an earthquake was felt in the Mississippi valley, at Holly Springs, Oxford, and Grenada in Mississippi, Memphis and Lagrange in Tennessee, St. Louis in Missouri, and Cairo in Illinois. How far beyond these limits it extended we have not yet learned. At Memphis the shock lasted about ten seconds, and was severe enough to tumble down chimnies, upset loose articles, and cause the people to run out of their houses. It is reported to have been most severe at Holly Springs, Mississippi, and Lagrange, Tennessee.

11. *Geological Survey of Nevada.*—Mr. R. H. STRETCH, of Virginia City, we are informed, has been appointed State Geologist of Nevada, in conformity with the provisions of the Act passed last winter by the Legislature of this new State.

III. BOTANY AND ZOOLOGY.

1. *The Tennessee Yellow-Wood* (*Cladrastis lutea*).--One of the very handsomest of our ornamental trees has this summer flowered finely in the south of England, as we learn from the Gardener's Chronicle,—the tree "completely covered with long drooping branches of pure white flowers, many of them nearly eighteen inches in length and from ten to twelve inches wide at the shoulders. The foliage, being of a lively green, contrasted favorably with the pure white blossoms. It is also nicely scented." An unusually warm summer has for once brought this tree well into blossom in England. Even here it blossoms copiously only every other year; this year it did so to perfection, owing to the heat and dryness of last season and the very favorable spring of the present year. The fine large tree in the Cambridge Botanic Garden was, as it were, veiled with white, and many of the graceful pendent clusters were fully two feet in length. A. G.

2. *Welwitschia mirabilis*, HOOK., fil.—Some account of this very strange vegetable, and of the interesting memoir, in the *Linnæan Transactions*, in which Dr. Hooker made it known to the botanical world, was given in our vol. xxxvi, for Nov. 1863. Through the great kindness of Dr. Hooker, the Herbarium of Harvard University has recently received a fine old trunk of this *tree*,—if we may so call a woody plant which, though perhaps a century old, is only a foot or two in height, and as broad as it is high, and never had any other foliage than the primary pair of leaves, the cotyledons,—accompanied by the cones (for it is a sort of coniferous tree), both dry and in alcohol. A. G.

3. *On the Movements and Habits of Climbing Plants*; by CHARLES DARWIN.—This is a long paper read before the Linnæan Society in February last, and published in its *Journal*, where it fills 120 pages of the double number, 33 and 34, issued in June. The investigations which it records were made, we believe, during a period when the author's ordinary scientific labors were interrupted by illness,—as was no less the case with respect to his former papers on Dimorphous and Trimorphous Flowers and his volume on the Fertilization of Orchids by the aid of Insects. Of these works and of the present,—side-issues as they are,—it may fairly be said, that they show a genius for biological investigation, and

a power of turning common materials and ordinary observations to high scientific account, which, if equalled, have not been surpassed since the days of Hunter and Charles Bell. This will be the opinion equally, we suppose, of those who favor and of those who dislike Mr. Darwin's theory of the gradual transformation of specific forms through natural selection, upon which, indeed, all these collateral researches have a bearing, direct or incidental. In the present case the bearing is obvious. The gradual acquisition by certain plants of advantageous peculiarities is inferred from the gradation of forms and functions. Properties and powers which are latent or feebly developed in most plants are taken advantage of by some, made specially useful, and enhanced from generation to generation. Tendril-bearing plants,—the most specialized in structure and the most exquisitely adapted to the end in view,—are supposed to have been derived from leaf-climbers, and these in turn from simple twiners.

The author states that he was led to this subject by a brief note, communicated to the American Academy in the summer of 1858, (and reprinted in this Journal,) in which the writer of the present notice recorded his observation of the coiling of certain tendrils by a visible movement promptly following an extraneous irritation. Mr. Darwin's observations were more than half completed before he became aware that the spontaneous revolution of the stems and of some tendrils of climbing plants had been observed and recorded almost 40 years ago, and nearly at the same time, by Palm and by von Mohl, and had been the subject of two memoirs by Dutrochet, published more than twenty years ago. But the mode in which the free and growing end of a stem sweeps around seems not to have been previously well made out, having been more or less confounded with the torsion of the axis which many twining stems, such as the Hop and the Morning Glory, are apt to undergo. It is plain to see, however, that many stems which revolve do not twist at all; and those that do never could twist on their axis at every revolution without speedy destruction,—indeed usually do not twist until they have ceased revolving. Every one must have noticed that the growing extremity of a Hop, Convolvulus, or other twiner, when unsupported, hangs over or stretches out horizontally to one side. But it is not so well known that this outstretched portion, while at the proper age, is continually sweeping round, in circles widening as it grows, and always in the same direction, in search of some object round which to twine. The Hop revolves with the sun; the Convolvulus, Bean (*Phaseolus*) &c., against the sun, that is, in the same directions that they twine. Two or three internodes are usually revolving at the same time. Mr. Darwin observed thirty-seven revolutions in one internode of a Hop,—the first revolution made in about 24 hours, the second in 9 hours, the third and the following ones up to the eighth in a little over 3 hours each. "The shoot had now grown 3½ inches in length, and carried at its extremity a young internode an inch in length, which showed slight changes in its curvature. The next or ninth revolution was effected in 2 hours and 30 minutes. From this time forward the revolutions were easily observed. The thirty-sixth revolution was performed at the usual rate; so was the last or thirty-seventh, but it was not quite completed; for the internode abruptly became upright, and, after moving to the center became motionless. I tied a weight to its upper end, so as slightly to bow it, and thus to detect any movement; but there was none. Some time before the last revolution the lower part of the internode had ceased to move. . . . . It moved during five days; but the more rapid movement after the third revolution lasted during three days and twenty hours. The regular revolutions from the 9th to the 36th inclusive, were performed at the average rate of 2 h. 31 m. The weather was cold, and this affected the temperature of the room, especially during the night, and consequently retarded a little the rate of movement. . . . . After the seventeenth revolution the internode had grown from 1¾ to 6 inches in length, and carried an internode 1⅞ inch long, which was just perceptibly moving; and this carried a very minute ultimate internode. After the 21st revolution the penultimate internode was 2½ inches long, and probably revolved in a period of about three hours. At the 27th revolution our lower internode was 8⅜, the penultimate 3½, and the ultimate 2½ inches in length; and the inclination of the whole shoot was such that a circle 19 inches in diameter was swept by it. When the movement ceased the lower internode was 9 and the penultimate 6 inches in length; so that, from the 27th to the 37th revolutions inclusive, three internodes were at the same time revolving."—(pp. 3, 4.)

