THE

BOTANICAL GAZETTE.

EDITOR:

JOHN M. COULTER,
WABASH COLLEGE, CRAWFORDSVILLE, IND.

ASSOCIATE EDITORS:

C. R. BARNES,
Purdue University, La Fayette, Ind.

J. C. ARTHUR,
N. Y. Agric. Exper. Station, Geneva, N. Y.

VOLUMES IX & X.

and
Index 1-10

INDIANAPOLIS:
CARLON & HOLLENBECK, PRINTERS AND BINDERS.
1884—1885.

INDEX TO VOLUMES IX AND X.

BOTANICAL GAZETTE.

VOL. IX. JANUARY, 1884. No. 1.

A Botanical Holiday in Nova Scotia. I.

BY T. J. W. BURGESS, M. D.

[That the following notes do but scant justice to the botany, and still less to the scenic beauties of a comparatively little traveled region, I am fully aware, but give them in the earnest hope that they may serve as a stimulus to induce some one more able than myself to undertake such a work. In their preparation I have to acknowledge the valuable assistance of Professor Macoun, while to Mr. Sereno Watson and Professor D. C. Eaton, for aid in determining some of the plants enumerated, thanks are also due.]

Granted a three months' leave of absence from my official duties, came the question how best to spend it. The numerous methods suggesting were finally sifted down to two: a visit to the "old country," as we Canadians, copying our English sires, still love to call the land of their birth, or a trip through Nova Scotia with my friend, Professor Macoun, who was about to make an investigation of the flora of that region. A love of nature, combined with a knowledge of the fact that a chance to "do" the Maritime Provinces in such excellent company, both socially and scientifically, might never occur again, decided me in favor of the latter scheme.

Having joined company with the Professor and his son at Montreal, we left there by the Intercolonial Railway on the evening of June 7th, 1883, and in the morning found ourselves speeding swiftly through the picturesque scenery of the lower St. Lawrence. Not the least striking feature of the landscape were the typical French villages, where the quaint old houses, with their gaily painted, sharp pitched roofs, curving gracefully from the projecting eaves, nestled so quietly, unchanged since the days when the Bourbon lilies waved above "La Nouvelle France." Everywhere along the track we noticed *Rhododendron Rhodora*, Don, in great abundance, and often for miles, the bogs, stretching far as the eye could see on each side, were a mass of purple bloom. pricked out with snowy tufts, the tops of *Eriophorum vaginatum*, L The stout stems of *Veratrum viride*, Ait. were shooting up in all the low meadows, while *Antennaria plantaginifolia*, Hook. carpeted the dry knolls. At Rimouski we turned our backs on the St. Lawrence and journeyed south to the valley of the Metapediac. If, as is said, the name of this famous salmon stream denotes "musical waters," the title is well deserved. Winding through the green valley in a constant succession of rapids for nearly sixty miles we watched its sparkling waters, so strangely pent in by the mountains rising in every shape, from six to eight hundred feet on either hand. The season was backward and a few patches of snow were still lying along the banks, and many of the poplars were just beginning to put forth their leaves. Evening saw us across the Restigouche and into New Brunswick, while breakfast time next morning found us at Amherst and in Nova Scotia. A few hours more and we had reached Truro, our first regular botanizing ground.

Having settled ourselves at an hotel, our first thought was to explore the town, a bustling place with pleasant streets, extensively adorned with English elms, but *abeunt studia in mores*, and we were soon making for the fields and woods beyond. The ground, as well as the atmosphere, was remarkably humid, and it did not take long to discover the tendency of Western bog plants to grow here on the hill sides Sphagnum was everywhere, *S. acutifolium*, Ehrh., in its various forms, being the leading species. The scarcity of many of *our* commonest weeds at once struck us. *Verbascum Thapsus*, L., *Cynoglossum officinale*, L., *Cnicus arvensis*, Hoff., *Echinospermum Lappula*, Lehm., and others were conspicuous by their absence, their places being supplied by *Carum carui* L., *Ranunculus acris*, L., *Leontodon autumnale*, L., and *Nepeta Glechoma*, Benth., which covered the pastures, roadsides and railway tracks. *Kalmia angustifolia*, L., with *Vaccinium Canadense*, Kalm and *Pennsylvanicum*, Lam., engrossed the open, while *Maianthemum Canadense*, Desf., and *Cornus Canadensis*, L., filled the woodlands. The noble hardwood forest was replaced by one composed of *Abies nigra*, Poir., *alba*, Mx., *balsamea*, Marshall, and *Canadensis*, Mx., *Pinus resinosa*, Ait., *Strobus*, L., *Larix Americana*, Mx., and *Betula papyracea*, Ait., and *alba*, var. *populifolia*, Spach.; *Fagus ferruginea*, Ait., *Acer saccharinum*, Wang. and *rubrum* L., being rare. Ferns were very abundant and well represented by *Polypodium vulgare*, L., *Pteris aquilina*, L., *Asplenium Filix-fœmina*, Bernh., *Phegopteris polypodioides*, Fée and *Dryopteris*, Fée, *Aspidium cristatum*, Swz., *Thelypteris*, Swz., *spinulosum*, Swz. vars. *intermedium*, Eaton and *dilatatum*, Hook., *marginale*, Swz., and *acrostichoides*, Swz., *Onoclea sensibilis*, L., and *Struthiopteris*, Hoff., *Dicksonia punctilobula*, Kunze, *Osmunda Claytoniana*, L., *cinnamomea*, L., and *regalis*, L. and *Botrychium Virginicum*, Swz. *Carex vulgaris*, Fries, wonderful in the innumerable variety of forms it assumed, was the commonest of the sedge family, with *C. pallescens*, L., a "good second." *Cerastium arvense*, L., whitened the meadows with flowers often half an inch in diameter, and a, probably introduced, form of *Ranunculus repens*, L., was a pestilent weed. Seemingly more at home in dry than wet ground, this Buttercup occurred both at Truro and in most parts of the province, not only in fields and along the streets, but in swamps and woods far removed from any signs of habitation. It differed markedly from our Ontario plant in being much less coarse in appearance, with flowers larger and often partially double. It was also less hairy and threw out runners less freely, while the divisions of the leaf, which were less acute, had whitish markings at the sinuses.

One of the best botanical localities in the neighborhood of Truro was a little stream, called Leper's Brook. At its upper end, shut in between frowning cliffs, was a picturesque cascade, from which the waters descended by a series of rapids, through a deep wooded ravine, for nearly a mile, until they emerged in the open on which is located the town. On the low ground at its embouchure were found *Ranunculus abortivus*, L. var. *micranthus*, Gr. and *Nardosmia palmata*, Hook., while the delicate flowers of *Primula Mistassinica*, Mx. studded the springy hillside, which was covered with *Bartramia ithyphylla*, Brid. in magnificent fruit. Along its banks grew *Stellaria borealis*, Bigel., and, close to the edge, in crevices of the rocks, *Carex torta*, Boott seemed at home, jostling superb specimens of *Streptopus amplexifolius*, DC., whilst a little farther up from the water *S. roseus*, Mx. showed its purple blossoms with *Viola blanda*, Willd. nestling about its roots. On the wooded slopes the drooping racemes of *Acer Pennsylvanicum*, L., hung gracefully above masses of *Lonicera ciliata*, Muhl. and *caerulea*, L., which in turn concealed *Thalictrum dioicum*, L., *Ribes lacustre*, Poir., and *prostratum*, L'Her., *Epigæa repens*, L., (past flowering), *Danthonia spicata*, Beauv., and *Equisetum scirpoides*, Mx. The sides of the ravine and the cliffs about the falls formed a perfect paradise for mosses, liverworts and lichens, in which the Professor fairly revelled. Covering the ground, rocks and trees, they were embarrassing in their multiplicity, this locality alone yielding nearly two hundred species, among which were *Diphyscium foliosum*, Wéb. & Mr., *Orthotrichum Ludwigii*, Schw., *Dicranum subulatum*, Hedw., *Bryum Duvalii*, Voit., *Hypnum pulchellum*, Dicks., *Pogonatum urnigerum*, Brid., *Grimmia conferta*, Funk., *Scapania undulata*, L., and *compacta*, Aust., *Jungermannia cordifolia*, Hook., and *Sticta crocata*, Ach.

The railway track and fields bordering it, a little west of the town, enriched our portfolios with *Stellaria graminea*, L., *Luzula pilosa*, Willd., *Carex vitilis*, Fries, *umbellata*, Schk., *Novæ Angliæ*, Schw., *tenella*, Schk., *Deweyana*, Schk., *Emmonsii*, Dew., *arctata*, Boott, *flava*, L., and *Houghtonii*, Torr., *Poa debilis*, Torr. and *annua*, L., and *Equisetum sylvaticum*, L. Here, too, were large patches of *Bæomyces roseus*, Pers. hiding with its beautiful flesh-colored apotheciæ the sterile clay banks. In the woods a few miles to the east, we picked up *Cratægus tomentosa*, L., *Trillium cernuum*, L., *Oakesia sessilifolia*, Watson, and *Carex scabrata*, Schw. and *gracillima*, Schw., and in a little creek running through a dense tamarack swamp, richly fruited specimens of *Fontinalis Lescurii*, Sulliv., and *disticha*, H K. & Wils.

A jaunt to the salt marshes at the head of Cobequid Bay introduced us to a very choice assemblage of saline plants, but owing to the earliness of the season, most of them, though quite recognizable, were unfit to take. We managed, however, spite of the mosquitoes, which were especially virulent, to secure fine specimens of *Triglochin maritimum*, L., *Carex Norvegica*, Schk. and *maritima*, Vahl. and *Hierochloa borealis*, R & S. In shallow ponds and wet places along the road, during our homeward drive, were gathered *Menyanthes trifoliata*, L., *Carex teretiuscula*, Good., *sterilis* Willd, *trisperma*, Dew., and *aquatilis*, Wahl., *Panicum latifolium*, L , and *Glyceria nervata*, Trin.

A week saw so much sameness in the area for convenient field work, that, with note-books enriched with the names of 366 flowering and vascular cryptogamic plants and 254 of the lower orders, we turned our faces southward.

Three hours of railway travel and we were at Halifax, that city by the sea, with its fair and famous harbor. and after narrowly escaping being torn to pieces by a mob of clamorous hackmen, were soon comfortably domiciled. The city is a place of great military strength, and from the strongest of the works, the citadel, occupying an eminence in the centre, is the best view of it and its surroundings to be had. To the west lie the placid waters of the Northwest Arm. while the ship-encumbered Harbor and Bedford Basin make the southern and eastern boundaries of the peninsula on which the city is built. Far beyond stretch the distant hills and forests as a background, and at one's feet lies a foreground of busy streets, while McNab and Georges Islands with their frowning fortifications help well to break the watery middle distance. The drives around Halifax are numerous and charming, and the city itself possesses many objects of interest, chief among which I would rank the Public Garden, where, differing from too many of them, nature is not made entirely subordinate to art.

Our first day here was devoted to an examination of Point Pleasant, as the extremity of the Halifax Peninsula is named. The vegetation had changed, and we made many additions to our list. Plenty of oak, *Quercus coccinea*, Wang. var. *tinctoria*, Gr., was mixed with the evergreens which still formed the woods, while the most noticeable among the shrubs were *Hamamelis Virginiana*, L., *Rhus typhina*, L., *Vaccinium corymbosum*, L., var. *pallidum*, Gr., *Gaylussacia resinosa*, T. & G., and the fragrant *Myrica cerifera*, L. Willows were but sparsely represented by *Salix cordata*, Muhl., *discolor*, Muhl., and *livida*, Wahl. var. *occidentalis*, Gr., their places in the low grounds and along rivulets being taken by *Alnus incana*, Willd. and *viridis*, DC., *Viola lanceolata*, L., though seeming to prefer boggy, was found also in dry, stony soil ; aud *sagittata*, Ait., its broadly halberd-shaped leaves differing greatly from the oblong lanceolate ones of the form I had been accustomed to see, occurred in flower and seed. *Lechea minor*, Walt. was not uncommon in dry places, and *Stellaria uliginosa*, Murr. filled a swampy patch just outside the city. Of that subject of so many charming superstitions, the clover, a species not heretofore recorded in Canada was found in *Trifolium medium*, L., easily distinguished from *pratense*, L. by its long stalked heads. *Houstonia cœrulea*, L, covered the grassy banks and meadows, its pale lilac flowers forming a marked and very pleasing feature in the landscape, and *Potentilla tridentata*, Soland., vied with it in profuseness on rocky ground. An Aralia, so tall and shrubby that we could hardly believe it to be *A. hispida*, Vent., was growing close to the roadside, where also was noticed *Rumex salicifolius*, Wein. The sandy banks in places were completely clothed with *Vaccinium Vitis-Idæa*, L. and *Juniperus Sabina*, L. var. *procumbens*, Pursh, while *Clintonia borealis*, Raf., here and there in the woods, occupied the ground to the exclusion of all other plants. Peeping above the glossy leaves of a patch of this kind, its beautiful rose-colored blossoms contrasting strangely with the delicate lemon-colored umbel of the lily, we saw our first orchid in *Cypripedium* *acaule*, Ait. Every ditch was choked with *Alopecurus geniculatus*, L. and its congener *A. pratensis*, L. was common along the roads and in fields, forming with *Anthoxanthum odoratum*, L the common pasture grass. As at Truro, *Carex vulgaris*, Fries, was most prominent among the carices, but *debilis*, Mx., and *folliculata*, L. were fresh additions to this genus.

