volving mirror, and the fixed mirror at a distance of about 2000 feet. By this arrangement, with a speed of rotation of 257 turns per second, he obtained a deflection of 115 millimeters; whereas, Foucault using a speed of 400 turns per second, and causing the light to traverse a distance of 20 meters, had obtained a deflection of 8 millimeters. The revolving mirror was driven by a turbine-wheel operated by a blast of air. Its speed, which was measured by an electric tuning-fork, was readily adjusted by a stop-cock, and the deflection was measured by a micrometer.

Mr. Michelson gives a most careful discussion of the errors of his constants, including the determination of the value of the micrometer screw, the rate of vibration of the tuning fork, etc., and concludes with the consideration of several "objections" which have been suggested from time to time.

The final value for the velocity of light *in vacuo* is 299944 $\pm$ 51 (in air, 299864), or, in round numbers, 299940 kilometers per second = 186380 miles per second,* the remarkably small error, $\pm$ 51 kilometers, being composed of the total constant error in the most unfavorable case, and the probable errors of observation. This quantity, $\pm$ 51 kilometers, cannot be said to express the *probable error* of the determination, in the ordinary acceptance of the term; combining, as it does, *probable errors*, strictly speaking, and estimated constant errors.

These experiments were made by Master Michelson at the Naval Academy, Annapolis, at private expense, and to him the entire credit is due. A new determination of the velocity of light, embodying essentially the same arrangement, but with more elaborate and expensive apparatus, is now being made under official auspices by Prof. Newcomb, Superintendent of the Nautical Almanac.

It is probable that in this way the most accurate value of the solar parallax, so essential to astronomy, can be deduced.

ASTRONOMICAL MEMORANDA.—(Computed for the meridian of Washington, D. C., November 29, 1880):

	H.	M.	S.
Sidereal time 05 mean noon	16	35	50
Equation of time		11	15

mean noon *following* apparent noon.

The *Sun* is 21° 39′ south of the equator, at meridian transit, and will continue to move south until December 21.

The *Moon* reached its last quarter on November 24d. 8h. 47m. It does not come to the meridian until 10 A.M. of November 30.

Mercury was in inferior conjunction, November 23, and is not now visible to the naked eye. It precedes the sun by about 52 minutes, and is five degrees farther North.

Venus is plainly seen in the southwest; a short time after sunset; following the sun by 2h. 33m., and gradually increasing the distance. Its declination is 24° 43′ south.

Mars is at present too close to the sun for observation.

Jupiter, though gradually growing fainter, is still the most brilliant object in our eastern sky at evening. It passes the meridian at 8 P.M., at an altitude of 54° above the southern horizon. Its more exact position at that time is: Right Ascension, oh. 37m. 43s.; declination, +2° 28′.

Saturn, less brilliant than Jupiter, is, notwithstanding, equal or superior to the larger planet in point of interest. It is readily found about 13° E. by N. of Jupiter, presenting a good view of the southern side of its rings.

Uranus is in right ascension 11h. om. 52s. declination +7° 9′.

Neptune is in excellent position for observation, reaching the meridian at about 10 P. M. It was in opposition on November 4, and may now be found in Right Ascension 2h. 41m. 27s. declination +13° 46′.

A new 10 in. equatorial, with an object glass by Merz, has been presented to the Geneva Observatory by its director, Prof. Emil Plantamour. It is to be devoted to observations of the major planets and their satellites, of parallax of stars, and of double stars, with occasional observations of minor planets.

DR. Schmidt has made a new determination of the time of rotation of Jupiter upon its axis, from observations in 1879 and 1880, of the red spot upon its disc. His preliminary discussion gives for the time of rotation 9h. 55m. 34.42s.

IN a letter to *Nature*, dated October 2, Prof. Pickering, of Harvard College Observatory, announces that the period of Ceraski's new variable star is probably 2.5 days, instead of 5 days, as previously published by Schmidt. It is especially remarkable for the rapidity of change during part of its period. The total variation is from about the 6.7th to the 10th magnitude. The approximate place for 1881 is, R. A. oh. 51m. 48s. Dec. +81° 14′.1.