The shoots of many climbers sweep their circles more rapidly than the Hop,—the common Pole Bean (*Phaseolus vulgaris*) in rather less than two hours, Convolvuluses of various species in the same time or rather less; while more woody stems naturally move more slowly, some requiring from 24 to 50 hours for each revolution. But the thickness or texture of the shoot does not govern the rate, many slender shoots moving slower than some stout ones, and some lignescent quicker than other purely herbaceous ones. The movement appears to be accelerated, up to a certain point, by raising the temperature, or rather is retarded by lowering it; but while the conditions are nearly the same, the rate is often remarkably uniform. The quickest rate of revolution of a proper stem observed by Mr. Darwin was that of a *Scyphranthus*, in 77 minutes. When the light comes from one side, the semicircle towards the light is usually described in less time, often in less than half the time, of that from the light. The tendency of young stems to turn toward the light is here active as usual, but is overcome by a superior force. The end of the shoot describes circles or broad ellipses, or else, from insufficient power or mechanical disadvantages, narrow ellipses, semicircles, or irregular figures. A horizontal shoot of considerable length will thus be found, not unfrequently, to sway from side to side in a semicircular course, while the extreme internodes are making complete revolutions.

A striking illustration of the amount of space that may be swept over is afforded by a case in which Mr. Darwin allowed the top of a *Ceropegia* to grow out almost horizontally to the length of 31 inches,—three long internodes terminated by two short ones. The whole revolved at rates between 5¼ and 6¾ hours for each revolution, the tip sweeping a circle of above five feet in diameter and 16 feet in circumference, travelling therefore at the rate of at least 32 inches per hour. "It was an interesting spectacle to watch the long shoot sweeping, night and day, this grand circle, in search of some object around which to twine."

As to the nature of this revolving movement, Mr. Darwin clearly shows that it is not a torsion of the axis, but a successive bending [similar to that by which ordinary stems bend toward the light], the direction of which is constantly and uniformly changing. "If a colored streak be painted (this was done with a large number of twining plants) along, we will say, the convex line of surface, this colored streak will, after a time depending on the rate of revolution, be found to lie along one side of the bow, then along the concave side, then on the opposite side, and, lastly, again on the opposite convex surface. This clearly proves that the internodes, during the revolving movement, become bowed in every direction. The movement, is, in fact, a continuous self-bowing of the whole shoot, successively directed to all points of the compass." It is an automatic movement, of the same character as those which these and other parts of plants effect in changing position or direction, sometimes slowly and sometimes with a visible motion. The movement may be likened in one case to that of the hour-hand or the minute-hand of a clock, in the other to the second-hand, but in both is as truly a vital movement as is the contraction of an involuntary muscle. It must be effected—as Mr. Darwin recognizes—either by the contraction of the cells on the concave side, or by the turgescence and elongation of those on the convex side of the internode, or by both,—probably the former, as various facts go to show; but questions of that kind are not investigated in the present essay.

No differences in this regard are observable in the behavior of exogenous or endogenous stems, or even of those of climbing Ferns. *Lygodium scandens*, according to Darwin, revolves like other twiners; it completes its revolutions in six hours, or on a very hot day in five (moving against the sun, which is much the commoner case); this is about the average rate of Phænogamous twiners, like which it comports itself in all respects. Our own *L. palmatum*, we find, revolves in the same way, in about four hours, the temperature being 75° Fahr.

The power of revolving depends, of course, upon the general health and vigor of the plant, and upon the age of the shoot, is retarded by lowering the temperature, is interrupted by any considerable disturbance, such as exposure to cold or to much jarring; carrying the plant from one place to another, or cutting off a shoot and placing it in water, stops the movement for a time, just as it does the more vivid automatic movement of *Desmodium gyrans.* But each internode is so independent that cutting off an upper one does not affect the revolutions of the one beneath. Twining stems are far from being insensible to the action of light (as Mohl supposed), the half-revolution towards the light being not uncommonly twice faster than that from it; but as the rate of revolution by day and by night is nearly the same, the one half of the circuit is accelerated just as much as the other is retarded. This influence of the light is quite remarkable when we consider the slenderness of most revolving internodes, the small surfaces they expose, and that their leaves are little developed.

The design, as we must term it, of this revolving of the end of twining stems is obvious, and usually effectual. Such stems, even when no supporting object is within their reach, will reach each other, and by twining together make a mutual support, from which, as they lengthen, they may reach yet farther. The connection of the revolving with twining is obvious, though the latter is not a necessary consequence; for many stems revolve which do not twine, but climb in some other way.