An excursion to McNab's Island, at the mouth of the harbor, was next in order, and having been ferried across the Northwest Arm to Herring Cove, we hired a fishing boat for the trip. Here, while waiting for our men to get ready, the Professor's ever watchful eye detected a fresh treasure in *Montia fontana*, L., which very interesting plant grew plentifully on a moist grassy slope above the sea, and was in prime seed. In many of the island swamps the grass, in spots, was hidden by the profusion of *Viola cucullata*, Ait., which exhibited a number of variations, in one locality white flowers almost entirely replacing the purple. *Archangelica Gmelini*, DC. was just coming into flower along the gravelly shore, and *Brassica Rapa*, L., covered an old field, but in other respects the flora was almost identical with that of the mainland. Returning, we made an exploration of the high, rocky bluffs above the cove, and were amply rewarded by the discovery of *Hudsonia ericoides*, L., *Arenaria Grœnlandica*, Spreng., *Empetrum nigrum*, L., *Corema Conradii*, Torr., *Dicranum spurium*, Hedw. and *majus*, Turn., and *Pogonatum brevicaule*, Brid

Since first settling down to work, we had been constantly on the look out for a genuine peat bog, and on a tramp over the road leading from the head of the Arm along the Chain Lakes, we were at last lucky enough to strike one. Lying close to the road it held a perfect harvest of new things, and we were able fairly to load ourselves with the spoils. *Viola primulæfolia*, L. and *Arethusa bulbosa* L., were abundant and in full flower, while *Habenaria tridentata*, Hook., was just coming into bloom. *Utricularia intermedia*, Hayne, and *Gerardia purpurea*, L. were also there, and the sedges, numerous and valuable, included *pauciflora*, Lightfoot, *exilis*, Dew., and *irrigua*, Smith. This day was still farther marked as a red letter one by the finding, at the head of Chocolate, one of the Chain Lakes, of *Ilex glabra* Gr , a plant, which, though reported, we could hardly persuade ourselves could exist here.

Origin of Domesticated Vegetables.

BY E. LEWIS STURTEVANT, M. D.

There are two methods of studying into the origin of our domesticated plants, the one historical, the other through investigation into the causes of variation. The first method has the disadvantage that events of this character but rarely find explicit record; the second that we as yet have deficiency of proper data. We are hence obliged, if we would attain truthful conclusions, to combine the two methods, and through pains-taking consulting of scattered mention, the guarded interpretation of hints to be gained from tradition and vernacular names, and the recognition of changes due to the acts of man, to follow the protean changes from course to course, until we either attain the limit of our knowledge or indication of the original species.

We may in the furtherance of this course recognize certain truths which we must consider axiomatic; that variation is an indication of changed environment, and that departure in the plant from the natural motive towards a motive more subservient to man's wants is evidence of man's interference; that as through man's agency plants become removed from natural conditions, and have qualities dependent upon domesticated conditions impressed upon them, so when neglected by man these acquired qualities disappear in a large measure, and the plant changes, not reverts, to conditions which enable it to satisfy the requirements of nature; that change of form, added to the plant through man's selection, if beneficial to the plant, when left to nature will be maintained in the plant escape or garden wilding; that a large number of varieties is an indication of antiquity of culture, especially if such varieties are of different types.

Applying these thoughts to a case in illustration, we should at once infer a greater antiquity of origin for the turnip than for the ruta-baga; for the carrot than for the parsnip; and where the varieties and types are very many, as in maize, wheat, beans, etc., we would infer very great antiquity of culture. So seedless fruits indicate man's ancient interference, and should only be expected to occur in regions which are or have been occupied by man.

If a highway leads from Jericho to Jerusalem, it is certainly proper to infer that the same road leads from Jerusalem to Jericho If variations of a certain kind are produced only by man's interference, if the fact be well established, it is certainly proper to infer that if variations of this kind are found they indicate a former cultivation. We can even go further and say that if the agency of man induces numerous variations favorable to man's wants in a species, then that the presence of numerous variations in a species, of a kind favorable to man, indicate a previous agency of man. Thus, the peculiar distribution of the *Vitis Californica* in rows, near Fort Whipple in Arizona, is considered conclusive evidence that the ancient Pueblo Indians were in the habit of cultivating it; evidence of a dissimilar character, but very nearly as conclusive, for the ancient cultivation of the *Vitis Labrusca* is seen in the variability of this species, which is strikingly in the direction of the improvement of the fruit in individuals, as is known to the many farmers in New England who have transplanted improved kinds to their door-yards, and is a matter of common repute, as well as evidenced in the various named varieties, as the Concord, which have originated from its seed. If we plant the seed of the apple, as we note the varying quality of the seedlings, no two being alike, we can infer from this circumstance that the apple is a domesticated fruit, and of human origin; if we likewise plant the seeds of the American Crab, we can properly infer that it is a wild or natural species from the power its seeds possess of coming true to name. This method of research, if supplemented by a historical record, offers much promise to the investigator.

When we consider the number of species of vegetables that America has furnished to civilization, their number of variations, their high degree of improvement, and their constancy to type, we may infer, *prima facie*, that a civilization capable of producing these results has existed in the past. We need but mention the maize, the bean, the pumpkin and squash, the tomato, peppers, the potato, the cassava, chocolate, etc., etc.

It is not improbable that many of our so called natural species to which our domesticated varieties are referred, are themselves but escapes from a cultivated state. I do not know whether the wild parsnip of America has a close resemblance to the wild parsnip of Europe or not. We can not readily suppose that the wild parsnip was really brought to America, for it appears more reasonable to believe that it is an escape from cultivation; as the salsify certainly is about Geneva. In default of any mention, we certainly would be justified by common consent to refer our cultivated parsnip for origin to our wild parsnip, and yet how erroneous this would be. The same remark applies to the carrot. Should we not therefore be slow to refer the cultivated parsnip to the wild parsnip of European fields, or the cultivated carrots to the wild carrots? *Avena fatua* is supposed to be the parent form of the cultivated oat, but why not more reasonable to suppose it to be an escape, modified only from the cultivated oat in order to meet the conditions necessitated by its struggle under nature's conditions?

The history of the Indians, after the discovery, shows that they were greedy for new sources of food supply, and the facts connected with their habits of living all show that they exercised a care over vegetable productions. Thus the melon and the peach received distribution over wide areas in advance of a European discovery; the onion was even mentioned by Cortez as found in Mexico; the maize, the bean, and the squash, in varieties, all plants of tropical origin, and which could not maintain themselves without care, were staple crops throughout northern America, even to Lake Coulonge on the Ottawa river, and beyond the St. Lawrence, where the crops required seeding, protection and preservation of seed over the winter months. The sunflower was grown for its seed by the Hurons, as seems also to have been the Jerusalem artichoke for its roots. Bartram notes seeing in the south a plantation of hickory nuts cultivated by the Indians. The *Prunus Americana* seems to have been planted by the New England natives, and this seems also to have been the case with *Prunus Chicasa* in the southwest, although I find no distinct mention of the fact. Numerous other illustrations occur in my notes of a cultivation or domestication of plants throughout America, and a care and curious concern about forms and colors which must have caused selection to have been exercised; at any rate, when we have so-called wild species of the same varieties, the variability of these wild species in the portion which finds use is noticeable.

Indeed, the careful student must recognize that the American Indians were an agricultural people wherever natural conditions and tribal strength would admit, and that they were efficient agents not only in the geographical distribution of certain plants, but also in the producing of varieties. Circumstances, as in European nations in times past, made the tribes usually hunters and agriculturists, often agricultural solely, and again devoted wholly to the chase, and living on wild productions.

The history of the origin of our American vegetables must come from a close study of the history of a people, as well as from a study into the causes and effects of variations. These two methods in time may admit of certain generalizations, and it seems safe to assume that the results of such a study will not be in accordance with accepted notions. The physiological method will bring a certainty so far as it accomplishes a conclusion, which the method of systematic botany does not supply. Until we can separate escapes from natural species, that is, until we can determine species apart from changes impressed upon plants by man, it seems unsafe to refer our cultivated plants to localities wherein occur wildings of like species. Far preferable the argument from historical mention of the habits and movements or migrations of peoples. It seems probable that *variability or trueness to seed may become the test as to the sufficiency of a conclusion in favor of or against an assigned species.* This fact is an interesting one for the scholarly botanist, for it only needs the reading of De Candolle's work to realize the uncertainty at present existing.

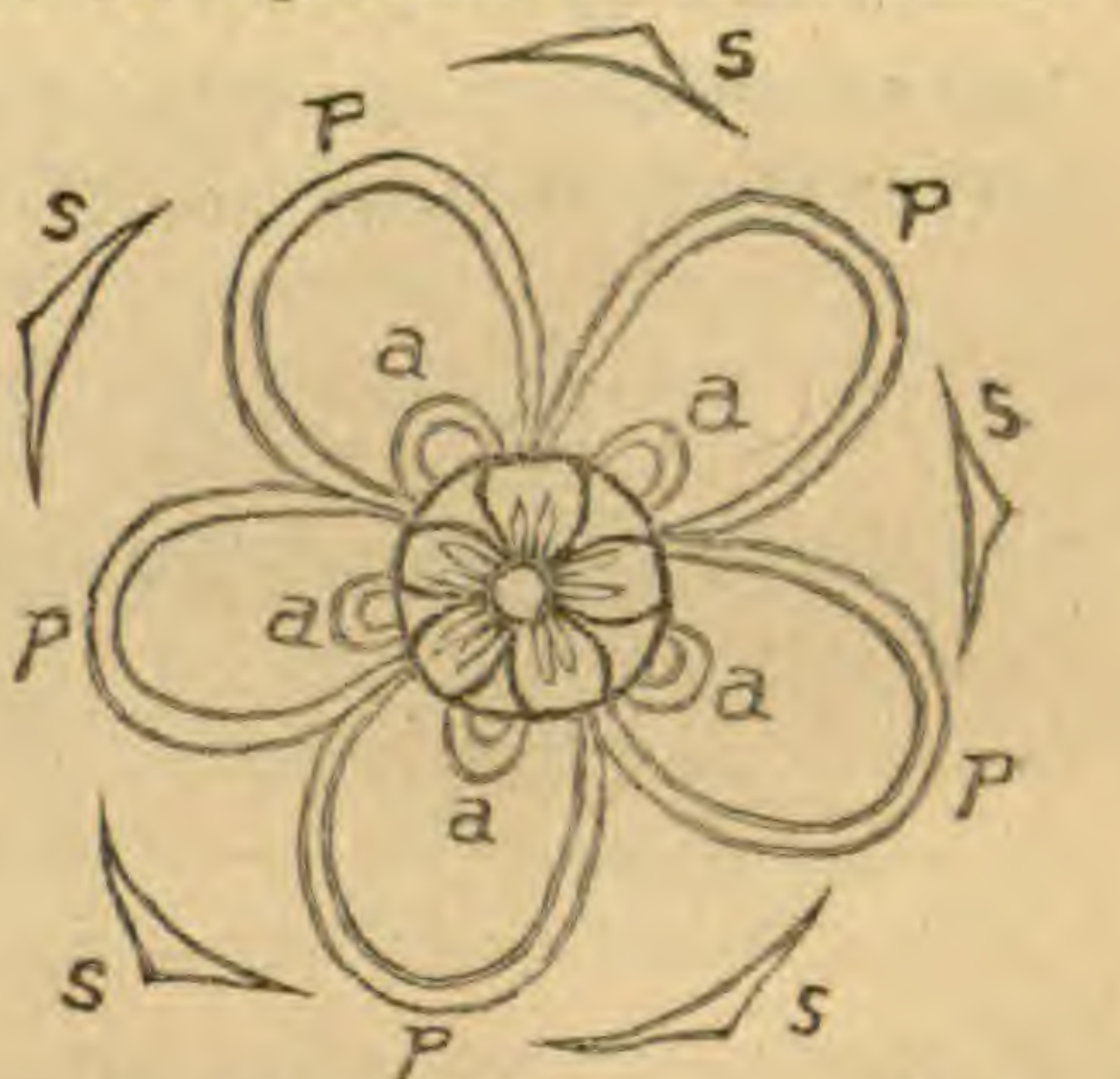
GENERAL NOTES.

Notes on Mahernia.—The genus *Mahernia* in the natural order *Sterculiaceæ* presents many points of botanical interest. Our readers doubtless are familiar with the shrub as it occurs in conservatories, with its pinnatifid leaves, very large and laciniate stipules, appearing like a whorl of leaves, and cymose clusters of honey-yellow flowers. These stand two together, bell shaped and pendant from the branches. The blossoms possess a most delicious fragrance. I have elsewhere recorded the observation of Miss Anna Chace, of Valley Falls, R. I., that of the two flowers one is always convolute to the right, and the other to the left.

A stamen with fan-like row of hairs at *f*, and fleshy disk at *d*.

A petal with its nectary, *n*.

I have now to mention some notes that I made upon the species last winter in relation to the manner in which its nectaries are protected from small predatory insects. It will be remembered that the five stamens are somewhat monadelphous, and that they stand opposed to the five petals. This ante-position suggests the suppression of a second whorl in the andrœcium. The anthers are upturned at their bases, and have a fan-shaped row of hairs. The filaments present about midway a fleshy, crescentic disk, pubescent with downward pointing hairs. The incurved claws of the petals form nectaries *over which these disks exactly fit.* No more perfect protection could be offered. This disk probably offers no obstacle to strong flying insects attracted by the powerful fragrance and the bright color of the flowers, but would effectually prevent the entrance of minute creeping species. The accompanying diagrams will illustrate the particular parts, and the ground plan of these parts in their mutual relations.



Ground plan of flower: *s*, sepals; *p*, petals; *a*, crescentic disks of filaments.