W. C. W.

WASHINGTON, D. C., Nov. 23, 1880.

MICROSCOPICAL COLLECTIONS IN FLORIDA.*

By DR. C. C. MERRIMAN.

It has been my fortune during the past two Winters to spend a few weeks in the regions of Central Florida. Lake Harris is the most southern and the most beautiful of the cluster of lakes which forms the source of that exceedingly picturesque river, the Ocklawaha. With high banks, and surrounded by a belt of hummock land as rich as any that Florida affords, this lake is becoming settled upon, and its lands are fast being taken up by enterprising southerners for orange-groves and pine-apple plantations. The sojourner will find the society of this lake-settlement intelligent and hospitable beyond anything that would be expected in so new and pioneer a country. The vegetation of this almost tropical region is so full of interest to the microscopist, and the causes conducing thereto so peculiar, that I have thought them deserving of especial mention and illustration.

The absence, or at least the rarity of frosts injurious to vegetation in these lake districts, gives the longest possible season for the growth and maturity of such organs as are best, or especially, adapted to the exigences of Florida plants. There is a period of rest, usually comprising about the three Winter months, after which vegetation takes up and continues its growth again as if there had been no period of interruption; so that practically there is a continous development of plant life, whether annual or perennial, from birth to death.

The soil of Florida, as of all the South-Atlantic seaboard, is sandy and naturally barren. No polar glaciers have ground up for these regions, as for the Northern States, a rich and abundant alluvium, sufficient in itself for the production of a rapid and vigorous vegetation. The South has apparently only the siftings of our Northern soil, carried down to the ocean by rivers, and then washed up by the sea-waves to form their interminable sandy plains. But to compensate for this natural infertility of soil, the atmosphere, especially of Southern Florida, abounds in all the elements of plant growth. The winds which come up from the Gulf on one side, or the Atlantic on the other, are charged with moisture, and bear also minute quantities of nitric acid and saline compounds; while the exhalations from the swamps and marshes furnish in abundance the salts of ammonia and carbonic acid. Now to utilize these precious products from the air, it is necessary for plants to

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* NOTE.—Foucault's experiments gave the velocity as 185200 miles per second.

*Read before the Sub-section of Microscopy of the A. A. A. S.

have peculiar organs, such as absorbing glands, glandular hairs, stellate hairs, protecting scales, and a variety of other special appendages. All these have been developed by time and necessity, in remarkable profusion and perfection in the vegetation of Southern Florida. Although the meagre soil produces no nutritious grasses, and scarcely enough of an honest vegetation to keep an herbivorous animal from starving; yet there is an abundant flora such as it is—air plants, parasitic growths, insectivorous plants, and strange herbs seeking a livelihood in any other way than the good old honest one of growing from their roots. It is this fact which makes the microscopial interest of botanical researches in Central Florida. One can scarcely examine with a two-thirds objective the flowers, leaves or stems of any plant growing there without discovering some beautiful or striking modification of plant hairs, or scales, or glands, or other absorbing or secreting organs.

We will notice first the Onosmodium as found in Florida —*O. virginianum*. It grows from Virginia south, but is more glandular I think, in Florida than anywhere else. It will be almost the first plant one would stop to observe on entering the pine woods—a dark-green, narrow-leaved, biennial herb; its straight stem of the second year's growth, about a foot high, bearing a raceme-like cluster of flowers, coiled at the end, and straightening out as the flowers expand. The leaves of this plant are thickly studded on both sides with stiff transparent hairs, lying nearly flat on the surface, and all pointing toward the tip end of the leaf. At the base of each hair is a cluster of glandular cells, amounting sometimes to fifty or more, arranged in beautiful geometrical forms. When pressed and dried in the herbarium, the body of the leaf turns to a dark green, almost black, and on this back-ground, with a half-inch objective, the hairs stand out like sculptured glass, and the glands like mosaics of purest pearls. I think it is the most attractive opaque object that can be shown under the microscope.