"When at last the [revolving] shoot meets with a support, the motion at the poiut of contact is necessarily arrested, but the free projecting part goes on revolving. Almost immediately another and upper point of the shoot is brought into contact with the support and is arrested; and so onward to the extremity of the shoot; and thus it winds round its support. When the shoot follows the sun in its revolving course, it winds itself round the support from right to left, the support being supposed to stand in front of the beholder; when the shoot revolves in an opposite direction, the line of winding is reversed. As each internode loses from age its power of revolving, it loses its power of spirally twining round a support. If a man swings a rope round his head, and the end hits a stick, it will coil round the stick according to the direction of the swinging rope; so it is with twining plants, the continued contraction or turgescence of the cells along the free part of the shoot replacing the momentum of each atom of the free end of the rope.

"All the authors, except von Mohl, who have discussed the spiral twining of plants maintain that such plants have a natural tendency to grow spirally. Mohl believes (S. 112) that twining stems have a dull kind of irritability, so that they bend toward any object which they touch. Even before reading Mohl's interesting treatise, this view seemed to me so probable that I tested it in every way that I could, but always with negative results. I rubbed many shoots much harder than is necessary to excite movement in any tendril or in any foot-stalk of a leaf-climber, but without result. I then tied a very light forked twig to a shoot of a Hop, a *Ceropegia*, *Sphærostema*, and *Adhatoda*, so that the fork pressed on one side alone of the shoot and revolved with it; I purposely selected some very slow revolvers, as it seemed most likely that these would profit from possessing irritability; but in no case was any effect produced. Moreover, when a shoot winds round a support, the movement is always slower, as we shall immediately see, than whilst it revolves freely and touches nothing. Hence I conclude that twining stems are not irritable; and indeed it is not probable that it should be so, as nature always economizes her means, and irritability would be superfluous. Nevertheless I do not wish to assert that they are never irritable; for the growing axis of the leaf-climbing, but not spirally twining, *Lophospermum scandens* is, as we shall hereafter see, certainly irritable; but this case gives me confidence that ordinary twiners do not possess this quality, for directly after putting a stick to the *Lophospermum*, I saw that it behaved differently from any true twiner or any other leaf-climber.

"The belief that twiners have a natural tendency to grow spirally probably arose from their assuming this form when wound round a support, and from the extremity, even whilst remaining free, sometimes assuming this same form. The free internodes of vigorously growing plants, when they cease to revolve, become straight, and show no tendency to be spiral; but when any shoot has nearly ceased to grow, or when the plant is unhealthy, the extremity does occasionally become spiral. I have seen this in a remarkable degree with the ends of the shoots of the *Stauntonia* and of the allied *Akebia*, which became closely wound up spirally, just like a tendril, especially after the small, ill-formed leaves had perished. The explanation of this fact is, I believe, that the lower parts of such terminal internodes very gradually and successively lose their power of movement, whilst the portions just above move onward, and in their turn become motionless; and this ends in forming an irregular spire.

"When a revolving shoot strikes a stick, it winds round it rather more slowly than it revolves. For instance, a shoot of the *Ceropegia* took 9 h. 30 m. to make one complete spire round a stick, whilst it revolved in 6 h.; *Aristolochia gigas* revolved in about 5 h., but took 9 h. 15 m. to complete its spire. This, I presume, is due to the continued disturbance of the moving force by its arrestment at each successive point; we shall hereafter see that even shaking a plant retards the revolving movement. The terminal internodes of a long, much-inclined, revolving shoot of the *Ceropegia*, after they had wound round a stick, always slipped up it, so as to render the spire more open than it was at first; and this was evidently due to the force which caused the revolutions being now almost freed from the constraint of gravity, and allowed to act freely. With the *Wisteria*, on the other hand, a long, horizontal shoot wound itself at first, in a very close spire, which remained unchanged; but subsequently, as the shoot grew, it made a much more open spire. With all the many plants which were allowed freely to ascend a support, the terminal internodes made at first a close spire; and this, during windy weather, well served to keep the shoots in contact with their support; but as the penultimate internodes grew in length, they pushed themselves up for a considerable space (ascertained by colored marks on the shoot and on the support) round the stick, and the spire became more open.

"If a stick which has arrested a revolving shoot, but has not as yet been wound round, be suddenly taken away, the shoot generally springs forward, showing that it has continued to press against the stick. If the stick, shortly after having been wound round, be withdrawn, the shoot retains for a time its spiral form, then straightens itself, and again commences to revolve. The long, much-inclined shoot of the *Ceropegia* previously alluded to offered some curious peculiarities. The lower and older internodes, which continued to revolve, had become so stiff that they were incapable, on repeated trials, of twining round a thin stick, showing that the power of movement was retained after flexibility had been lost. I then moved the stick to a greater distance, so that it was struck by a point 2½ inches from the extremity of the penultimate internode; and it was then neatly wound round by this part and by the ultimate internode. After leaving the spirally wound shoot for eleven hours, I quietly withdrew the stick, and in the course of the day the curled part straightened itself and re-commenced revolving; but the lower and not curled portion of the penultimate internode did not move, a sort of hinge separating the moving and the motionless part of the same internode. After a few days, however, I found that the lower part of this internode had likewise recovered its revolving power. These several facts show, that, in the arrested portion of a revolving shoot, the power of movement is not immediately lost, and that when temporarily lost it can be recovered. When a shoot has remained for a considerable time wound round its support, it permanently retains its spiral form even when the support is removed.