W. Whitman Bailey, *Brown University.*

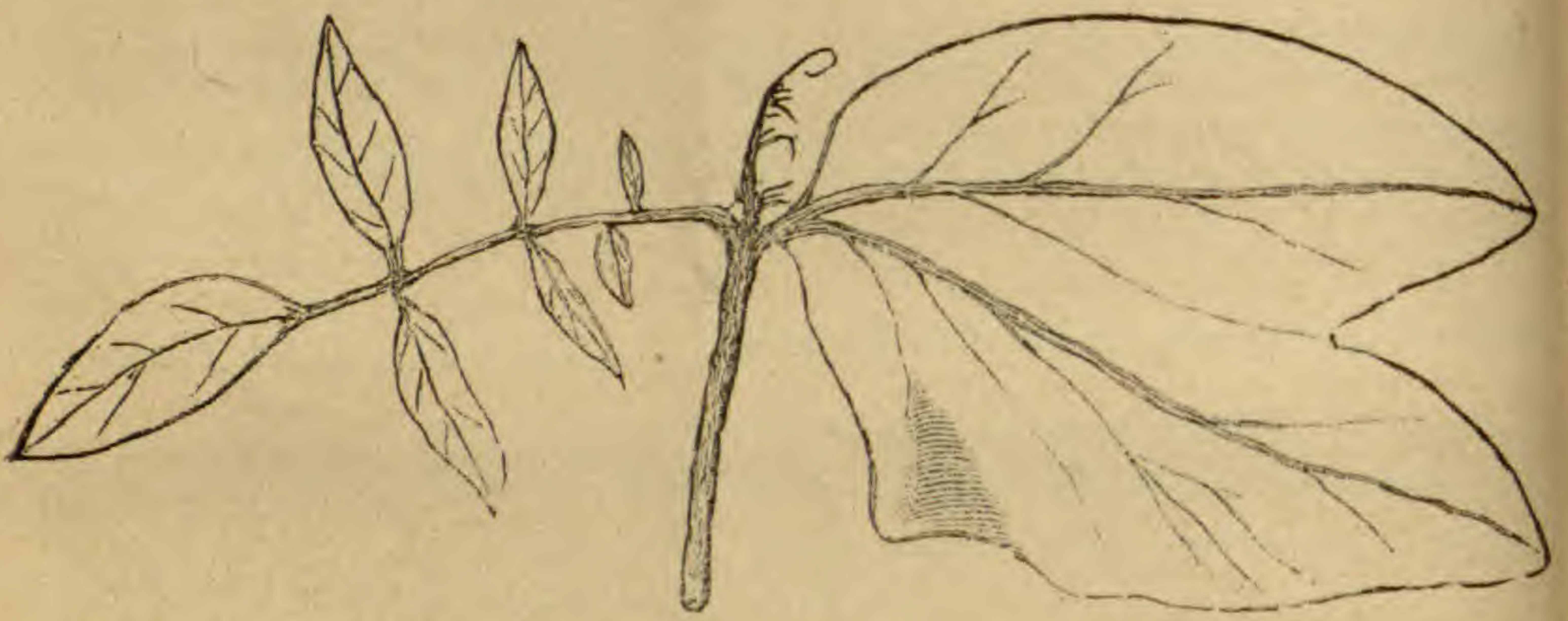
Remarkable Vitality of Willow Twigs.—During the summer of 1853 Sylvester Piper, now a resident of 3526 Jones street, Chicago, called my attention to a willow basket in a ditch, the basket having sprouts several inches in length all around it. A curiosity so remarkable—possibly having no parallel —led me to take immediate steps for its preservation. I dug the basket up with great care, and found it to be a worn out cast-away which had done service as a basket until it had become so badly worn as to be worthless, when it found its way into a ditch at the base of the bank of the Illinois and Michigan canal, about 300 feet from the Bridgport lock (now within the limits of the city) whence I transplanted it with great care, placing it in a wet place in my father's garden; but notwithstanding its former vitality and careful removal, the shock was too great for the tender shoots and they all died. The basket was made wholly or in part of unpeeled willow, whose dried and withered germs needed only the opportunity to return to life. I have often resolved to have the story of the "willow basket" written and placed upon record while there were still living other witnesses than myself to verify it.

In reply to a suggestion of Prof. Gray, "Whether it was possible that willow sprouts may have sprung up around the basket instead of from the willow of which it was composed," I need but add that with a perhaps more than ordinary love of tree culture, commencing in early boyhood and continuing to some extent to the present time, it seems impossible that I should be misled or satisfied with casual observation. In this case I was not. I handled the basket with my own hands while the sprouts were still fresh and growing.

Ossian Guthrie.

[This incident comes to us abundantly substantiated by several persons of unexceptionable integrity and forcible acumen. Its scientific value was suggested to the author by Mr. Leander Stone, assistant editor of *Northwestern Christian Advocate*, Chicago; and it was referred to the Gazette for publication by Dr. Asa Gray, to whom the article was first sent.—Eds.]

Cobæa scandens.—Among some specimens of *Cobæa scandens* appeared one that seemed to me worthy of notice. The cotyledons were grown together, the first pair of true leaves were also combined in one and placed opposite the



double cotyledon. The first pair of leaves usually has only six leaflets, while this has eight. The plant is represented by the accompanying figure.

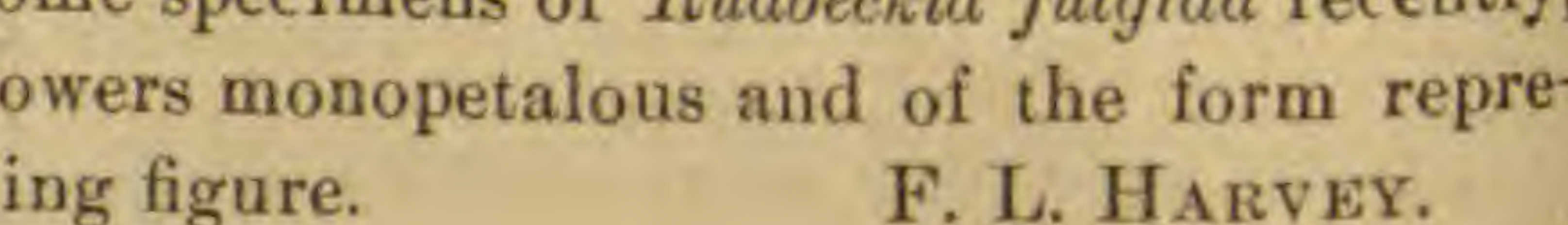
F. L. HARVEY.

Rudbeckia fulgida.—I believe the ligulate flowers of the order *Compositæ* are regarded as monopetalous corollas split down on one side. While collecting some specimens of *Rudbeckia fulgida* recently, I found one of the ray flowers monopetalous and of the form represented by the accompanying figure.

F. L. HARVEY.

The Root-hairs of Adiantum pedatum, L.—While examining the root-hairs of the above-named fern recently, I found two instances of abnormality which seem worth recording.

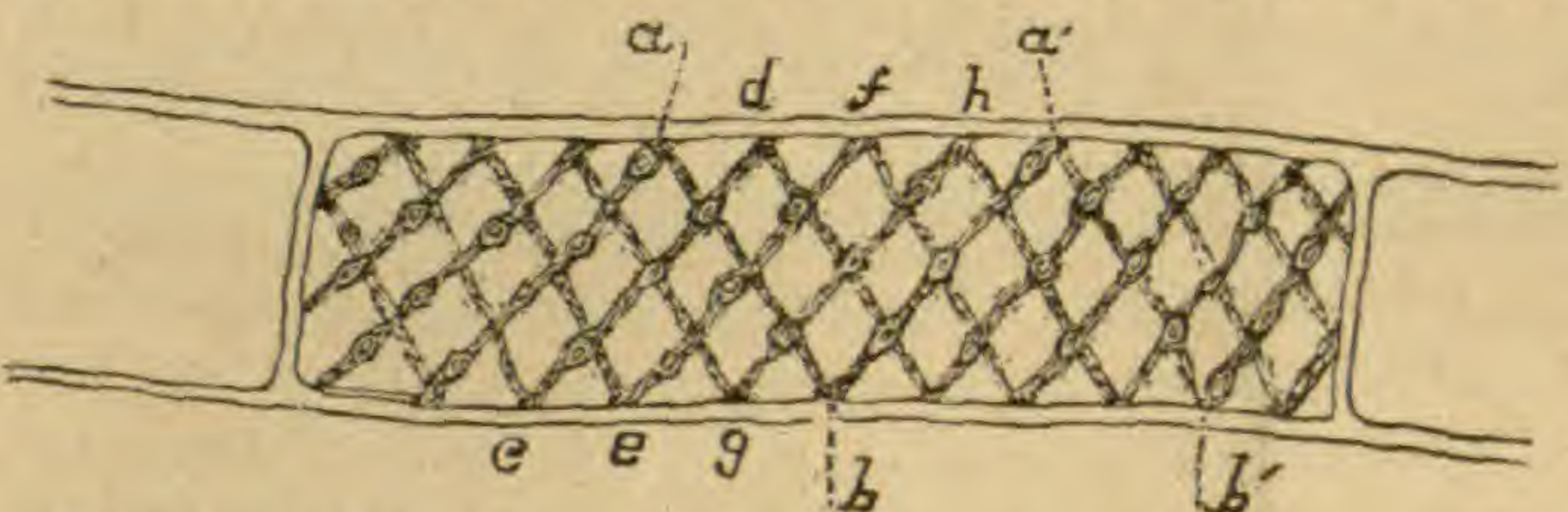
The root-hairs of the Maiden-hair fern are exceedingly numerous and long, so numerous and so long that in most cases they form a brown, cottony mat about the rootlets. These hairs are all single-celled, having the proximal moiety wavy, and the distal end clubbed and otherwise deformed. The walls of two of the hairs were found to present near their proximal ends a *spiral thickening*, giving them an extraordinary likeness to spiral vessels. The spiral thread extended in one case one-fourth of the length of the hair, and in the other half as far. In both the thread commenced and ended quite abruptly. The accompanying figure will give an idea of the diameter of the hair, and the closeness of the spiral.



Root-hair of *Adiantum pedatum*, L., showing spiral thickening. $\times \frac{450}{1}$. *p, p*, scattered masses of protoplasm. *s*, spiral thread. *w*, wall of hair.

C. R. B.

The Chlorophyll Bands of Spirogyra.—In some cases it is desirable to count the number of chlorophyll bands in each cell of a filament of *Spirogyra*. When the band is single or double there is no difficulty, but when the filaments are crowded with chlorophyll the task is not so easy. While studying *Spirogyra* Mr. O. F. Dragoo, of the class of '86, Purdue University, devised a novel and certainly very ingenious plan, which may be explained by reference to the accompanying diagram.



. Diagram of the chlorophyll bands in a cell of *Spirogyra*.

Select any band, as *ab*, and focus on its profile, as at *a*. Follow the band to the opposite side of the cell where it is again seen in profile, as at *b*. Fix the points *a* and *b* in memory, focus on the upper surface of the filament and count the number of bands between *a* and *b*, in this case three, *cd*, *ef*, *gh*. This number, increased by one, the one first examined, will be the number of distinct bands in the cell. C. R. B.

EDITORIAL NOTES

The Philadelphia Academy of Sciences is building up a very fine herbarium, claiming now to possess probably one-half the known species of plants. The growth has been very rapid for some years, the past year showing an addition of 2,868 species. The species are all poisoned, labeled, and systematically arranged, and this great work is being done gratuitously by the persistent labors of Mr. J. H. Redfield, assisted by other botanists.

Dr. T. F. Allen, in the *Torrey Bulletin* for October and November, gives some notes on the American species of *Tolypella*, accompanied by six plates. A key to the species is given and six new species described.

In the December number of the *Gardener's Monthly* is given an abstract of a lecture by Dr. J. T. Rothrock upon "American Forestry." The statement is made that, so far as the lumbering product is concerned, Michigan ranks first, followed by Pennsylvania, Wisconsin, and New York, and far down the list stand Oregon and Washington. If the forests of Pennsylvania are ravaged as in the past, the lecturer estimated that in much less than fifty years they would be stripped, and it is urged that forests should be planted at least as fast as they are cut down.

Prof. C. E. Bessey, in the December *Naturalist*, describes a new species of insect-destroying fungus, under the name *Entomopthora Calopteni*. It occurs as a clay-colored mass in the body cavity and femora of the common locust, *Caloptenis differentialis*.

In the American Journal of Science for December, Dr. Gray gives quite an elaborate review of De Candolle's "Nouvelles Remarques sur la Nomenclature Botanique," which for those who either can not read or do not have the original will be a convenient substitute for a translation.

Mr. Thos. Meehan calls attention to the fact that considerable quantities of a sweet liquid are frequently secreted by certain flowers during and after anthesis which are not derived from nectar glands, and do not appear to be associated with means for cross-fertilization.

J. Duval-Jouve, a well-known French botanist, died at Montpellier Aug. 25.

Prof. Dr. Nicholas Anton Pedicino, director of the Botanical Gardens at Rome, died at Naples Aug. 2.

The commission sent out by the German government to study the cholera in Egypt was successful in identifying a specific baccillus infesting the lower portion of the small intestine. In size and shape it most closely resembles the bacillus of glanders. That it is the cause of cholera has not been proven, as no animal susceptible to the disease could be found with which to experiment.

There were no papers in botany before the National Academy of Sciences held in New Haven, Nov. 13-16.

Prof. Dr. Leimbach, President of Irmischia, desires to obtain good herbarium specimens of American *Orchidaceæ* in exchange for European specimens. His address is Sondershausen, Germany.

The herbarium of the late Prof. Alphonso Wood was purchased by the College of Pharmacy of New York City. When overhauled some of the specimens were found to be in a bad condition, and have been destroyed. The others have recently been mounted, and will eventually be systematically arranged.

Recent investigations connect the forms known as *Ozonium* with various species of *Lenzites*, *Coprinus* and *Craterellus*; and they are to be regarded as the sclerotium stages of these fungi.

Dr. Joseph Leidy, in *Science* for November 30, gives some account of "Crystals in the bark of trees." Botanists are not quite so ignorant of the subject as might be inferred from the article, and reference to Gray's Structural Botany, p. 59, Bessey's Botany, p. 59, Sach's Text Book, p. 64, Prantl and Vines's Botany, p. 36, and a host of other references that might be noted, would indicate that considerable if not "sufficient notice" had been given.

In a late number of *Botanische Zeitung* Büsgen gives an account of some experiments he has been performing at Strassburg for two seasons in the feeding of *Drosera rotundifolia*. The results confirm the conclusions of Francis Darwin and others, and the plants fed with animal matter through their leaves were stronger and more vigorous in every way than those that were not thus fed but equally favored in every other respect.

Mr. Byron D. Halsted, in *Science*, describes and figures a "combination walnut," being a nut which is covered partly by a walnut hull and partly by a shellbark hull, as if *Carya* and *Juglans* had been guilty of cross-fertilization. Within the hull it seems that the nut was entirely walnut. The specimen is worth a careful examination.

A rare chance is offered to botanists to supply themselves with a very desirable plant. Two years ago Prof. F. L. Harvey collected *Dioclea Boykinii* in extreme Southern Arkansas, but not knowing the species was so rare obtained but very few specimens. Next summer he proposes to visit the locality again, and if he can get subscriptions enough to lighten his traveling expenses, he will collect enough for everybody. Subscriptions for specimens should be sent to Prof. F. L. Harvey, Fayetteville, Ark.