That these glandular cells, covering, as they do, nearly half the surface of the leaves, especially the upper surface, and differing from all other vegetable cells, subserve an important purpose in the sustenance of the plant, there cannot be any doubt; but just what that purpose is, or what is the mode of operation, I think, has never been ascertained.

In the same locality will very likely be found the most beautiful of all the Croton plants, the *C. argyranthemum*. Unlike the other Crotons, which are bushes, this is an herb growing only about a foot high, with a milky sap which exudes when the stem is broken. The leaves are silvery, verging in some cases to a bronze color, and are thickly covered on the upper side with most remarkable and beautiful stellate scales. The flower-buds and stem, when pressed, make much more beautiful opaque objects than the leaves.

The object of these scales is, without doubt, to prevent the too rapid evaporation of the moisture stored up in the plant. They are the exquisitely woven blankets which preserve the precious juices so laboriously gathered. The same kind of covering is spread over the leaves and stems of all the air-plants of Florida, and doubtless for the same purpose. The well-known Florida moss, although not a moss, but a member of the pine-apple family (*Tillandsia usneoides*), is an exceedingly beautiful object under the microscope. Each hanging stem is overlaid with filmy white scales, every one of which is fastened in its place by what would seem to be the stamp of some miniature seal on golden-tinted wax. This plant, as ordinarily seen on the live-oaks near cities, is a dirty-looking and unattractive object, and goes by the name of "black moss." But in out-of-the-way places, removed from the dust and smoke of settled localities, it is pearly white, and exceedingly beautiful both to the naked eye and under any power of magnification. Florida moss should be preserved with only a very slight pressure, just enough to make the threads lie straight. After it has dried in this way, small cuttings may be mounted in the ordinary cells for opaque mounting.

On the high banks of the lake, and in the adjoining fields may be found the large-leaved and vigorous-growing Calicarpa (*C. Americana*), sometimes called the French mulberry, a bush growing some five or six feet in height. The under side of the leaves of this plant are nearly covered with little round, yellow, sessile glands, flattened on top and marked off into eight ten sections by ribs like those on a melon. They are in immense numbers—something like thirty thousand to the square inch—over half a million on a good-sized leaf. Under a light net-work of branching glandular hairs, viewed with a two-thirds objective, these polished ambor-colored disks glisten like a spangle of golden beads. The same kind of glands is found on the leaves of many other shrubs in Florida—the sweet myrtle (*Myrica cerifera*), the low-ground blueberry (*Vaccinium tenellum*) a certain bush or dwarf hickory (*Carya glabra*) and some others. These glands have been variously called resin dots, resin glands and odoriferous glands. So far as I can judge, however, they are not connected with any resinous or odoriferous secretions. From their almost perfect resemblance to the terminal bulb of the mushroon glands of the Pinguicula and Drosera, which are known to be absorbing glands, the probability is that these also serve to absorb moisture and ammonia from the atmosphere and from rains. Although I am free to acknowledge that the position of the glands, being for the most part on the under side of the leaves, militates somewhat against this view of their purpose.

Great care will have to be taken in pressing and drying vegetable specimens in the moist climate of Florida. The little threads of the mould fungus will be sure to creep over the surface of the leaves, spoiling them for microscopical material, if they are not quickly and effectually dried. For this purpose it is well to have a good supply of the bibulous botanical paper, and to change the specimens every day to fresh sheets for at least four or five days. The sheets, after being once used, should be spread out in the sun to dry. A weight of about thirty pounds may be used for the pressure.