"When a stick was placed so as to arrest the lower and rigid internodes of the *Ceropegia* at the distance at first of 15 and then of 21 inches from the center of revolution, the shoot slowly and gradually slid up the stick, so as to become more and more highly inclined; and then, after an interval sufficient to have allowed of a semirevolution, it suddenly bounded from the stick and fell over to the opposite side, to its ordinary slight inclination. It now recommenced revolving in its usual course, so that after a semi-revolution it again came into contact with the stick, again slid up it, and again bounded from it. This movement of the shoot had a very odd appearance, as if it were disgusted with its failure but resolved to try again. We shall, I think, understand this movement by considering the former illustration of the sapling, in which the contracting surface was supposed to creep from the southern, by the eastern, to the northern, and thence back again by the western side to the southern face, successively bowing the sapling in all directions. Now with the *Ceropegia*, the stick being placed a very little to the east of due south of the plant, the eastern contraction could produce no effect beyond pressing the rigid internode against the stick; but as soon as the contraction on the northern face began, it would slowly drag the shoot up the stick; and then, as soon as the western contraction had well begun, the shoot would be drawn from the stick, and its weight, coinciding with the northwestern contraction, would cause it suddenly to fall to the opposite side with its proper slightly inclined positions; and the ordinary revolving movement would go on. I have described this case because it first made me understand the order in which the contracting or turgescent cells of revolving shoots must act.

"The view just given further explains, as I believe, a fact observed by von Mohl (S. 135), namely, that a revolving shoot, though it will twine round an object as thin as a thread, cannot do so round a thick support. I placed some long revolving shoots of a *Wisteria* close to a post between 5 and 6 inches in diameter, but they could not, though aided by me in many ways, wind round it. This apparently is owing to the flexure of the shoot, when winding round an object so gently curved as this post, not being sufficient to hold the shoot to its place when the contracting force creeps round to the opposite surface of the shoot; so that it is at each revolution withdrawn from its support."—(pp. 9–13, *passim.*)

The successive shifting of the contracting side of the shoot, which explains the revolution or bowing in turn in every direction, no less explains the twining round a proper support, leaving however some idiosyncrases unexplained. Some tendrils and some petioles of leaf-climbing plants equally possess this revolving power; but their usefulness depends mainly upon additional and more special endowments,—mainly upon the power of directly responding by curvature to the contact, more or less prolonged, of an extraneous body.

Of *Leaf-climbers*, no instance is more familiar than that of *Clematis* or Virgin's Bower. Little more was known of them than that they climbed by curling their petioles (common or partial) around neighboring objects. Mr. Darwin made observations upon eight species of *Clematis*, seven of *Tropæolum*, the common species of *Maurandia*, *Lophospermum*, *Fumaria*, &c., as also upon *Gloriosa* and *Flagellaria*, which climb by a tendril-like production of the tip of the leaf. From the summary it appears that plants which belong to eight families are known to have clasping petioles, and those of four families climb by the tips of their leaves. In almost all of them the young internodes revolve, in some of them as extensively as in twining plants,—the movement being plainly serviceable in bringing the petioles or the tips of the leaves into contact with surrounding objects. Those whose shoots revolve most freely are also capable of twining spirally around a support; but when the stem twines (as in *Clematis Sieboldii* and *calycina*, but not in *C. Viticella*), it has the peculiarity of winding first in one direction for two or three turns, and then in the opposite direction. The petioles are principally efficient in these plants, and that by means of an endowment which is not shown to belong to twining stems, with one or two exceptions. That is, the petioles or their divisions are sensitive to the contact of an extraneous body, contracting on the side touched so as to curve or coil around it. That the footstalk is directly sensitive to the touch, just as tendrils are, Mr. Darwin proved by lightly rubbing them with a twig for a few times, when in the course of some hours it bends to the rubbed side, afterwards becoming straight again; or by leaving the body in contact it is permanently clasped by the footstalk. So sensitive are some footstalks that "a loop of thread weighing a quarter of a grain caused them to bend; a loop weighing one-eighth of a grain sometimes acted, and sometimes not." In one instance, in *Clematis Flammula*, even the sixteenth part of a grain caused a petiole to bend through nearly 90 degrees. With rare exceptions only the young petioles are sensitive. Take the cultivated *Clematis Viticella* for an illustration of the mode in which the leaves do the work of climbing.

"The leaves are of large size. There are three pairs of lateral leaflets and a terminal one, all borne by rather long petioles. The main petiole bends a little, angularly, downwards at each point where a pair of leaflets arises, and the petiole of the terminal leaflet is bent downward at right angles; hence the whole petiole, with its rectangularly bent extremity, acts as a hook. This, with the lateral petioles directed a little upward, forms an excellent grappling apparatus by which the leaves readily become entangled with surrounding objects. If they catch nothing, the whole petiole ultimately grows straight. Both the medial and lateral petioles are sensitive; and the three branches, into which the basi-lateral petioles are generally subdivided, likewise are sensitive. The basal portion of the main petiole, between the stem and the first pair of leaflets, is less sensitive than the remainder, but it will clasp a stick when in contact. On the other hand, the inferior surface of the rectangularly bent terminal portion (carrying the terminal leaflet), which forms the inner side of the end of the hook, is the most sensitive part; and this portion is manifestly best adapted to catch distant supports. To show the difference in sensibility, I gently placed loops of string of the same weight (in one instance weighing ·82 of a grain) on the several lateral and on the terminal sub-petioles; in a few hours the latter were bent, but after 24 h. no effect was produced on any of the lateral petioles. Again, a terminal sub-petiole placed in contact with a thin stick became sensibly curved in 45 m., and in 1 h. 10 m. had moved through ninety degrees, whereas a lateral petiole did not become sensibly curved until 3 h. 30 m. had elapsed. In this latter case, and in all other such cases, if the sticks be taken away, the petioles continue to move during many hours afterward; so they do after a slight rubbing; but ultimately, if the flexure has not been very great or long-continued, they become, after about a day's interval, straight again."—(p. 31.)