The American Association Proceedings for 1882, recently distributed, contain the following botanical papers, printed either in full or by abstract: Palæozoic Floras of Canada, by J. W. Dawson; Flora of N. America, by Asa Gray; Position of the Gamopetalæ, by L. F. Ward; Revision of the Genus Clematis, by Jos. F. James; Achenial Hairs of Compositæ, by G. Macloskie; Action of Frost on Leaf-cells, by C. E. Bessey; Motion of Roots of Corn and Beans, by W. J. Beal; Fertilization of Yucca, by C. V. Riley; Plant-cells and Living Matter, by L. Elsberg; Some Vegetable Poisons, by T. J. Burrill.

PART FOUR of volume 173 of the Phil. Transactions of the Royal Society of London is devoted to a report by Lawes and Gilbert on the botanical results of experiments on the mixed herbage of permanent meadow, conducted for more than twenty years in succession on the same land. It embraces 235 quarto pages with many tables, and is replete with interesting matter.

MR. THOS. MEEHAN, who visited the western coast last summer, dissents in the current signatures of the Proc. Phila. Acad. from the views of Mr. Muir, to be found in the Proc. Am. Assoc., that the Sequoias create by their presence the streams and moisture where they grow, and states that, on the contrary, other kinds of forests are equally good accumulators of moisture, while a moist soil is not essential to the growth and full development of the Sequoias, but adds that the seed, nevertheless, requires for its survival a humid atmosphere till after germination and the thorough establishment of the plantlet. The absence of humid conditions at the present time that may reasonably be inferred to have once existed, sufficiently accounts for the failure of the Sequoias to spread beyond the bounds they have evidently maintained for a long term of years.

MR JOHN MUIR furnishes seven quarto pages of Botanical Notes to the report of the Cruise of the Revenue-Steamer Corwin in 1881, just issued from the government printing office. Lists are given of the flowering plants collected at various localities on the coasts of Alaska, Siberia and adjacent islands.

DR. A. L. CHILD follows his previous paper in the *Pop. Sci. Mo.* (Dec. '82) with another (Dec. '83) on the "Concentric Rings of Trees," in which he repeats the main statements of the former paper and brings additional testimony to show that the concentric rings of trees are not necessarily annual. This evidence (here presented in tabular form) is based upon actual specimens cut from trees of known age.

Specimens furnished by	*Species.*	*Known age, yrs*	*Number of Rings.*
Hon. Robt. W. Furness	Pig hickory	11	16
" " " "	Green ash	8	11
" " " "	Ky. Coffee tree	10	14 main, 21 sub-rings.
" " " "	Bur oak	10	24
" " " "	Black walnut	5	12
" " " "	Chestnut	4	7
" " " "	Peach	8	6
" " " "	Chestnut oak	24	18
Prof. J. L. Budd, Iowa Agr. College.	Spruce (Puget S'd) specimen 12 in. long	15	18 at one end, 12 at the other end.
Mr. H. P. Child, Kansas City Stock Yards.	Pine	8	19
	Soft maple	14	16 main, 47 sub-rings.

The evidence here presented is certainly very strong; strong enough at least to make us drop the term "annual rings" and substitute the more expressive and in many cases more truthful one, *growth rings*.

CURRENT LITERATURE.

Contributions to North American Botany. By Asa Gray. Proc. Am. Acad. 19. pp. 1–96.

As would be expected, the principal part of this contribution is devoted to the *Compositæ*, new species being described and certain genera revised. The following notes were made in looking through the pages, and while they seem desultory they indicate somewhat the order of treatment:

The principal accessions to *Asteroideæ* are four new species of *Erigeron*, all but one from Arizona. *Inuloideæ* are represented by three new *Gnaphaliums*, two of them Mexican, and a foot-note calls attention to the fact that the Mexican species of this genus are sadly in need of revision. Among *Helianthoideæ*, *Viguiera* gains four or five new species and in *Encelia* it is found that the presence or absence of pappus is so inconstant a character that the primary sections must be reduced. A new subgenus of *Helianthella*, *Enceliopsis* by name, is proposed to include *H. nudicaulis* and *H. argophylla*. All the species of *Actinomeris* are included under *Verbesina*, except those upon which Nuttall originally founded the genus, and an enumeration of N. Am. and Mexican species of *Verbesina* is given, *Actinomeris* appearing for the most part under the section *Pterophyton* and the specific names transferred, except *A. pauciflora*, which appears as *V. Warei*, there being already a Mexican *V. pauciflora*. After a new study of all the species of *Laphamia* and *Perityle* Dr. Gray thinks the two genera should be preserved with their original limitation, and not changed as suggested by Bentham.

A new genus of *Helenioideæ* is named *Eatonella*, in honor of Prof. D. C. Eaton, and contains two species. On page 21 a revision of the genus *Baeria* is given, showing 15 species. A re-arrangement of species under *Eriophyllum* and *Bahia* is given, *Actinolepis* (exclusive of *Ptilomeris*) being included in the former, and *Achyropappus* in the latter, thus relieving the genus *Schkuhria*. A revision of *Actinella* is given, showing 19 species, arranged in three sections, the first of which (*Plateilema*) is new. *Dysodia*, *Hymenatherum* and *Tagetes* are also revised and receive serveral new species. For *Pectis* three new sections are proposed and the relation of the species shown. A revision of § *Seriphidium* of *Artemisia* is given, showing nine species. The author holds on to *Cacalia* as distinct enough from *Senecio* to rank as a separate genus, and gives a conspectus of N. Am. species. Some interesting species of *Senecio* are described and certain changes in nomenclature made. *S. aureus*, var. *werneriæfolius* takes specific rank under the variety name, while *S. Elliottii*, T. & G. comes under the var. *obovatus* of *S. aureus*. The name *S. Neo Mexicanus* is now given to a puzzling form which appears in collections variously named *S. Fendleri*, *multilobatus*, *aureus*, etc. A key to N. Am. and Mexican species of *Perezia* § *Acourtia* is given in a foot-note, while a revision of the genus *Stephanomeria* appears in the body of the contribution, showing 14 species, two of which are new. A synopsis of the Rocky Mt. and Pacific species of *Hieracium* is given, six new species and several varieties being described.

There is also a revision of *Troximon*. Under "Miscellaneous genera and species," five new species of *Astragalus* appear. A new Rocky Mt. *Sambucus* is described, *S. melanocarpa*, and the name *Lonicera Sullivantii* given to the form which appears in the Manual as *L. flava*. The real *L. flava* has a range wholly southern, and the name *L. Sullivantii* should be substituted for all the *L. flava* from "Central Ohio to Illinois, Wisconsin and Winnipeg." A new genus of *Rubiaceæ* from Cuba is described, *Nodocarpæa*. *Fedia* and *Plectritis* are both included in *Valerianella*, and the species of the Manual become as follows: *F. olitoria* = *V. olitoria*; *F. Fagopyrum* = *V. chenopodifolia*; *F. radiata* = *V. radiata*; *F. umbilicata* = *V. Woodsiana*, var. *umbilicata*; *F. patellaria* = *V. Woodsiana*, var. *patellaria*. A new genus of Lobelias, *Parishella*, is described, a notice of which appeared in Bot. Gaz. 7, 94. The two forms which heretofore have appeared under *Gaultheria Myrsinites* are separated into two species, one retaining the old name, and the other being called *G. ovatifolia*. Two new species of *Asclepias*, one from Florida and the other from Arizona, and two of *Gentiana*, both from the Rocky Mts. of Wyoming, Colorado and southward, three of *Phacelia* from S. California, five of *Eritrichium*, all from S. California, with several other genera represented by single species, complete the contribution. Most of the work here recorded has been done in the preparation of the forthcoming volume of the Synoptical Flora, the appearance of which all botanists sincerely hope may not be much longer delayed.

BOTANICAL GAZETTE.

VOL. IX. FEBRUARY, 1884. No. 2.

Some North American Botanists.

IX. LEWIS DAVID DE SCHWEINITZ.

BY A. P. MORGAN.

A little sketch of the labors of the celebrated de Schweinitz in the department of mycology, may give some notion of the large and varied field of natural objects open to the eyes of the inquiring botanist in every locality, and may also give good encouragement as to the amount that may be accomplished by working therein, provided the work be done in a persistent and systematic way.

It is greatly to be desired that some one, as Mr. Rau, in a position to obtain the facts, should give us an extended account of the life and labors of this great botanist. In so far as I may touch upon his biography, I quote from memory and aim only to be generally correct, but, in reference to his labors, I have before me the "*Synopsis Fungorum in America Boreali media degentium*," communicated to the American Philosophical Society, Philadelphia, 15 April, 1831.

Lewis David de Schweinitz was born at Bethlehem, Pa., in 1794, and sent to Europe to receive his education. He there distinguished himself in mycologic studies, and with Albertini, published the "*Conspectus Fungorum in Lusatia superiori*." Returning to his native land, he settled at Salem, N. C., where he remained a few years. The results of his mycologic studies in this locality were published at Leipsic, in 1818, by his friend, the celebrated Schwaegrichen, as "*Synopsis Fungorum Carolinæ Superioris*." In 1821 he returned to his native village in Pennsylvania, where his delightful studies were continued till his death, which occurred, I think, in 1834. He enjoyed the friendship of the most distinguished botanists of his time, both in Europe and in this country. With the vigorous prosecution of studies in Fungology, his merits as a close and careful student of nature and his important contributions to botanical knowledge will be recognized.

The *Synopsis Fungorum in America Boreali* enumerates more than three thousand species, divided among the classes as follows:

Hymenomycetes	1146
Pyrenomycetes	1055
Gasteromycetes	297
Hyphomycetes	312
Gymnomycetes	289
Total	3099

Of these 1216 are new species, natives of America, while the remaining 1883 are identical with European forms; that is, 40 per cent. are native species, and 60 per cent. common to both countries. The great genus *Sphæria* alone contains 680 species, of which 387 are new. *Peziza* stands with 213 species, 58 of them new. *Polyporus* contains 153 species, 41 new. But it seems rather singular that he should not have been able to add more than 14 new species to the great genus *Agaricus*. The labor on these plants seems to have been reserved for our own time. Prof. Charles H. Peck, in his reports up to date, enumerates 525 species of *Agaricini*, of which 272 are new.

After his return from Europe how de Schweinitz must have reveled in the novelties of the New World! With what delight he must have beheld the magnificent *Agaricus illudens*, and with what wonder the singular *Mitromyces lutescens!* With what pleasure he must have gathered the first specimens of the fairy *Peziza floccosa!*

The system in which his plants are enrolled is partly that of Fries and partly that of older botanists; he did not have access to the third volumes of the *Systema Mycologicum*. In the elucidation and rearrangement of his species a very inviting field and a meritorious work is open to the systematic Fungologist. Many changes are being made and much new discovery; the great genus *Sphæria* is now broken up into orders and numerous genera. It seems singular that the Fungi that can be perfectly preserved, that are the most easily studied, should be in such a chaotic state of classification.

It is to be regretted that de Schweinitz has not given us more of his views on the life-histories of the Fungi, which are so interesting at this time; his maturity of observation would undoubtedly have enlightened many dark points. It is a significant fact, for example, that while he mentions *Puccinia graminis* as "vulgatissima in graminibus," he does not chronicle *Æcidium Berberidis.*

The herbarium of de Schweinitz rests in the Academy of Natural Sciences, Philadelphia. It is very much to be desired that a reprint be made of the *Synopsis Fungorum,* as it is practically inaccessible to the ordinary student. Still more desirable is it that a *Synopsis Fungorum* be compiled that shall include all the North American species identified and described up to the present time, and which now, perhaps, more than double in number the enumeration of de Schweinitz.

A Botanical Holiday in Nova Scotia. II.

BY T. J. W. BURGESS, M. D.

By June 21st we had exhausted the time laid out to be spent in the neighborhood of Halifax, and taking the Windsor and Annapolis Railway to the latter place, caught the steamer crossing to Digby. Here we were first able truly to realize the wonderful rise of the tide in the Bay of Fundy, our landing being made from the *hurricane* deck, then *below* the level of the wharf. Quitting the boat for the rail again, we were soon on a road, the Southern Counties, which we concluded to be chiefly remarkable for the slow rate at which it could travel, no less than four and a half hours being taken to cover the 65 miles between Digby and Yarmouth.

At Yarmouth, the most southern point touched in our trip, we had expected to find considerable change in the vegetation, but this was less marked than we had looked for, so that a considerable part of the four days spent here was devoted to mounting sea-weeds and drying the plants, of which we had a very large accumulation on hand. A modification of Mr. Macoun's method of drying mosses was tried on flowering plants and found to work most successfully. Our hotel being provided with an unroofed balcony, as soon as the sun had thoroughly heated the floor of this, we took our plants, and placing each sheet of specimens between two driers, covered the floor with a layer, small stones at the corners of the sheets preventing their disturbance by the wind. Only one thickness was spread at a time, and no pressure used except the weight of the single drier covering the specimens. The plan was admirable for plants wilted by a couple of days in press, an hour under a hot sun serving to completely cure specimens that would have taken four or five days changing;

but with ones fresh or insufficiently wilted, the process was useless, as the absence of pressure allowed the leaves to curl up. Plants thus preserved seemed to keep their color better than when done by the ordinary method, but were, I fancy, rendered more brittle. A marked feature of Yarmouth and vicinity were the cut hedges of white or English thorn, which, in connection with the trees and flowers extensively planted, had a very pleasing effect. Fogs, however, were very prevalent, and the melancholy sound of the fog horn constantly ringing in the ears had anything but a cheering influence over a stranger. Of our findings here the most noteworthy were *Lepigonum salinum*, Fries, on brackish sands; *Alchemilla vulgaris*, L., abundant in waste places, and in fields bordering the harbor, *Galium Aparine*, L., on a bar running out into the sea, where also were *Potamogeton pectinatus*, L., in brackish pools, and *Allium Schœnoprasum*, L., in large bunches on dry ground, but close by; *Tussilago Farfara*, L., common along the streets and railway track; *Symplocarpus fœtidus*, Salisb., (the only place we saw it in Nova Scotia), in a pasture field near the lighthouse on Cape Forchen; and *Rhinanthus Crista-galli*, L., everywhere. *Scirpus pungens*, Vahl., and *Carex salina*, Wahl., *tentaculata*, Muhl., *filiformis*, L., and *viridula*, Mx., were also collected, as were *Agrostis alba*, L., *Elymus mollis*, Trin., *Aira cæspitosa*, L., and *Holcus lanatus*, L. The last was very plentiful in the fields, but especially so along grassy banks overhanging the water.