The objects heretofore mentioned are all for opaque mounting. Almost every preparer of slides has his own favorite method for this kind of work. I myself prefer the use of the transparent shellac cells. Clarified shellac is dissolved in alcohol, and filtered through cotton-wool under a bell-glass, and with the application of heat. The solution is evaporated down until it is so thick that it will only just run—almost a jelly. In this condition it can be put on a slide with a camel's hair brush on the turn-table, and very quickly worked up into a ring with the point of a knife, used first on the inside to make the cell of the size wanted, and then on the outside to turn the cement up into a compact ring. Two or three applications of the cement, with intervals of a day or two after each, will make cells of sufficient depth for all ordinary specimens. These cells dry quite slowly; and if artificial heat is used it must be increased only very gradually, otherwise vapor of alcohol bubbles will make their appearance in them. A small ring of Brunswick black may be made in the inside of the cell, to which, when thoroughly dry, the object may be fastened with a very little liquid marine glue. In this case both sides of the leaf can be seen, which is often desirable. In all opaque mountings a minute aperture should in some way be left open into the inside of the cell, so that it shall not be hermetically sealed up. This little precaution will save an innumerable number of failures.

The collector in Florida will not fail to secure a supply of the-leaf stems of the castor oil plant (*Ricinus communis*). In regions beyond the influence of frosts, this plant grows continuously from year to year, and becomes quite a tree. It is only in such a growth that the spiral tissue of the fibro-vascular bundles is fully perfected. The castor oil plants grown in our climate during one short season, will furnish very little spiral tissue, mostly spotted ducts and scalariform cells. There is no more beautiful object for multiple staining than thin longitudinal sections through the woody fiber, the vascular tissues, and the pith cells of well matured leaf-stems of the castor oil plant. I will briefly describe my process of making these stainings. After being decolorized in chlorinated soda, the sections may be left for half a day or more in a solution of carmine in water containing a few drops of aqua ammoniæ; then for half an hour in a rather weak solution of extract of logwood in alum water, and finally 10 to 15 minutes in a weak solution of anilin violet or blue in alcohol. From this they can be carried through absolute alcohol into turpentine, and mounted in balsam at any time thereafter. If successful in this staining you will have the pith cells in red, the spiral tissue in blue, the wood cells in purple and the stellate crystals in green or yellow.

But the chief objects of interest to the microscopists in the vegetation of Florida, are the insectivorous plants. Not only are they more abundant, and, as I think, more perfectly developed in the central lake regions of Florida, but some varieties are found there differing, it seems to me, from any found elsewhere. I desire particularly to mention one which I discovered, and which perhaps might be entitled to rank as a new species.

In a lagoon-like basin at the side of a small lake near Lake Harris, in water from two to three feet deep, I found numerous specimens of the insectivorous plant known as the Drosera or Sun-dew, growing thriftily and floating about among the scattered water-weeds, without any attachment whatever, indeed with very little root of any kind, the dead leaves that hung down in the water seeming both to buoy it up and to hold it upright. This plant differs from all the described species of Drosera, so far as I have been able to to ascertain, in having an upright, leaf-bearing stem from four to five inches long, in floating free on the water, and in having unusually long, vigorous and numerous leaves. As I never found this floating Drosera in any other location, and as there was an abundance of the ordinary *Drosera longifolia* growing on the adjoining shore, I could not resist the suspicion that at this very spot in some past time a plant of the *longifolia* had by accident become uprooted, and floated out on the water—that finding it could capture insects even better on the water than crowded among shore plants, it adapted itself permanently to its new location and modes of growth. It appeared to me quite within the bounds of probability that here was an instance of the evolution of a species *in loco*.