In numerous cases, notably in *Solanum jasminoides*, the petiole when clasped increases very greatly in thickness and rigidity, undergoing a change in its woody structure by which the fibro-vascular bundles, originally semilunar in cross-section, develop into a closed ring, like that of an exogenous stem.

Lophospermum scandens of the gardens climbs, like its allies *Maurandia* and *Rhodochiton*, by clasping petioles; but in this plant, alone, the young internodes are also sensitive to the touch.

"When a petiole clasps a stick, it draws the base of the internode against it; and then the internode itself bends toward the stick, which is thus caught between the stem and the petiole as by a pair of pincers. The internode straightens itself again, excepting the part in contact with the stick. Young internodes alone are sensitive, and these are sensitive on all sides along their whole length. I made fifteen trials by lightly rubbing two or three times with a thin twig several internodes; and in about 2 h., but in one case in 3 h., all became bent: they became straight again in about 4 h., subsequently. An internode, which was rubbed as much as six or seven times with a twig, became just perceptibly curved in 1 h. 15 m., and subsequently in 3 h. the curvature increased much; the internode became straight again in the course of the night. I rubbed some internodes one day on one side, and the next day on the opposite side or at right angles; and the curvature was always toward the rubbed side."

Here, then, is one case in which the sensibility of a stem is manifest, and is turned to useful account. The peduncles of the allied *Maurandia semperflorens* are also sensitive and flexuous, although Mr. Darwin insists that they are useless for climbing. That some stems should be sensitive might have been expected; for tendrils of axial nature (e. qr. of *Passiflora gracilis*) are not less sensitive than those of foliar nature, as of *Leguminosæ*, *Cucurbitaceæ* and *Cobæa*. And if twining stems in general are not endowed with "a dull kind of irritability," as Mohl conjectured, it may well be because the equally wonderful automatic revolving movement leaves no need for it. In general, the most striking cases of automatic movement belong to leaves or their homologues.

The distinction can be only somewhat arbitrarily drawn between Leaf-climbers,—especially those with small or undeveloped leaflets, or where the tip of the leaf forms a hook or tendril-like projection,—and Tendril-climbers. The tendril, however, whether answering to leaf or stem, is the more specialized organ, adapted only for climbing, and endowed in different plants with very various and some highly remarkable powers. To this subject Mr. Darwin has devoted more than half of his essay. An analysis of it must be deferred, for want of space.

Near the close of the essay, under Hook-climbers, Mr. Darwin remarks that:—

"Even some of the climbing Roses will ascend the walls of a tall house, if covered with a trellis; how this is effected I know not; for the young shoots of one such Rose, when placed in a pot in a window, bent irregularly toward the light during the day and from it during the night, like any other plant; so that it is not easy to understand how the shoots can get under a trellis close to a wall."

Now we have had occasion to observe that the strong summer-shoots of Michigan Rose (*Rosa setigera* Mx., *R. rubifolia* R. Br.), trained on a latticed wall, are strongly disposed to push into dark crevices and away from the light; they would, many of them, pretty surely place themselves under the trellis, and the lateral shoots of the next spring would emerge as they seek the light. We suspect this is also true of the Sweet Brier.

A. G.

4. *Gradation from "Individual Peculiarities" to Species in Insects.*—The following are the concluding paragraphs of a paper by Dr. B. D. Walsh "*On Phytophagic Varieties and Phytophagic Species.*" The name *phytophagic* is given to those otherwise identical insects which differ, as varieties or species, according to the species of plant they feed upon. "When certain unimportant characters in the insect are correlated with the food-plant, while at the same time there is no sufficient reason to doubt that the two varieties freely intercross," the forms are called *phytophagic varieties.* When, from the lack of intermediate forms, intercrossing may be inferred not to take place, they are called *phytophagic species.* Dr. Walsh sums up his conclusions thus:

"From the facts referred to above and those recorded by me elsewhere, we may construct the following almost unbroken series, from the first dawnings of the Phytophagic Variety to the full development of the Phytophagic Species.

1st. Difference of food, even when the food-plant belongs to widely distinct botanical families, is accompanied by no difference whatever, either in the larva, pupa or imago state.—*Attacus Cecropia* Lin., *Dryocampa imperialis* Drury, *Lachnus Caryæ* Harris, (*Proc. Ent. Soc. Phil.* I, p. 303), and hundreds of other species.

2nd. Difference of food is accompanied by a marked difference in the color of the silk-producing secretions.—*Bombyx Mori* Lin., the common silkworm.

3rd. Difference of food is accompanied by a tendency toward the obliteration of the normal dark markings in the imago.—*Haltica alternata* Illig.

4th. Difference of food is accompanied by marked, but not perfectly constant, colorational differences in the larva, but none whatever in the ♂ ♀ imago.—*Datana Ministra* Drury.

5th. Difference of food is accompanied by a marked and perfectly constant difference in the size of the imago.—*Chrysomela scalaris* Lec.

6th. Difference of food is accompanied by a marked difference in the chemical properties of gall-producing secretions, the external characters of the ♂ ♀ imago remaining identical.—*Cynips q. spongifica* O. S. and *C. q. inanis* O. S.