Several probably paying localities had been marked on our way down from Halifax, and the first of these to be reached on our return journey was Annapolis. All about us now was historic ground, this being the ancient capital of Acadia and the oldest European settlement north of the Gulf of Mexico. Visited by the French under Champlain in 1604, it was made the following year the site of their first colony in America. Then Porte Royale, it remained so till a century later, when, captured by the English, the name was changed in honor of Queen Anne to Annapolis Royal, since abbreviated to Annapolis. Like other Acadian strongholds the fort is now a ruin, and the place that once rang with the tread of armed men echoes with the merry laughter of children, whose play-ground it is. What a pleasant memory is the evening hour spent on the old grass covered ramparts, the sea with its never ceasing murmur at our feet, and old North Mountain frowning grandly down upon it. What a pleasure, too, is the possession of souvenirs of our visit in *Hyoscyamus niger*, L., found blooming freely in the decaying earth-works, and *Lychnis vespertina*, L., growing abundantly, not only in the old cemetery connected with the fort, but in the streets, fields, and waste places all about the town. A drive into the country showed the antiquity of the settlement in *Aquilegia vulgaris*, L., *Inula Helenium*, L., *Lysimachia vulgaris*, L., and other tall growing flowers and weeds completely naturalized and established by the roadsides. *Alopecurus pratensis*, L., introduced by the French and known as "French timothy," was the grass generally cultivated for hay, but occasional patches of *Dactylis glomerata*, L., were seen. In the salt marshes *Juncus Gerardi*, Loisel, was in beautiful flower and made quite a show along the beach, where also were seen *Scirpus maritimus*, L. and *Glyceria distans*, Wahl. Between the marshes and the road were, in low ground, *Liparis Loeselii*, Richard., *Scirpus microcarpus*, Presl. and *Carex Pseudo-Cyperus*, L. and *conoidea*, Schk., and on gravelly banks, *Trifolium hybridum*, L. A remarkable form of *Corallorhiza multiflora*, Nutt., was found in the woods near the residence of Mr. Pittman, a gentleman who had kindly invited us to visit him. In shape the flowers were those of *multiflora*, but the whole plant, except the petals, was, in all cases, pale yellow instead of brown or purplish. A day was given to a deep defile in North Mountain, known as the "ice gorge," from the fact that under the rocks there, ice can be found all summer. The bottom of the ravine was occupied by a rivulet clear as crystal, while its sides were densely clothed with a fine growth of hardwood, among which *Ostrya Virginica*, Willd., was noticed for the first time. In places the sombre woods were lightened by the delicate pink flowers of the wood-sorrel, *Oxalis Acetosella*, L., or, as it is sometimes called from its blossoms being supposed to ring the chimes that call the spirits to their moonlight revelry, "fairy-bells;" and in others, ravishing beds of the wax like *Moneses uniflora*, Gr., loaded the air with fragrance. *Osmorrhiza brevistylis*, DC., *Pyrola chlorantha*, Swz., *Epiphegus Virginiana*, Bart., *Habenaria orbiculata*, Torr., *Listera cordata*, R. Br. and *convallarioides*, Hook., *Corallorhiza innata*, R. Br. and the common form of *multiflora*, Nutt., *Eleocharis obtusa*, Schultes, *Carex rosea*, Schk., and *Cystopteris fragilis*, Bernh., were also collected and fully compensated us for our tiresome climb over the rough sides of the mountain.

Our next stop was at a little wayside station, Kingston, to examine the bad lands lying along this part of the railway. The sand hills, covered with the withered flowers and half-ripened fruit of *Hudsonia ericoides*, L., where a week before they had been a mass of golden bloom, gave evidence of the advance of the season. The same localities abounded in *Corema Conradii*, Torr., with immature fruit, and *Arctostaphylos Uva-ursi*, Spreng, while *Comandra livida*, Richardson, was found in a sandy slashing in the woods. Growing along the track was a depauperate form of *Rosa lucida*, Ehrh., and in a woodland back of the station *Helianthemum Canadense*, Mx., *Spergula arvensis*, L. in fields, *Pilea pumila*, Gr. in low woods, *Panicum depauperatum*, Muhl. on dry banks, and *Amblyodon dealbatus*, Pal. Beauv. on the bottoms of dried up hollows in cranberry marshes, were also picked up, and made welcome additions to our list. In a swamp at Bridgetown, a neighboring village, is a fine grove of *Thuja occidentalis*, L., a tree, we were informed, which, though common in the adjoining province of New Brunswick, is very scarce in Nova Scotia.

Jumping from Kingston to Kentville, behold us in a very pretty little town, with many of the streets bordered with magnificent specimens of *Ulmus Americana*, L. It was our starting point for a drive across Annapolis valley, famed for its fertility, to the "Look-Out" at Cape Blomidon. The valley lies between the North and South mountain ranges, and thus sheltered from the cold winds and chilling fogs of the Bay of Fundy, with a wonderfully rich soil, has earned the title of the "Garden of Nova Scotia." Early morning saw us under way, our path lying past vast orchards and fertile farms, each vying with the other in its appearance of thrift and good husbandry. Picking up, *en route*, *Potamogeton gramineus*, L., *Sagittaria variabilis*, Eng. var. *angustifolia*, Gr., and *Carex hystricina*, Willd, by noon we had reached the mountain top, and a glorious prospect lay at our feet. Five counties were in view at once, and the panorama of fields, meadows, and orchards, with the white farm houses surrounded by trees, and here and there a village with its church spires glancing in the sunlight, was one seldom surpassed in any land, and which, once seen, could never be forgotten. While feasting our eyes on the scene, we had the good fortune to detect *Botrychium matricariæfolium*, A. Br. along the grassy roadside, while in crevices in the face of the cliff were fine bunches of *Woodsia Ilvensis*, R. Br.

On leaving Kentville our road entered the country which Longfellow has made famous. From Grand Prè, literally "great meadow," one has only to look about on the ocean of billowy grass to see how apt was the name, and we can not wonder at the unwillingness of the Acadians to quit so peaceful a spot. Few traces of the French village are now to be found, but the hollows that once were the cellars of their houses are still pointed out. There, too, now gnarled and decaying, are the willows that formerly lined the streets and perhaps witnessed the troth-plight of Gabriel and Evangeline, while the dykes, built to keep the sea from their meadows, and at which sturdy Basil himself may have lent a helping hand, yet serve the same useful purpose. Great as is the charm of the place to the poet or sentimental tourist, it offers but scant attraction to the botanist, and accordingly we pushed on to Windsor, passing, just on the outskirts of that place, the old homestead of "Sam Slick" (Judge Haliburton). The Avon, on which the town is built, is principally made by the tide from the Basin of Minas, and is a noble stream at high water; at low water, shorn of its beauty, the banks and far-stretching flats of red mud are something stupendous. Strolling out to Fall Brook, about four miles from the town, in low places along the highway were found *Juncus articulatus*, L. and *Carex retrorsa*, Schw., and on the hillsides bordering it *Panicum dichotomum*, L. In meadows by the creek were fine specimens of *Oxalis corniculata*, L. var. *stricta*, Sav., and *Oenothera pumila*, L., while *Carex panicea*, L., grew along a ditch being dug for the waterworks in a boggy field. A day having been put in at this place, we boarded the evening train for Halifax, and hastened to seek in our new quarters a much needed rest.

On July 3d we turned, for the last time, our faces away from Halifax, preparatory to a run through Cape Breton, the northern extremity of the province. At Bedford, nine miles from the city, in addition to a host of new, many of our old acquaintances reappeared, and in much better collecting condition. Near the "Prince's Lodge," once the residence of the Queen's father, the Duke of Kent, for a long distance the railway track was covered with beautiful specimens ot *Aquilegia vulgaris*, L., in both flower and seed. Here likewise was a very large-flowered form of *Geranium Carolinianum*, L., and in rocky places *Poa cæsia*, Smith. Dry gravelly roadsides yielded *Urtica dioica*, L., and boggy spots were brilliant with *Myosotis laxa*, Lehm., or, as Coleridge so prettily describes it,

> "That blue and bright-eyed flow'ret of the brook,
> Hope's gentle gem, the sweet forget-me-not."

Notes on the North American Forms of Podosphæra.

BY F. S. EARLE.

I have lately examined a number of specimens of this genus, from different localities and on different host plants, with a view of trying to determine their specific relations.

Although quite a marked difference may be observed between perithecia taken from the same leaf, specimens on the same host plant from different localities resemble each other quite closely, and these forms may be characterized as follows:

1. Form on *Prunus Cerasus.*

(From four specimens, different parts of Illinois.)

Amphigenous, fruiting plentifully on the lower side of the leaf; perithecia dark brown, from .00275 in. to .00375 in. in diameter; appendages dark brown for more than half their length, sometimes forking near the base, varying in number from 8 or 10 to as many as 18 or 20, placed irregularly on the upper surface and ascending at different angles, varying greatly in length, even on the same perithecium, 1¼ to 3½ times the diameter; tips hyaline, 3 to 5 parted, much swollen.

2. Form on *Prunus Americana.*

(One specimen, Dixon, Ill.)

Amphigenous, fruiting below; perithecia .0025 in. to .00325 in.; appendages few, about 6 or 8, placed irregularly, but sometimes ascending nearly parallel, 1¼ to 2 times the diameter, 4 or 5 times parted, tips not much swollen.

3. Form on *Amelanchier Canadensis.*

(Two specimens from Massachusetts and Connecticut. Coll. A. B. Seymour.)

Amphigenous, or epiphyllous; perithecia .00275 in. to .00325 in.; appendages 8 to 16, 2 to 3 times the diameter, much as in the form on *Prunus Cerasus*, but rather darker and less variable, tips swollen.

4. Form on *Spiræa tomentosa.*

(Two specimens, Massachusetts. Coll. A. B. Seymour.)

Amphigenous, fruiting both sides of leaf or more abundantly above; perithecia small, .0025 in. to .00325 in.; appendages numerous, 12 to 24, radiating from all parts of the upper surface, 1 to 2 times the diameter, 3 to 5 times parted, tips only slightly swollen.

5. Form on *Cratægus*—

(Three specimens from Illinois.)

Amphigenous or epiphyllous; perithecia small, .0025 in. to .003 in.; appendages 8 to 12, mostly curving upward, but not fascicled, 1 to 2½ times the diameter, 3 to 4 times parted, tips somewhat swollen.

These forms all have septate appendages and do not differ materially in their spores and asci. The differences that do appear are chiefly in the size of the perithecia and in the number and length of the appendages. As these vary more widely in perithecia from the same leaf than do the averages of the different forms, there seems no ground for their separation into distinct species, unless we allow more weight to the difference of host plant than is usual in the *Erysiphei;* but they should be considered as belonging to a large, widespread, variable species, comparable with *Erysiphe lamprocarpa*, Lev. and *Microsphæra penicillata*, Lev.

Saccardo, in his "Sylloge Fungorum," gives *Podosphæra Oxyacanthæ* (DC.) De Bary, with "appendages 8 to 10, about equal to the perithecium," on species of *Cratægus* in Europe, Algeria, etc. Our form on *Cratægus* agrees well with this description, except that the appendages are sometimes a little longer, which we have seen to be an unimportant character.

He divides the forms that have usually been referred to *P. Kunzei*, Lev. between *P. myrtillina*, Kunze, having "6 to 10 appendages, three times the diameter, radiating divergently," on *Vaccinium* in Europe; and *P. tridactyla*, (Wallr.) De Bary, having "few, 3 to 7 appendages, three times the diameter, rising in a parallel bundle," on species of *Prunus* in Europe and North America.

Two European specimens in my collection on *Prunus domestica* and *Prunus Padus* show the peculiar character of *P. tridactyla*, having the few appendages clustered at the summit of the perithecium and rising in a parallel bundle. A part of the perithecia from the specimen on *Prunus Americana* (see above), approached this form rather closely, but in all the other specimens examined the appendages are more or less widely divergent, thus seeming to bridge the difference between this form and *P. myrtillina* Kunze[1].

The form on *Spiræa* has been described by Howe in Vol. 5, of the *Torrey Bulletin*, under the name of *P. minor*.

As *Erysiphe Oxyacanthæ* DC., was the earliest name given

[1]Having never seen specimens on *Vaccinium*, I can not, of course, say that this is to be included with the other forms, but there is nothing in the description by which it can be separated.

to any of these forms[1], that specific name will have to be retained for the combined species which may be characterized by the following description:

PODOSPHÆRA OXYACANTHÆ (DC.)

Erysiphe Oxyacanthæ, DC.; Podosphæra clandestina (Wallr.) Lev.; P. myrtellina, Kunze (?); P. tridactyla (Wallr.) De Bary; P. Kunzei, Lev.; Alphitomorpha tridactyla, Wallr.; Podosphæra minor, Howe.

Mostly amphigenous; perithecia .0025 in. to .00375 in. in diameter, dark brown, reticulations large and prominent; appendages variable, from four or five to twenty or more, septate, colored for half or more of their length, variously parted, tips sometimes much swollen; ascus oval, thick walled; spores 8.

Podosphæra biuncinata, C. and P. on *Hamamelis*, is a distinct, well marked species, having long, slender hyaline appendages.

Additions to the Habitats of N. American Sphagna.

For several years past the writer has made excursions into the southern parts of New Jersey in order to examine and note the distribution of the various species of *Sphagnum*, and the most important results are herewith given. The varieties new to this country are indicated in small caps.

Sphagnum Portoricense, Hampe, occurs in ponds at Pleasant Mills, Atlantic Co.; at Atsion & Brown's Mills, Burlington Co.; at Malaga, Cumberland Co., and at Willow Grove, Gloucester Co.

Sphagnum imbricatum, Hernsch. (*S. Austini*, Sull.), occurs in swamps at Toms River, Ocean Co.; at Atsion, Burlington Co.; near Newfield, Gloucester Co.; also in the northern part of New Jersey, at Budds Lake, Morris Co.