The Drosera or "sun-dew" is found on the margins of nearly all small ponds and permanently wet places throughout the south. It is a small red plant, growing close to the ground, and glistening in the sunlight. Its little whorl of expanded leaves forms a circlet as beautiful as any flower, and often so very small that I have frequently mounted whole plants with flower-stalk and buds on one slide. Each leaf of the Drosera has, spread out on its upper surface and edges, from two to three hundred arms, called tentacles because endowed with the power of motion, and of such varying lengths that when naturally incurved their ends just meet at the centre of the leaf. Each tentacle has at its extremity a pad, like an extended palm, with a ridge raised lengthwise upon it, and in this palm is a bundle of spiral vessels connected with the same tissues in the leaf. Now all the tentacles secrete and exude from the glands at their ends a little drop of a very adhesive fluid ; and the glistening of these drops in the sunlight on their usually bright red back-ground, gives to the plant its beauty and its name of the "sun-dew." An insect attracted to and alighting on these leaves is inevitably held fast. The tentacles by which it is held very soon begin to bend towards the centre of the leaf, carrying the fly with them. Then in some mysterious way, intelligence is communicated to the other tentacles, and they too begin to turn towards the centre of the leaf, in the course of an hour or two completely covering the captural prey. If the insect is caught entirely on one side of the leaf, then only the tentacles of that side inflect. The glands, after envelopment, exude a gastric fluid which dissolves the nitrogenous matter in the body, after which, by another change of function, they absorb and carry down into the plant all this nutritious little feast. In the course of three or four days the tentacles again expand and prepare themselves for another capture.

There are several reasons which lead me to believe that these unique and most wonderful organs of the Drosera are a direct and special development from the common, simple mushroom glands, which are found on many plants, and which have for their primary function to absorb moisture and ammonia from the atmosphere and from rains. I found on the calyx and flower stem of the Drosera an abundance of these mushroom glands. Indeed the flower stem with its buds furnishes by reason of them, an exceedingly beautiful object for the microscope, both in a natural state and when prepared by double staining.

I have found it quite a general rule as regards plants, that whatever organs, such as stellate hairs or glands, the leaves may possess, the calyx and stem of the flower will show them in far greater luxuriance and beauty. The stellate hairs of the Deutzia, the Crotons, and the Shepherdias are far more numerous and striking on the flower buds than on the leaves. The mushroom glands which are found on the leaves of the Saxifrage and Pinguicula, are multiplied many fold in number and attractiveness on the calyx and flower stem of these plants. So I regard that this was once the case with the Drosera ; and that the mushroom glands, which are now found on the flower, were then common to the leaves. A process of evolution has transformed them on the leaves into those wonderful motile arms adapted to the capture of insects, but has left them unchanged on the flower, where that function would be of no use to the plant. I occasionally find in my preparations a solitary mushroom gland among the tentacles of the leaf—a remnant of a race that has been supplanted. There is found in Portugal a plant very similar to the Drosera, the Drosophyllum, which has still only the mushroom glands on its leaves, and catches insects in great quantity by loading them down with the viscid secretion which these glands abundantly pour forth.

To exhibit the very delicate structure of the leaf and tentacles of the Drosera, it is necessary to color them but slightly. The danger will be in over-staining ; therefore, after decolorizing and immersing for a few hours in the carmine solution, the specimens should be exposed to only a very weak fresh solution of logwood for fifteen or twenty minutes. If the anilin blue is resorted to at all, it must be in a very weak solution. A mounting of a leaf and a stem with flower buds in one cell in camphorated or carbolated water, makes a very pretty and complete slide for the Drosera.

The Utricularia is a floating, carnivorous plant which grows in the shallow water of quiet ponds. On the surface of the water from five to seven leaves are spread out like the spokes of a wheel, and from the centre of these leaves the plant sends upward its flower stalk and downward its root-like branches, floating freely in the water. Among the thickly branching fibres of these long submerged stems, are perched innumerable little bladders or utricles, not much larger than the head of a pin, each provided with a mouth, at the bottom of a sort of funnel of bristles, closed with a cunning little trap-lid which opens inward, engulfing and imprisoning whatever minute creatures or substances may happen to be resting on it. In these sacks during the growing season, we will find numerous microscopic water fleas, mites and beetles, with grains of pine pollen and other floating particles. The organic bodies will be found in all stages of digestion, showing that the plant derives nourishment from such captured prey ; and apparently its only means of livelihood is trapping.