7th. Difference of food is accompanied by a slight, but constant change in the coloration of the abdomen of the ♂ ♀ imago, and by a very slight change in the chemical properties of the gall-producing secretions, the galls of the two insects, though typically somewhat distinct, being connected by intermediate grades in the case of the latter.—*Cynips q. punctata* Bassett and *C. q. Podagræ* Walsh.

8th. Difference of food is accompanied by one marked and perfectly constant colorational difference, and others which are not perfectly constant, in the larva, but none whatever in the ♂ ♀ imago.—*Halesidota tessellaris* Sm. Abb. and *H. Antiphola* Walsh.

9th. Difference of food is accompanied by several slight but constant structural differences in the ♂ imago, but none whatever in the ♀ imago.—*Clytus Robiniæ* Forst. and *Cl. pictus* Drury.

10th. Difference of food is accompanied by a slight but constant structural difference in both ♂ and ♀ imago.—1. *Tingis Tiliæ* n. sp. and *T. amorphæ* n. sp. 2. (Doubtful.) *Diapheromera femorata* Say and *D. Velii* n. sp.

11th. (Doubtful.) Difference of food is accompanied by very strong structural and colorational differences in the larva and in all probability by a constant structural difference of generic value in the ♀ imago, the ♂ imagos being to all external appearances identical, and the two insects belonging to different genera.—*Sphingicampa distigma* ♂ ♀ Walsh and *Dryocampa bicolor* ♂ Harris.

12th. Difference of food is accompanied by marked and constant differences, either colorational, or structural, or both, in the larva, pupa and imago states.—*Halesidota tessellaris* Sm. Abb. and *H. Caryæ* Harris, and hundreds of species belonging to the same genus and commonly considered as distinct species.

The constitution of the human mind is such, that the same evidence carries with it very different degrees of weight, when presented to different intellects. Others will no doubt draw different conclusions from the facts catalogued above; but for my own part, as on the most careful consideration I am unable to draw any definite line in the above series, and to say with certainty that here end the Varieties and here begin the Species, I am therefore irresistibly led to believe, that the former gradually strengthen and become developed into the latter, and that the difference between them is merely one of mode and degree."

5. *Illustrated Catalogue of the Museum of Comparative Zoology at Harvard College.* No. 1, *Ophiuridæ and Astrophytidæ;* by THEODORE LYMAN. 200 pp., large 8vo, with two colored plates. Cambridge, 1865.—The Museum of Comparative Zoology, under the directorship of Professor Agassiz, at Cambridge, has already become a vast collection in some departments of zoology, and is on the rapid increase. The idea of connecting with a catalogue of the Museum the publication of occasional memoirs upon the species here gathered, has for some time been in contemplation, and the first number has just been issued with the above

title. The style of publication selected for the series is all, as regards paper, type and arrangement, that the eye could desire, and this first memoir, by Mr. Lyman, makes a most excellent beginning of the series. The Ophiuridæ and related Asterioids have been for some years his special department of study. The memoir contains detailed descriptions of the species from the shores of North and South America and Greenland, that are now in the Museum and also in the collections of the Smithsonian Institution, including in all 105 species, of which 26 are new; and it is illustrated by two beautiful colored plates, on which seven of the species are represented. It contains also an extended bibliography, and a table of the known species of Ophiuridæ and Astrophytidæ.

IV. ASTRONOMY AND METEOROLOGY.

1. *Shooting Stars seen at Hinsdale, Mass., in August,* 1865.—The following observations were made on the days specified below, the writer's station being at Hinsdale, Mass., about W. long. 73°, N. lat. 42½°. During all the observations the atmosphere was pure and unclouded, but the moonlight interfered with all but the brighter paths. The area of observation was centered considerably north of Perseus, but reached generally to Auriga. It was not, however, more than four-fifths of the field ordinarily due to a single observer.

Aug. 9th.—From $2^h\ 20^m$ to $3^h\ 45^m$ A. M., an interval of $1^h\ 25^m$, ten meteors were seen, of which nine were closely conformable to a radiant centering in A. R. 47°, N. P. D. 33°.

Aug. 10th.—Between $2^h\ 25^m$ A. M. and $3^h\ 50^m$, an interval of $1^h\ 25^m$, nineteen meteors were seen, of which *all were conformable* to a radiant centering in A.R. 42°, N. P. D. 34°; but elongated some 4°, either way, across the meridians.

Aug. 11th and 12th.—The sky was wholly obscured by clouds.

Aug. 13th.—Between $10^h\ 45^m$ P. M., and $0^h\ 45^m$ of Aug. 13th, an interval of 2^h, sixteen meteors were seen, of which twelve were conformable closely to a radiant point in A. R. 52°, N. P. D. 32°. Two-thirds of the whole number were seen in the first three quarters of an hour.

Aug. 14th.—Between $0^h\ 10^m$ A. M. to $1^h\ 35^m$, an interval of $1^h\ 25^m$, twenty meteors were seen, generally slow in angular velocity and wholly destitute of a *regimen* to their lines of direction, except that three of the earliest and one of the latest conformed to an area of several degrees around A. R. 68° N. P. D. 18°. Three of the flights were very long but *unstable* in motion—say 30° of arc traversed in 2½ to 3 seconds of time.

It seems to be clear from the foregoing that the proper August meteors in this instance, appeared as early, at least, as the first morning hours of the 9th, and were not discernable later, at least, than 11 P. M. of Aug. 12th. In other words, the duration of the phenomenon did not exceed four days, and probably did not quite cover that duration.

Notwithstanding the impracticability of observing on the important mornings of the 11th and 12th, a shifting of the radiants, as above specified, was unmistakable. A. C. T.