Dr. G. Martin, of West Chester, Pa., while in Florida, during the month of March, this year, sent me a lot of Sphagna for identification, amongst which I was fortunate enough to detect a number of plants of *S. imbricatum*, Hornsch. This species has not, to my knowledge, been heretofore found south of New Jersey.

Sphagnum papillosum, Lindbg., is found in bogs near Toms River, Ocean Co.; Atsion and Quaker Bridge, Burlington Co., and in fruit near Newfield, Gloucester Co.

---

[1] I am under obligation to my friend Mr. A. B. Seymour, of Cambridge, Mass., for aid in establishing the nomenclature of this subject, as well as for many of the specimens from which the above descriptions are taken.

Var. CONFERTUM, Lindbg., near Newfield, Gloucester Co.; *Sphagnum cymbifolium*, Ehrh., var. *squarrosulum* (Nees.) in bogs, Atsion, Burlington Co.

Var. CONGESTUM, Schimp. (var. *purpurascens*, Russow.,) occurs near Newfield, Gloucester Co.

Sphagnum acutifolium, Ehrh., var. DEFLEXUM, Schimp., margins of bogs, Newfield, Gloucester Co.

Var. ELEGANS, Braithw., open bogs, Atsion, Burlington Co.

Sphagnum subsecundum, Nees., var. AURICULATUM, (Schimp.) Lindbg., swamps near Newfield, Gloucester Co.

Var. OBESUM, Wils., swamps near Atsion, Burlington Co.

Sphagnum neglectum, Angstr. var., swamps near Newfield, Gloucester Co.

Sphagnum macrophyllum, Bernh., in ponds at Willow Grove, Cumberland Co., and Malaga, Gloucester Co.

EUGENE A. RAU, *Bethlehem, Pa.*

GENERAL NOTES.

Vitis riparia.—As represented in this locality this is a strong, vigorous climber, growing in bottoms and low grounds along streams; the flowers appear from one to two weeks later than any other species of *Vitis* here, but the fruit is ripened remarkably soon.

Usually we have ripe grapes the first week in July, but this season was very backward with late frosts, and I saw no ripe fruit until the 12th of July, while the so-called Summer grape (*V. æstivalis*) ripens its fruit about the middle of September. Now, as our manuals call this a Winter or Frost Grape, and it is so stated in the Floras of Iowa and Michigan, I would inquire if this is the usual habit of the plant in other localities?

The panicles are shorter and closer, with smaller and sweeter berries than those of *V. cordifolia*.

Here it is called Fox, Slue, or Sioux Grape.—FRANK BUSH, *Independence, Missouri.*

Graphephorum festucaceum, Gray.—Last July, while collecting *Scirpus fluviatilis*, Gray, in a small slough about a quarter of a mile west of my house, I found a grass which proves to be an interesting discovery. Judging it to be a *Graphephorum*, though differing from the description of the single species and its variety *major* in the Manual, I sent it to Dr. Gray for determination, who promptly reported it to be *Graphephorum festucaceum*, Gray, (*Arundo festucacea*, Willd.), for the first time in the United States so far as he knew, and who requested me to announce this addition to our flora in the BOTANICAL GAZETTE. He adds, however, that it abounds in the Saskatchewan region, and is well known in N. Europe. In Dr. Vasey's recent paper on "The Grasses of the United States," the range given is from British America to Alaska. The present locality, therefore, extends its range several hundred miles southward. It probably occurs in Minnesota, as I found it but six miles south of the state line. It grows quite rank, in water from one to two feet deep, along with such plants as *Scirpus fluviatilis*, Gray, *S. validus*, Vahl, and *Typha latifolia*, L.—R. I. CRATTY, *Armstrong, Iowa*.

Sarcodes sanguinea.—Mrs. Austin's interesting note I only saw recently, on my return from the Pacific. While in the Yosemite Valley, on the 17th of June, Dr. Chas. Schaffer, of the Philadelphia Academy, Mr. J. M. Hutchings, the well-known and estimable guardian of the Yosemite, and I, took a pick-axe to Glacier Point especially to study the snow plant. We dug out carefully a fine specimen. It had started about a foot below the surface. We took the mass of earth to a neighboring pool, and washed out as gently as possible every particle of earth. In this way we found to a positive certainty that there was no attachment whatever to the roots of any other plant. The forest growth consisted of *Abies concolor*. There was nothing else growing near the snow plant. We may say positively it is not a parasite in the usual sense of the word. Is it a saprophyte—a plant of the *Monotropa* type, feeding on decaying vegetable matter? We could find no trace of vegetable matter more than is found in any ordinary earth, except here and there a few scattered pieces of charcoal about the size of peas, and not many of these. There was really nothing to indicate that the plant might not live and grow as ordinary plants, just as Mrs. Austin suggests, except the absence of ordinary roots. The roots, if they may be so called, consisted of a coralline mass, like unto, but larger than we find in *Corallorhiza*, *Monotropa*, and similar "saprophytes." Is it a perennial as Mrs. A. believes? I know *Corallorhiza* will come up for several years from pieces planted of these coralline masses. There is no reason why *Sarcodes* should not. However, I planted in a piece of woodland on my premises two very large masses kindly sent to me by a lady in Nevada, but there was no sign of their appearance last year. I have sown seeds now which I brought from the Pacific, in this piece of woods, to give them a chance to take any course they choose.

Those who have the opportunity will, I think, confer a great botanical service by studying closely this plant. We have come to believe that parasites with green leaves like the mistletoe, take crude sap from the foster plant and elaborate it for themselves, and that the paler plants take the sap already elaborated, and hence have no use for green leaves. If plants like *Sarcodes* feed neither on the living nor on the dead, they should have green leaves; or is it not necessary that they should obtain anything whatever from the atmosphere? I have thought that such plants as *Epiphegus* and some others are parasitic in the earlier stages, form this coralline mass, cut loose from the parent, and then live for some time on the mass so formed; but the evidence I have had does little more than suggest this. It seems to me there is a very interesting field open for those who have the opportunity for investigation.—THOMAS MEEHAN.

Zinnia grandiflora, Nutt.—In the latter part of July last, while botanizing in the vicinity of Pueblo, Colorado, I found this species of *Zinnia* in great abundance, and was especially struck with its singular and, to me, novel method for the dispersion of its seeds. The plants, though rarely more than four or five inches in height, were very showy, because of the abundance of their bright yellow flowers, large for the size of the plants. When I came to examine them somewhat closely I found that much of their conspicuousness was due to the fact that the ray-flowers, even of the oldest heads, though they had become dry and rigid, had lost but little of their original color. Further observation revealed the fact that the rays are persistent even until after the akenes are fully ripened. The heads then fall or are detached entire from their peduncles, and the thin, light, stiff rays, now answering for wings, they are carried away by the wind to great distances from the parent plant. By this method the seeds are dispersed for the growth of another year.

I record the fact as one of great interest. I have never seen the like artifice employed by any other plant for the dissemination of its seeds, nor seen such a one noticed by any writer.

I met the plant soon after in New Mexico, where it seemed equally abundant. It is well figured and described in Dr. Torrey's botanical contribution to Emory's "Notes of a Military Reconnoissance," p. 144.—DAVID F. DAY, *Buffalo, N. Y.*

Notes from the New York Agricultural Experiment Station.—In chapter xi, "Animals and Plants under Domestication," Darwin says that it is worth mentioning that he "fertilized the purple sweet pea (*Lathyrus odoratus*) with pollen from the light-colored Painted Lady. Seedlings raised from one and the same pod were not intermediate in character, but perfectly resembled both parents." I can offer some parallel illustrations:

Kernels of Waushakem flint corn, exposed last year to hybridization from Minnesota dent, planted this year, yielded ears of perfect Waushakem and perfect Minnesota type, without any intermediates. Kernels of Minnesota dent likewise exposed last year, yielded this year perfect ears of Minnesota dent and Waushakem corn without intermediates. Again, hybrid kernels from flint and sweet crosses have flint and sweet ears, without any intermediates, and flint and dent crossed kernels ears of flint and dent corn without any intermediates. Pop corn kernels likewise produced sweet corn, flint corn and pop corn ears, but no intermediates.

In crossing sweet and wrinkled peas, smooth and wrinkled peas were found in the same pod, but no intermediates. In crossing a smooth pea with pollen of the sugar pea, the pod was of the garden type, the seed of the sugar type.

Blue seed produced both blue and cream-colored peas, and cream-colored seed produced, occasionally, blue seed—excellent evidence in favor of the view that natural crossing occasionally takes place.

William the First, a smooth pea, planted late, but the pods harvested in a ripe condition, yielded wrinkled peas for crop.—E. LEWIS STURTEVANT, *Director.*

EDITORIAL NOTES.

M. L'Abbé Anzi, an Italian lichenologist, died recently.

Prof. Dr. Th. Nitschke, director of the Botanic Gardens in Münster, Germany, died August 30, in his fiftieth year.

Prof. Wm. Trelease gave four lectures during the month of January before the Johns Hopkins University, on the fertilization of flowers.

Dr. Geo. Vasey, in the December *Torrey Bulletin*, describes two new species of grasses, *Agropyrum Scribneri* from Montana, and *Sporobolus Buckleyi* from Texas.

Carl Salomon has recently published "Nomenclator der Gefässkryptogamen," giving the genera, species, synonymy and distribution of the higher cryptogams; a much needed work.

Bulletin No. 7 of the Illinois State Laboratory of Natural History, to be issued soon, will be devoted to a "Descriptive Catalogue of the North American Hepaticæ," by Prof. L. M. Underwood, of Syracuse University.

Prof. Burrill calls attention in *Science Record* to a common mistake of supposing that *pébrine* of silk-worms is caused by *Micrococcus bombycis*, when instead it produces the quite distinct disease of *schlaffsucht* to which caterpillars are subject.

The Bulletin of the Botanical Society of France contains an account of the germination of the oospores of *Peronospora viticola*, the grape mildew, stating that, contrary to preconceived opinion, zoospores are not formed, but a mycelial tube is at once pushed out.

In the January *Naturalist* Prof. Bessey gives an account (with cuts) of hybridism in *Spirogyra*, observed last August at Ames. *S. majuscula* and *S. protecta* were seen to conjugate, the zygospore resembling those of *S. protecta*, this species also being functionally the female.

G. Haberlaudt shows that the so-called rudimentary fibro-vascular bundle in the center of the stems of mosses is a water-conducting bundle. An aqueous solution of resin rises in the central bundle only, and quite rapidly there, when the cut end of a stem is immersed in it.

The states of Indiana, Illinois, Michigan and Wisconsin are included in the last "Contributions toward a List of the State and Local Floras of the U. S." by W. R. Gerard and N. L. Britton. This list, when completed, will prove a most valuable one, as, judging by our own State, it is a most reliable one.

At the November meeting of the San Diego Natural History Society Dr. Parry gave an interesting account of the singular *Pinus Torreyana*, which was discovered by him in 1850. As the range of this species is confined to a narrow strip of coastline not more than four miles long, the society is taking measures for its preservation.

IN SCIENCE GOSSIP for January, W. B. Grove gave some "Notes on Yeast-Fungi," being a translation from Dr. Winter's edition of the "Kryptogamen-Flora," with notes by the translator. Twelve species are described and figured.

CINCHONA LEDGERIANA has been having quite an airing in the *Journal of Botany*, the last number adding still another to the long list of papers on the subject. The editor probably voices the wish of all his constituency when he brackets at the close of the article these words: "This discussion is now closed.—ED. JOURN. BOT."

THE "FUNGUS FORAYS" of the Natural History societies of Britain were not so successful last season as usual, owing to unfavorable weather and a scarcity of specimens. Probably the most interesting item was the finding of thirty-four species of *Cortinarius* in the vicinity of Hereford, during a four days gathering of the Woolhope Field Club.

IT SEEMS THAT *Sphæria Coulteri*, Peck, collected in 1872 near Yellowstone Lake, turns out to be the representative of a new genus, which Professor Saccardo describes in the *Torrey Bulletin* for December, and names *Neopeckia*, thus associating Professor Charles H. Peck's name with that of the writer in a way that is very pleasant to the latter.

LIGNIFICATION HAS HERETOFORE been supposed to be confined to internal tissues, but A. Lemaire shows (Ann. Sci. Nat. xv, p. 297) that the epidermal cell walls may undergo this change. A section of the epidermis, transferred from an alcoholic solution of phloroglucin to hydrochloric acid, has its lignified parts colored a beautiful rose-red.

IN 1882 MR. A. STEPHEN WILSON published an account of the discovery of certain bodies found in potato leaves, which he claimed to be sclerotia of *Phytopthora infestans*, which view Mr. Plowright accepted. In the December *Journal of Botany*, Mr. Murray and Dr. Flight publish the results of an investigation of specimens furnished by Mr. Wilson, which go to show that the so-called sclerotia are merely masses of oxalate of lime.

HECKEL GIVES an account in the *Bulletin* of the *Société géogr. de Marseille* of the African nut called Kola. It is the product of a tree belonging to the order *Sterculiaceæ* of which the chocolate tree of tropical America is a member. The chemical composition of the two fruits is much alike. Kola is very highly esteemed by the African tribes, often bringing its weight in gold-dust, and in periods of scarcity a slave being required for a single nut.

BYRON D. HALSTED, in *Science* for Jan. 11, contends for the use of italics in printing scientific names, which does not accord with the practice in that periodical, nor the views of its editor. *Science* is a radical in the use of type, and some of the changes introduced seem not a little absurd to those accustomed to a very different order of things. In reference to the use of italics for scientific names, however, the writer has found its greatest convenience in the saving of time. Such names are thus made catch-words, and a glance down a page reveals the species spoken of and invites either to skipping or a closer reading.

BOTANICAL MICRO-CHEMISTRY is growing in importance if one may judge by the number of reagents coming into use. Eighty-eight, including *only the more important ones* in use up to June, 1883, are now advertised by Dr. Theodor Schuchardt (Görlitz). While only a very few of these are necessary in the ordinary study of histology, many of them are absolutely indispensable in the delicate investigations concerning the nucleus, bacteria, contents of cells, nature of cell walls, etc.