When taken from the water and dried under slight pressure, the submerged portions of the Utricularia will be found literally covered with diatoms ; and many very interesting chrysalids of water-insects will be found attached to them. These will all be washed off if the plant is bleached in chlorinated soda. To preserve them it will be necessary to remove the color in alcohol, and besides to handle very carefully. The staining can only be single ; and I have found a weak solution of eosin in water, to be the best material for coloring, showing at the same time the structure of the utricles and the captures contained in them. Specimens of new growths, showing the just forming utricles and the peculiar circinate mode of growth, should be included on the slide. The mounting should be in camphorated water.

The Pinguicula, another of the insectivorous plants, is found abundantly on the more open plains, and not far from wet places. It is a compact rosette of very light green leaves, growing close to the ground, from the centre of which rises a single flower-stalk, eight or ten inches high. The leaves have their edges turned up, forming a shallow trough, and on the upper surface are mushroom glands, which exude a viscid secretion. Insects are caught and held by this sticky substance until they die. The nutritious matter is then dissolved out by an acid secretion, and is ultimately absorbed into the substance of the plant by the glands on the leaf. The edge of a leaf when excited by a capture will bend over upon it for a short time ; merely for the purpose, I think, of more effectually securing it, and of bathing it in the secretions. The calyx and flower-stalk, as I have already mentioned, are thickly covered with the same mushroom glands that are found more sparingly on the leaves. I have never seen any evidence that the flower appendages take any part in the digestion of insects. They seem to be rather in the nature of an ornamentation than of anything useful. For exhibition, therefore, or for double-staining, the calyx and flower stem will be found by far the most attractive part of the plant. The best way to preserve them, as well as all such small material, until wanted for use, is to put them green into a common morphia vial with a few drops each, of alcohol and water, and then to cork and seal them up tight with melted beeswax. To prepare them for the slide these objects may be treated precisely as recommended for sections of castor-oil plant, but should be mounted in a weak solution of glycerine in camphorated water.

If cells are made of rings punched out of the thin sheets of colored wax, used by artificial flower makers, and then coated with either liquid marine glue, or a mixture in equal parts of gold size and gum damar, dissolved in benzole, this method of liquid mounting may be as easily and safely performed as mounting in balsam. In very many cases simple water, made antiseptic in any manner, will be found far preferable to any other media, both for retaining the full and distended forms of minute organs, and for bringing out the delicate markings of vegetable structure which the highly refractive balsam would entirely obliterate.

There is only one other insectivorous plant found in Florida—the pitcher plant—*Sarracenia variolaris*, a species growing only in the South-Atlantic States. It is found in low and wet places among the open pine-barrens, but is not as abundant as the others which have been mentioned. The leaf is a hollow, conical or trumpet-shaped tube, with a flange or wing running up one side, and a hood which arches over the orifice of the tube. During the growing season this tube is usually more than half filled with water, which we must suppose secreted by the plant itself, because the hood effectually sheds all rain-water from it. Crowded into the bottom of the tubes of mature leaves, we shall almost invariably find a mass of the hard and indigestible parts of insects. These creatures have been in some way attracted into that suspicious looking receptacle, and once in have been unable to get out again. A mere partially covered tube, however, with a little water in it, is by no means a fly-trap. Not one insect in a hundred would fall into that well and drown, if there were not some special device absolutely preventing it from crawling upward. Now a microscopical examination of the inside of the hood and tube of the pitcher plant reveals the most skilful contrivances for securing insect prey that could possibly be imagined. In the first place, there are in the upper part of the receptacle and about the mouth, great numbers of sessile glands which secrete abundantly a sweet fluid, very attracting to ants and flies. Further, there is on the inner surface of the hood and mouth, a formidable array of comparatively long pike-pointed spines, all pointing backward and downward. These grade off into a shorter, more blunt, but still exceedingly sharp-pointed spines, which overlap each other like tiles on the roof of a house. This kind of coating lines the tube for a third of the way down, the spines growing finer until at last they grade off into regular hairs which line all the lower part of the tube ; spines and hairs all pointing downward. An insect attempting to retrace its steps after its ambrosial feast, would find nothing which it could penetrate or grasp with the hooklets of its feet ; and the wetness of the spines, from the constantly overflowing glands, would probably prevent it from making use of any other device that insects may have for climbing glazed surfaces. As a matter of fact no creature comes out of that prison-house, unless it be with the single exception of one cunning spider, which in some way finds a safe and rich retreat under the hood of its great vegetable rival.