2. *Shooting Stars seen at New Haven in August,* 1865.—On the night of Aug. 9–10th I saw, during half an hour, ending about 2^h A. M., ten shooting stars, about two-thirds of them moving from Perseus. The

in its revolving course, the point of difficulty,—that is, the projecting extremity of the shoot. Unless the tendril had the power of thus acting, it would strike against the extremity of the shoot, and be arrested by it. As soon as all these branches of the tendrils begun to stiffen themselves in this remarkable manner, as if by a process of turgescence, and to rise from an inclined into a vertical position, the revolving movement becomes more rapid; and as soon as the tendril has succeeded in passing the extremity of the shoot, its revolving motion, coinciding with that from gravity, often causes it to fall into its previous inclined position so quickly, that the end of the tendril could be distinctly seen travelling like the minute hand of a gigantic clock." (p. 75.)

Cucurbitaceous tendrils are mostly compound, in this case three-forked. When one of the lateral branches has firmly clasped any object, the middle branch continues to revolve. If a full-grown tendril fails to reach and lay hold of any object, it soon ceases to revolve, bends downwards, and coils up spirally from the apex. Indeed it often coils while still outstretched and revolving, the tendency to shorten (as we presume) on the inner side from the tip downward, which is usually brought into action by contact with an extraneous body, at length operating spontaneously. Uncaught tendrils when they thus coil up throw themselves of course into a simple helix or spire. One end being free, this is the simple and necessary consequence of the relative shortening of the concave side, sufficiently continued.

In a caught tendril, the relative shortening of one side, (through which the tip hooks round and fixes itself to the supporting object,) being propagated downwards, the whole now throws itself into a spiral form—with more or less promptitude according to the species—thus pulling the free portion of the tendril-bearing shoot nearer to the support, and within easier reach of the next tendril above. Both ends of the tendril being fixed, and the winding round an axis (real or imaginary) necessarily involving or *being* a twist, it is certain that the caught tendril cannot now coil into a simple spiral, but that the spire will be at least double, a coil near one end of the tendril in one direction requiring the other to twist in the opposite direction, unless indeed it undergoes torsion. So, as is familiarly known, there is at least one neutral point in a caught and coiled-up tendril, usually in the middle, the turns on one side of it running from right to left, on the other from left to right. That the coils, whether simple or double and reversed (as the case may be) are not determined by any peculiarity in the tendril, but merely by the relative shortening of one side, may be readily shown by a thread cut from a piece of india-rubber, of unequal tension of the two sides; this, when stretched and allowed to shorten while the two ends are held fast in the same plane, forms at once a pair of reverse coils, or three or four such coils, just as caught tendrils do.

Mr. Darwin explains the point by analogous practical illustrations. He shows, moreover, that an important service rendered by the coiling or spiral contraction "is that the tendrils are thus made highly elastic." In Virginia Creeper, where the ends of the compound tendrils are peculiarly attached, "the strain is thus equally distributed to the several attached branches of a branched tendril; and this must render the whole tendril far stronger, as branch after branch cannot separately break. It is this elasticity which saves both simple and branched tendrils from being torn away during stormy weather. I have more than once gone on purpose, during a gale, to watch a Bryony growing in an exposed hedge, with its tendrils attached to the surrounding bushes; and as the thick or thin branches were tossed to and fro by the wind, the attached tendrils, had they not been excessively elastic, would have been instantly torn off and the plant thrown prostrate. But as it was, the Bryony safely rode out the gale, like a ship with two anchors down and a long range of cable ahead, to serve as a spring as she surges to the storm."

Moreover, while unattached tendrils soon shrink up or wither and fall off, as we observe in the Grapevine, Virginia Creeper, &c., these same plants show how an attached tendril thickens and hardens, gaining wonderfully in strength and durability. In a Virginia Creeper, "one single lateral branchlet of a [dead] tendril, estimated to be at least ten years old, was still elastic and supported a weight of exactly two pounds. This tendril had five disk-bearing branches, of equal thickness and of apparently equal strength; so that this one tendril, after having been exposed during ten years to the weather, would have resisted a strain of ten pounds."

Our space will not allow even an abstract of Darwin's account of the admirable adaptations and curious behavior of various tendrils, even of some very common plants; as for instance of the familiar *Cobœa scandens*, in which (the stem and the petioles being motionless) the great compound tendril borne at the summit of the leaf executes large circular sweeps with remarkable rapidity, carrying round an elaborate flexible grapnel, consisting of its fine subdivisions, from 50 to 100 in number, which are very sensitive even to a slight touch, bending in a few minutes toward the touched side, so that they clasp twigs very promptly, and all tipped with minute, double or sometimes single, sharp hooks, which catch in little inequalities, and may prevent the tendril-branchlets from being dragged away by the rapid revolving movement before their irritability has time to act, while the still free ones proceed to arrange themselves, by various queer and complicated movements so as to secure the most advantageous hold; then contracting spirally so as to bring other portions up within reach of the support, until all are inextricably knotted and fastened, and finally growing stouter, rigid and strong, binding the plant firmly to its support.

We cannot omit all mention of *Bignonia capreolata*, a not uncommon climber of our Southern States, of which we especially wish to obtain fresh seeds or young plants, that we may ourselves observe the remarkable behavior of its tendrils which Mr. Darwin describes. These are said to turn from the light, as in many other cases; they will clasp smooth sticks, but soon lose their hold and straighten themselves again. A rough, fissured, or porous surface alone satisfies them; their young tips seek and crawl into dark holes and crevices, in the manner of roots; then they develop their hooked extremity, and, especially when they meet with any fibrous matter, the hook swells into irregular balls of cellular tissue, which first adhere to the fibres by a viscid cement, and then grow so as to envelop them. This tendril can do nothing with a smooth post, fails to attach itself to a brick wall, but is well adapted to climb trees with rough and mossy bark.