THE HANDBOOK of British Fungi, by M. C. Cooke, published in 1871, has been almost as useful to students in this country as in England, and the announcement of a revised edition will meet with special favor from American botanists. The author, being unable to prepare the whole work at once, will give the Hymenomycetes in an appendix to *Grevillea*. The first installment in the December number, beginning with the white-spored agarics, embraces descriptions of thirty-eight species.

A PAPER HAS RECENTLY been read before the Linnean Society, by Mr. A. W. Bennett, on the reproduction of the *Zygnemaceæ*. His investigations go to support the views of De Bary and Wittrock, long since stated, that there are sexual differences in the conjugating cells. The cell taken to represent the female is greater in length and diameter than the other, and it is found that the protoplasmic contents pass only in one direction, and that change first begins in the chlorophyll bands of the supposed male cells.

SECTIONS OF DIATOMS have been obtained by W. Prinz, by a rather unexpected method. Sections made by imbedding a mass of diatoms in gum and cutting with a razor not proving satisfactory, Prinz boiled pieces of diatomaceous earth in Canada balsam and then ground fragments thin by the same process used in preparing mineral sections. He says: "In this way I have obtained thin laminæ of about a square centimeter in surface, containing hundreds of sections at right angles to the long axis of the frustule. These preparations * * * were of extreme thinness, in spite of the friability of the material."

PROF. D. S. JORDAN, in a recent visit to England, strolled into the village of Down in Kent, and talked with some of the villagers about Mr. Darwin. It is astonishing what little knowledge of his greatness had spread around his home. Among much interesting testimony from the villagers, the following statement of Mr. Parslow, for many years his personal servant, is especially interesting to botanists:

"The gardener used to bring plants into his room often of a morning, and he used to tie bits of cotton on them, and try to make them do things. He used to try all sorts of seeds. He would sow them in pots in his study."—*Am. Nat.*

VOLVOX GLOBATOR has long been considered a *hollow* spherical colony of unicellular algæ. Mr. J. Levick thinks that *Volvox* is not hollow but that the colony encloses a perfectly transparent gelatinous material which can be made evident by transferring some roughly handled (and probably thus ruptured) *Volvoces* to water containing powdered carmine. The carmine will adhere to surfaces exposed by the rupture of the superficial colony. Of sections of Volvox he says: "The contents are so perfectly colorless that they are quite imperceptible in water, unless it be charged with suspended matter, and then only show their presence by displacing this matter from the space which they occupy themselves."

THE WRITER READ recently an article, written by some enthusiastic convert, which was considered to contain some startling proofs of the doctrine of evolution. It is not worth mentioning, except that it represents a class of dabblers in science who, through gross ignorance, misinterpret discoveries and spring their startling deductions upon a gullable public. As it is this class that courts the daily press, and especially infests the weekly, the public mind is generally in an abused condition. The "mycologist" referred to had evidently read Dr. Cooke's little book on fungi, and at once became an ardent theorizer. He now claims that he can prove evolution off hand, for his reading of fungi literature assures him that it is a common thing for one genus to turn into another, and even for neighboring families to lose their identity in each other. *Uredo*, *Æcidium*, *et al.*, are to him genera, whose partition walls can be broken down only to prove the doctrine of evolution. To all this an agriculturist remarks: "If these things are so, can we stand out longer against the 'wheat and cheat' idea?" With such enthusiastic expounders, mycology, evolution and agriculture ought all to flourish, and the public mind be kept in a feverish state of excitement.

IN THIS DAY of hasty publication of new species, when every collector feels competent for this difficult work, it is refreshing to read in the *Naturalist* some suggestions by Prof. Bessey in regard to the publication of new species. There is no doubt that the right to describe stimulates the study of Systematic Botany, but such stimulation too often results in utter confusion. As cautious as the editors of this journal have been in this respect, and they are conscious of having frequently given offense to contributors, they have published species that had no right to stand, and they are perfectly willing to adopt either of the following suggestions of Prof. Bessey:

1. Every description to be accompanied by the statement that type specimens were deposited in this or that established herbarium.

2. Every description to be accompanied by specimens to be distributed by the editor of the journal giving such publication.

The third suggestion, that specimens should be deposited in the National Herbarium, is too restricted when we consider the present relative importance of our herbaria. We consider the first suggestion as the most feasible, and the second as most complete, but impracticable.

CURRENT LITERATURE.

Notes on the Cryptogamic Flora of the White Mountains. By W. G. Farlow. Extr. from Appalachia, vol. III., part 3, Jan. 1884, pp. 232–251.

This is an important contribution to the flora of a district of which the flowering plants have been well known for many years, but the algæ and fungi of which have been almost totally neglected. As a contribution to a knowledge of the distribution of some of the thallophytes, especially as affected by altitude, it is also interesting. In general it may be said that the thallophytic flora turns out to be similar to that of the Adirondacks and to the alpine and arctic flora of Europe. Twenty-three algæ are enumerated, and about one hundred and ten fungi, part of the latter, however, being the so-called imperfect or secondary forms. The following new species are described: *Propolis circularis, Sticta Tsugæ, Cylindrosporium Gei, Cercospora Pyri, Ramularia Oxalidis.* The primary object in visiting the region was to study the occurrence and distribution of the *Peridermia.* Three species were found. The first, *P. abietinum* (*P. decolorans Pk.*), on dwarf *Abies nigra*, is alpine. There are two forms known in Europe, one of which is supposed to be the æcidial stage of *Chrysomyxa Rhododendri.* This is the one collected, and although the *Chrysomyxa* could not be found, its supposed host affected the same situations as those of the *Peridermium.* The second, *P. balsameum*, on *Abies balsamea*, is sub-alpine. It differs but slightly from *P. columnare*, the European form associated as its æcidial stage with *Calyptospora Gœppertiana.* Its distribution, both in the White Mountains and in other parts of the country proves to be the same as of the *Calyptospora*, and so far as that goes, indicates that they are stages of the same species. The third *Peridermium, P. Peckii*, found at the base of the mountains, could not be connected with any teleutosporic form.

Botanical Micro-Chemistry, an Introduction to the Study of Vegetable Histology, by V. A. Poulsen. Translated with the assistance of the author and considerably enlarged, by William Trelease. Pp. 109. Cassino.

In the GAZETTE for August, 1883, Carl Müller's translation of this book was reviewed, and the hope expressed that we might have an English translation. That wish was hardly expressed before we learned that Prof. Trelease was undertaking the work, and in the neat volume before us we have the result. It is not necessary to repeat here the commendations of the previous review, but simply to give notice that the book is in the market, and is in every way one suited for the laboratory student. Some might prefer a different binding and thinner paper for a laboratory guide, but it is hard to make a publisher do less than his best, and this surely is an improvement on the style of Penhallow's Vegetable Histology. No one was better fitted for this translation than Prof. Trelease, and his thorough acquaintance with every detail of laboratory work make his additional notes (always signed with his own initials) not the least valuable part. A complete index adds to one's comfort, and we bespeak for this little book the careful attention of all students of Vegetable Histology.

The True Grape Vines of the U. S. and the Diseases of the Grape Vines. By Dr. Geo. Engelmann. Reprinted from the Bushberg Catalogue, pp. 9–20.

The Grape Manual, from which this paper is reprinted, is a most satisfactory affair, and is really very different from the ordinary horticultural catalogue. Dr. Englemann's paper is but a sample of the thorough and scientific way in which every subject relating to grape vines is treated. In the reprint before us the subject is treated in Dr. Engelmann's usual complete way. A full account of our species of *Vitis* is given, with a key to their arrangement, and, what is of very great value to botanists, a table of grape seeds is given, by the help of which it would seem that any one could name the typical forms of grapes. The systematic arrangement of N. Am. grape vines is as follows: I. True grape vines, with loose, shreddy bark and forked tendrils, and II. Muscadine grapes, with firmly adhering bark and simple tendrils. The second division contains only *V. vulpina*, L. (*V. rotundifolia*, Mx.) The first division is subdivided into two groups: A, those with more or less continuous tendrils, including only *V. Labrusca*, and, B, those with intermittent tendrils. Group B is subdivided into two sections based upon the pubescense or not of the leaves. In the pubescent or floccose section we have seed characters used for subdivisions, *V. candicans*, *V. Caribæa*, *V. Californica*, *V. monticola*, and *V. Arizonica*, having the raphe on the seed indistinct, and *V. æstivalis* and *V. cinerea* having the raphe very conspicuous. The glabrous-leaved section is also subdivided on the same seed character, *V. cordifolia* having the raphe conspicuous, and *V. palmata*, *V. riparia* and *V. rupestris* having the raphe indistinct.

The Elements of Botany: Embracing Organography, Histology, Vegetable Physiology, Systematic Botany and Economic Botany. Arranged for school use or independent study. Together with a complete glossary of botanical terms. By W. A. Kellerman, Ph. D., Professor of Botany and Zoology in the Kansas State Agricultural College, etc. 12mo. pp. x, 348. Philadelphia: John E. Potter & Co., 1883.

A reading of the announcement of this book awakened the hope that in it we might find something better arranged and proportioned than others on the same subject, but a perusal of the work is sadly disappointing. The preceding extract from the title page shows that Professor Kellerman has undertaken to compress a great deal of information into three hundred and fifty pages, and he has done this, unfortunately, at the expense of clearness and accuracy. In an endeavor to prepare a book whose brevity would suit it for use as a high school text-book on botany, the author has made a too common mistake by trying to tell too much in too small a space. In this, as in most of the school text-books on the biological sciences, the distinction between *education* and *learning* seems to be lost sight of. It seems to be the chief aim of their authors to put a vast mass of facts and definitions at the disposal of the student. After serving the immediate purpose of enabling him to pass the required examination, the book and its contents pass out of sight and out of mind. Whether or not such books are at all disciplinary depends on the teacher; if they are made so, it is *in spite of* their method, and not because of it.

In the particular volume under consideration, the proportion of one part to another is, in our opinion, extremely bad. Organography occupies 61 pp., Histology and Physiology 45, while Systematic and Economic Botany have 216. No wonder students "don't like botany" when they are fed on such dry husks. The amount of space to be devoted to any particular part of the subject may, however, be considered a matter of opinion, and we might easily forgive a mistaken judgment in this respect. Errors of fact and bungling statements and definitions are less easily overlooked, and this work abounds in both. One need go no further than the first page of text (p. 15) to find three examples of such. Only three organs, root, stem and leaves, are enumerated as visible, when "any common plant, such as a Grass, Rose-bush, Willow or an Oak" is examined. Why not trichomes? What would a pupil infer should he, by chance, actually examine a grass like *Panicum capillare* or any rose as to the relations of the hairs and prickles? A little further down we find "Hairs, *or* Trichomes. * * * * They are mostly *hair like.*[1]" In stating the differences between stems and roots it is said that "roots never produce buds" (p. 23), whereas every gardener knows how abundantly adventitious buds occur on the blackberry and other plants. On. p. 26 we read this in regard to bulb-scales: "This nourishment is consumed in such bulbous plants as the Hyacinth, etc., by the production of flowers *in advance of the leaves*." What *Dionæa* leaves would do with a *third* lobe which they are said to possess (p. 27) is hard to conceive. Although claiming to reduce the number of technical terms, the author introduces such needless ones as *fibrillæ* for root-hairs (p. 16), *rachis* for the common leaf-stalk of a com-

[1] Italics ours.—ED.

pound leaf (p. 35), and the almost obsolete series, *monogynous, digynous*, etc. The attempt at extreme brevity results in inadequate explanations; e. g., "The leaves of Iris are equitant, that is, straddling over each other" (p. 37). No pupil of any age, unless familiar with the arrangement of the bases of the leaves of Iris, would get the slightest idea of what is meant by equitant leaves. Under stipules (p. 37), the student is told, "in *Galium* they are interpetiolar and as large as the leaves and exactly resemble them, so that the leaves are said to be *whorled;* but in reality they are opposite, the two intermediate leaves on each side being free stipules." If true of the 4 and 8-leaved Galiums, it is a very unnecessary fact for the student, and it is especially out of place in an "organography," which almost ignores homology. The unrestricted definition of a pistil as consisting of three parts, ovary, style, and stigma, is followed two pages later (p. 53) by the words concerning the pine cone: "The scale is, therefore, the pistil." Nor does the antecedent premise of the "therefore" explain the apparent contradiction. Would not the two ideas of a pistil be slightly confusing to a novice? On p. 64 is the following astounding definition: "When the flowers are evidently arranged to favor self-fertilization and prevent cross-fertilization, they are said to be cleistogamous." Nor are the following from pp. 92 and 95 very much better: "Certain other cells, or rows of cells, become modified into tubes or ducts, and form the string-like masses, or form fibers in the stems of the higher plants. These are the fibro-vascular bundles." "The fibro-vascular bundles are composed of tracheary tissue, sieve-tubes and parenchyma."

The illustrations of the book are "copious"—too copious, such as they are. The majority are photo-engravings from the author's original drawings, some from nature (we suppose), some copied from various sources and some from Vick's catalogue. In some cases the source of the copied illustration is acknowledged; in many cases, particularly when slightly altered, it is not. In few instances is the name of the plant, from which the illustration is taken, given. Aside from their complete lack of artistic finish, some of the drawings contain glaring errors. Fig. 21 shows accessory buds for adventitious ones. The leaves of *Dionæa* seem, in fig. 25, to be distinctly cauline. Fig. 90, the diagram of an umbel, shows a *pyramidal* cluster; nor is there anything in the text to correct the impression. Fig. 91, the diagram of a spike, shows the flowers *widely separated*, and fig. 95, of the cyme, is *globular*. Fig. 96 shows a flower of one of the Malvaceæ (not named) as the typical flower; at least it is the one to which reference is made when first describing flower parts. Fig. 182, of *Navicula viridis*, has the striations projecting one-third of their length beyond the edge of the valve. Fig. 202, of the stomata and intercellular spaces of the leaf of Pine, is beyond description. Fig 212, a section of a stoma of the potato leaf, shows the guard cells with walls as thick as sclerenchyma, and so on. Only the most glaring errors have been mentioned, and those named *are confined to the first hundred pages.*

As lesser blemishes may be mentioned the faulty etymology of some of the terms and the inconsistent method in the expression of the Greek words in English letters—as an example of the latter notice "*hypogynous* (Gr. *hypo*, under; *guna*, pistil)." p. 48. The adoption of the English system of measures and temperatures is made on the plea of unfamiliarity with the metric. When and how shall pupils become familiar with the metric system if they are not forced to see and use it?