The bodies of the captured prey fall into the fluid in the tube and are macerated or decomposed, but without any signs of putrescence. Therefore the plant must at once absorb the animal matter, for otherwise this would cause the infusorial life, which is called putrefaction.

In order to show the internal structure of the pitcher-plant leaf, it will be necessary to separate the cuticle which bears the spines and glands from the rest of the leaf. To do this, pieces cut from the leaf, and preferably those showing the transition from one kind of spines into another, after being soaked in water, may be put into common nitric acid, and this brought up to the boiling point over an alcohol lamp. They should then be immediately washed in several waters, when it will probably be found that the cuticle, both the inner and the outer, has already separated from the parenchyma. The specimens will need no further bleaching, and may be stained either in eosin, dissolved in water, or in anilin blue in alcohol. As there is only one kind of tissue to be stained, it will be impossible to get more than one color in them. They should be mounted, or kept in water very slightly acidulated with carbolic acid.

I cannot but regard the pitcher plant as the most highly developed, and the most specialized in its organization of any of the insectivorous plants. It differs more widely from ordinary vegetation, and has more special and adapted contrivances about it, than any of the others. Now, as I believe that the truth of the modern evolutionary theory will be eventually brought to the test by well-studied monographs, made by microscopists, on some such highly differentiated organic structures as this pitcher plant, I do not deem it a digression to present here briefly some inferences which seem to me to arise from the developmental history of this particular plant. Of course, if the pitcher plant was developed from other and ordinary plants, it had at one time the simple plain leaves of common herbs. It must have early commenced in some way, to appropriate insect food on these leaves, because every essential change was for the betterment of the plant in this respect. The stem of the leaves soon began to put out flanges or wings on each side —the phyllodia of the botanists, which are not uncommon among plants. And these outspread wings must have assisted in the absorption of insect food that was washed down among them. Then the edges of the wings turned up, and curved around towards each other, until finally they met and grew together, forming a tube and a much more complete receptacle for decomposing animal bodies. A South American genus, the *Heliamphora*, is just in this condition at the present time. Then from some unknown cause and in a way exceedingly difficult to explain, our *Sarracenia* changed entirely its manner of capturing insects. The leaf bent over the orifice of the tube, forming the hood, and those remarkable spines and tiled plates were developed on the inside of the hood and tube, growing backwards, contrary to the order of Nature. When all this was accomplished and fully completed, but not before, our plant could commence its career as the most successful trappist of either the vegetable or the animal kingdom.

Now, according to the Darwinian theory, all these transformations were the result of innumerable slight and accidental variations, each one of which happened to be so beneficial to the particular plant concerned, that it got the start of all the others, and every time run them all out of existence. One cannot tell how many million times this extinction and reproduction must have occured, before our marvellously perfect little fly-trap was finally produced. Excuse me if I confess that not all the canonical books of Darwin are sufficient to make me put faith in the miracles of accidental evolution. I believe in the fact of the gradual development of the organic kingdoms ; for all science teaches it. But I believe it was governed and guided by forces more potent than accident or chance. The Being, or the first cause, if you will, that originated the simple elements of matter, and endowed them with the power and the tendency to aggregate into developing worlds, might equally as well have endowed certain of them with the power and the tendency to aggregate into ever advancing organisms. There is no chance, in the myriad forms of crystalline and chemical substances ; then why should there be in the scarcely more varied colloid forms of living matter ? In a world that unfolds from chaos in one steady line of progress, that shows only design at every advancing stage, I must logically place somewhere at its commencement the Almighty fiat of a Designer.