The Virginia Creeper also turns its tendrils from the light, and, although they will occasionally clasp a slender support, in the manner of its relative the Grapevine, they uniformly seek dark crevices, or especially broad flat surfaces, as a wall, a rock, or the trunk of a tree. Having brought their curved tips into contact with such a surface, these swell and form, in the course of a few days, the well-known disks or cushions by which they firmly adhere. Here is a tendril-climber, which emulates a root-climber, such as Ivy, in the facility with which it ascends smooth trunks, rocks, or walls.

A very short chapter is devoted to *Hook-climbers* and *Root-climbers.* The stems of the latter are said to "have usually no power of movement, not even from the light to the dark. But *Hoya carmosa*, which twines, also climbs by rootlets spreading over the face of a damp wall; and *Tecoma radicans* (our Trumpet Creeper) exhibits in its young shoots some vestiges of the revolving power with which its twining relatives are endowed."

In a dozen pages of *Concluding Remarks*, Mr. Darwin gives much interesting matter in the way of deduction and speculation, which it would be difficult to condense into an abstract.

Plants become climbers, he remarks, in order to reach the light, and expose a large surface of leaves to its action and that of the free air. Their advantage is, that they do this with wonderfully little expenditure of organized matter in comparison with trees, which have to support a heavy load of branches by a massive trunk. Of the different sorts of climbers, hook-climbers are the least efficient, at least in temperate countries, as they climb only in the midst of an entangled mass of vegetation. Next root-climbers, which are admirably adapted to ascend naked faces of rock; but when they climb trees they must keep much in the shade, and follow the trunk; for their rootlets can adhere only by long-continued and close contact with a steady surface. Thirdly, spiral-twiners, with leaf-climbers and tendril-bearers, which agree in their power of spontaneously revolving and of grasping objects which they reach, are the most numerous in kinds, and most perfect in mechanism; they can easily pass from branch to branch, and securely ramble over a wide and sun-lit surface.

After adducing some considerations in support of his opinion that both leaf-climbers and tendril-bearers "were primordially twiners, that is, are the descendants of plants having this power and habit," Mr. Darwin asks: "Why have nearly all the plants in so many aboriginally twining groups been converted into leaf-climbers or tendril-bearers? Of what advantage could this have been to them? Why did they not remain simple twiners? We can see several reasons. It might be an advantage to a plant to acquire a thicker stem, with short internodes, bearing many or large leaves; and such stems are ill fitted for twining. Any one who will look during windy weather at twining plants will see that they are easily blown from their support; not so with tendril-bearers or leaf-climbers, for they quickly and firmly grasp their support by a much more efficient kind of movement. In those plants which still twine, but at the same time possess tendrils or sensitive petioles, as some species of *Bignonia*, *Clematis*, and *Tropæolum*, we can readily observe how incomparably more securely they grasp an upright stick than do simple twiners. From possessing the power of movement on contact, a tendril can be made very long and thin; so that little organic matter is expended in their development, and yet a wide circle is swept. Tendril-bearers can, from their first growth, ascend along the outer branches of any neighboring bush, and thus always keep in the full light; twiners, on the contrary, are best fitted to ascend bare stems, and generally have to start in the shade. . . . .

"The object of all climbing plants is to reach the light and free air with as little expenditure of organic matter as possible; now, with spirally-ascending plants the stem is much longer than is absolutely necessary; for instance, I measured the stem of a kidney-bean which had ascended exactly two feet in height, and it was three feet in length. The stem of a pea, ascending by its tendrils would, on the other hand, have been but little longer than the height gained. That this saving of stem is really an advantage to climbing plants I infer from observing that those that still twine, but are aided by clasping petioles or tendrils, generally make more open spires than those made by simple twiners." (p. 110.)

The gradations between one organ and another, and their special endowments, and the great diversity of their movements, are illustrated at length; and the very large number of natural families which exhibit these endowments, in some of their members, is indicated; and it is noted that two or three genera alone have those powers in some of the largest and best defined natural orders, such as *Compositæ*, *Rubiaceæ*, *Liliaceæ*, Ferns, &c.; from which he infers "that the capacity of acquiring the revolving power, on which most climbers depend, is inherent, though undeveloped, in almost every plant in the vegetable kingdom." (p. 117.)

Mr. Darwin somewhere throws out the remark that the larger number and the most perfectly organized climbing plants, as of the scandent animals, belong to one country, tropical America.

In abruptly closing these extracts and brief commentaries, we would add, that the Linnæan Society has issued a separate reprint of this charming treatise, thus opening it to a wider circle of readers. A. G.

2. *Catalogue of Plants found in Oneida County* [*New York*] *and vicinity;* by JOHN A. PAINE, Jr. From Report of the Regents of the University of the State of New York, presented March 22, 1865. pp. 140, 8vo. Date at the close, October, 1865.—This full catalogue, upon which much labor has been expended, embraces in fact the whole central part of the State of New York. The actual geographical limits are nowhere indicated, and are perhaps indefinite; but the range appears to extend east to Schenectady, north to the St. Lawrence and Lake Ontario, west to the Genesee River, and south to the tier of counties bordering on Pennsylvania; and in special instances even overpassing these limits. Eighty-one native plants (species and varieties) are enumerated at the close as being additions to the Flora and later catalogue of the plants of the State by Dr. Torrey. But a good many of these, and especially of the twenty-six Carices, are such as depend upon difference of views as to species, some of which have been settled during the many years that