Finally, the entire omission of an index adds an inconvenience to the use of a book already unfit for use because of its many mistakes; and as a general statement it will probably hold good that Dr. Gray and Prof. Bessey would prefer to do their own abridging.

BOTANICAL GAZETTE.

VOL. IX. MARCH, 1884. No. 3.

Additions to the Peronosporeæ of the United States.

BY W. G. FARLOW.

The following additions should be made to the *Enumeration of the Peronosporeæ* given in the October and November numbers of the GAZETTE for 1883. Since the publication of the *Enumeration* a number of interesting forms have been received from correspondents in the Western States, to whom my thanks are due. The names of the correspondents are given below in connection with the species received from them. The numbers given are those affixed to the species in the *Enumeration*, and additional species are indicated by stars.

1. *P. viticola.*

The form on *Ampelopsis quinquefolia* was also found in September, 1883, at Ithaca, Wis., Prof. Wm. Trelease. It appears from a review in Just, which I have just seen, that Pirrota, in a paper published in Milan, 1880, stated that *P. viticola* occurs on species of *Cissus* and *Ampelopsis* in Italy. I have not seen the original paper of Pirrota, and its contents are only known to me from the review above named.

2. *P. Halstedii.*

Occurs on the following additional hosts: *Eupatorium ageratoides*, Wisconsin, Trelease; *Silphium perfoliatum* and *S. laciniatum*, Iowa, Profs. Bessey and Arthur; *Bidens chrysanthemoides*, Cambridge.

4. *P. Geranii.*

The form on *G. Carolinianum*, found by Mr. Earle, seems to belong to this species without doubt. Specimens collected in April show a large proportion of the monstrous conidia, others collected later, in May, show a smaller proportion of the large conidia, and in specimens on the same host collected by Mr. C. A. Hart in July the conidia are the same as in the normal form of *P. Geranii*.

9. *P. parasitica.*

Also on *Draba Caroliniana* and *Lepidium intermedium*, Iowa, Arthur.

10. *P. Potentillæ.*

On *P. Norvegica*, Illinois, C. A. Hart.

12*. P. ARENARIÆ (Berk.) DeBary.

Botrytis Arenariæ Berk. Journ. Hort. Soc. Lond. I., 31. Pl. IV.
P. Arenariæ DeBary. Ann. Sci. Nat. 4 Sér. Vol. XX., p. 110, Pl. XIII., f. 8, 9.

Var. MACROSPORA Farlow.

Conidiophores slender, repeatedly dichotomous, divisions flexuous, tips short, subulate, erect. Conidia ovate-elliptic, 13–17μ broad by 18–22μ long, pale violet colored. Oospores 38–48μ in diameter, very thick-walled, exospore deep yellowish brown, marked with prominent papillæ or short ridges.

On leaves of *Silene* sp. ? Cobden, Illinois, Earle.

This striking species covers the under surface of the leaves of some caryophyllaceous plant, probably a *Silene*. The species is intermediate between *P. Arenariæ* (Berk.) DeBary and *P. Dianthi* DeBary. The description given above, which was taken from Illinois specimens, shows that while the oospores are larger than those of *P. Arenariæ* and in size approach more nearly those of *P. Dianthi*, yet the markings of the exospores are like those of *P. Arenariæ*. In fact, the oospores are very strikingly marked, and in several respects recall the oospores of *Cystopus candidus*. The conidiophores and conidia resemble those of European specimens of *P. Arenariæ* rather than those of *P. Dianthi*. I should hesitate to call the species new, while admitting that the American form does not conform to the type of either of the European species named, and it is difficult to say whether, in the present case, we have a form of *P. Arenariæ* with large oospores or a form of *P. Dianthi* with prominently marked exospores.

13. *P. Arthuri.*

Also on *Œnothera biennis*, Illinois, Earle.

24. *P. grisea.*

Also on *Veronica arvensis* with oospores, Anna, Illinois, Earle.

26. *P. leptosperma.*

It was stated in the *Enumeration* that this species was first found in this country at Lake Minnetonka. This is an error, as it was found by Prof. Bessey on *Artemisia Ludoviciana* in Iowa, in September, 1882.

29. *P. sordida.*

On *Scrophularia nodosa*, Iowa, Arthur; Illinois, C. A. Hart.

In the specimens examined the conidiophores formed dense dirty patches, sometimes of considerable extent, on the under side of the leaves. In microscopic characters they agree perfectly with No. 99, Fung. Scand. Eriksson. No oospores were found. The description previously given may be emended as follows:

Conidiophores much and irregularly branched, dichotomous above, divisions divergent, tips acute, rigid, erect. Conidia violet-colored, ovate-elliptic, 20–23μ long by 15–19μ broad.

31. *P. Lophanthi.*

Also on *Lophanthus nepetoides,* Illinois, Prof. T. J. Burrill and C. A. Hart.

Since the publication of the *Enumeration* I have received additional specimens of this species on *L. scrophulariæfolius* from Prof. Arthur, in which, as well as in Mr. Hart's specimens, I have found oospores. They are about 22–26.5μ in diameter, considerably smaller than the oogonia, which are from 38–46μ in diameter. The wall of the oospores is thin and delicate, of a pale yellow color, and the exospore is nearly smooth.

31*. P. SCHLEIDENIANA DeBary l. c. p. 118, Pl. XIII., f. 1–3.

P. Schleideni Unger, Bot. Zeit. 1847, p. 315.
P. alliorum Fuckel. Fung. Rhen. 41.

Conidiophores stout, naked below, above rather sparsely and irregularly dichotomous, branches short, tips stout, flexuous, approximate in pairs. Conidia very large, 40–60μ long by 22–35μ, obovate, usually papillate at the apex and attenuated at the base; dark violet colored. Oospores ?

On *Allium Cepa.*

Ithaca, Wisconsin, Trelease. Europe.

A strongly marked species, characterized by its large conidia attenuated at the base and the short, stout, rather irregularly placed branches. According to Prof. Trelease it is abundant in Wisconsin, and does decided harm to the onion crop. The original name given by Unger was *P. Schleideni,* and dates from 1847. The name given by DeBary is *P. Schleideniana* Unger, and is generally adopted by recent writers. The reason for the change in name is unknown to me, but is probably on etymological grounds.

31**. P. GRAMINICOLA (Sacc.) Schroeter.

Protomyces graminicola Sacc. Myc. Ven. No. 496, 1876.
Ustilago? Urbani Magnus, Sitzungsbericht. Prov. Brand. 26 Apr. 1878.
Peronospora Setariæ Pass. Grev. VII. 99, 1879.
P. graminicola (sub-gen. *Sclerospora*) Schroeter, Hedw. VIII. 83, 1879.

Conidiophores solitary, sparingly branched above, main branches short and thick lying close to the axis, ultimate divisions dichotomous, tips short, straight, pointed. Conidia ovate or elliptic, about 20μ long, hyaline. Oospores spherical, 34–42μ in diameter, endospore very thick, exospore proper thin, the oospores enveloped rather closely by the thick lamellated, yellowish-brown oogonium wall.

On leaves of *Setaria viridis.*

La Crosse, Wis., Mr. Pammel. Comm. Trelease. Europe.

This curious species, for which Schroeter has created the subgenus *Sclerospora,* has been found in several European countries, but is at present only known at La Crosse in this country. The oospores of the Wisconsin specimens are precisely like those of European specimens. The description given above was taken from American specimens as far as the oospores are concerned, the description of the conidia being taken from Schroeter. In the Wisconsin specimens bodies were found on the surface of the leaves which may perhaps have been the conidia, but the material examined was not in sufficiently good condition to enable me to speak with certainty. The oospores are borne superficially on the leaves, and may be seen with the naked eye as dark brown specks. They readily fall from the leaves and collect in the form of a powder in herbarium envelopes. The endospores are very thick sometimes, in American specimens as thick as 4μ, which is thicker than reported European specimens. The exospore of other *Peronosporæ* is here represented by merely a thin film, whose surface is more or less roughened, but the oogonium wall itself, which is very thick and of a dark brown color, serves the purpose of an exospore, and instead of the spore escaping from the oogonium, as is generally the case, the oogonium falls from the leaf with the spore. The antheridia are plainly seen in Wisconsin specimens, even after having been dried for several months.

32. *Cystopus candidus.*

Also on *Nasturtium palustre* near Chicago, Arthur; and on *Sisymbrium canescens* with oospores, Arizona, H. H. Rusby.

33. *C. cubicus.*

On *Artemisia biennis*, Wisconsin, Trelease.

34. *C. Bliti.*

On *Amarantus blitoides*, Iowa, Arthur.

Besides the above, *P. nivea* and *P. Viciæ* are mentioned in a Partial List of the Fungi of Wisconsin, by Dr. W. F. Bundy, in the first volume of the Geology of Wisconsin. The hosts on which these species grew is not mentioned, but Dr. Bundy kindly informs me that *P. Viciæ* grew on cultivated peas in his garden, but he does not recollect the host of *P. nivea*, and unfortunately his specimens and notes on the subject were lost.

A Botanical Holiday in Nova Scotia. III.

BY T. J. W. BURGESS, M. D.

Led by the advertisements to believe that if we reached Port Mulgrave, on the Gut of Canso, in the evening, all we would have to do was to step off the cars on to the steamer for Sydney, we made no effort to catch the morning express, but loitered about Pictou and New Glascow until the afternoon. Our train, an accommodation, certainly deserved the name. Time seemed to be no object, and at every station train-hands and passengers "piled off" to gather wild strawberries, which were very fine and plentiful. Along the track *Senecio aureus*, L. var. *lanceolatus*, Oakes, seemingly the leading form throughout the country, grew luxuriantly, and in one spot *Amarantus retroflexus*, L. was abundant. After dark the air, woods and grass were ablaze with fireflies, producing a charming and fairy-like effect as we *dashed* (?) along. 9:30 P. M. saw us at Mulgrave Wharf, where we learned to our intense disgust that the steamer only met the express, and then crossed to the opposite side of the Strait to lie at Port Hawkesbury until morning, when she left for Sydney. By the time that we had found out for ourselves that the ferryman lived on the other side also,—so that though our vessel lay only a mile away, she might as well have been twenty,—the little waiting-room had been locked up, and the train had gone back to the village. Imagine our feelings! dumped, with our baggage, in the middle of a pitch-dark night, on a wharf with not a house in sight around it,—the nearest tavern a mile up the track, and no one to give us aid or information. Finally the station operator, the only one of the railway employes who had taken the least trouble to help us in our dilemma, volunteered to show us the way to the hotel, an offer we gladly accepted. Lucky it was we had a guide, or some of the party (for we were not alone in our misery) would in all probability have broken their necks, a long piece of trestle-work forming part of the track about half a mile from the wharf. The hour was late when we reached our destination, but the landlord, Mr. Gillis, a genuine Highlander, and his wife, did all they could to make us comfortable. Though most of the luxuries of modern civilization were wanting, everything was scrupulously clean, and a snack, washed down by a glass of real Scotch whisky, and followed by a pipe, was no bad preparation for a good night's sleep.

A glorious sunshiny morning and a scene to delight an artist's soul completed the cure of our over-night disappointment. The hotel was close to the water flecked with white sails, and being situated on high ground gave a superb view both of the strait and of the western shore of Cape Breton. Within a quarter of a mile was a lovely cove, Pirates' Harbor, one of the places formerly frequented by the famous (or infamous) Captain Kidd, and, like many others, said to be the scene of the burial of his ill-gotten wealth. Breakfast disposed of, we were speedily off for a scramble up a rocky glen at the head of this cove. At what seemed, until right up to it, to be the end of the ravine, the stream we had been following made a sudden bend at right angles, and, turning our eyes, Hartley's Falls in all their picturesqueness were in full view. Tumbling out of a narrow chasm cut in the solid rock, the water, descending in a mass of fleecy foam, was overhung by perpendicular cliffs, high up on which could be identified tufts of *Aspidium fragrans*, Swz., and *Asplenium Trichomanes*, L. This being the only locality known in the province for these ferns, though their situation presented no very great obstacles to a good climber, we willingly left the far from numerous bunches to gladden the eyes of future botanical explorers. About *Cystopteris bulbifera*, Bernh., also known only here, we were not so diffident, as it clustered abundantly about the base of the same rock. The entrance to the ravine furnished a new station for *Aspidium aculeatum*, Swz. var. *Braunii*, Koch, and further up grew *Viola canina*, L. var. *sylvestris*, Regel, while the wooded plateau above the falls was rich in *Habenaria Hookeri*, Torr. and *obtusata*, Richardson, and *Goodyera repens*, R. Br. and *Monotropa Hypopitys*, L. usurped the densely shaded banks. In the afternoon a walk to the wharf told us that this day's boat had struck a rock on her way up, and would be unable to sail again for some time; but so beautiful were our surroundings, and so rich in mosses our rocky glen, that the tidings were heard without regret. Our enforced stay was fully rewarded by the finding of the rare sea weed *Fucus serratus*, Linn., heretofore only known in America at Pictou, Nova Scotia, and Newburyport, Massachusetts, growing commonly on stones in the harbor; *Zygodon Lapponicus*, B. & S., *Hypnum cupressiforme*, L., *umbratum*, Ehrh., and *brevirostre*, Ehrh., and *Aulacommion turgidum*, Schw. among rocks in the ravine; and *Splachnum rubrum*, L. in a swamp on top of the plateau.

On the third day, successful in catching a steamer, we crossed to Port Hawkesbury, and were at last in the island of Cape Breton, formerly a distinct province, but now a part of Nova Scotia. Morning brought a pleasant sail down the strait to St. Peter's canal, passing through which we entered the famed Bras D'Or. Pen of mine can do no justice to the beauties of this strange ocean lake, which, sheltered from the sea of which it forms a part, divides the island in two, and ramifies through it in a hundred different directions. Bays, inlets, and straits, with islands, peninsulas, and broken coast, were all there, while high above towered the hills and their ancient forests, a mass of verdure. North Sydney, the end of our voyage, lying across the harbor from Sydney proper, is a straggling and dirty, but lively business place, with a people the embodiment of kindness and hospitality. Being a coaling station, many foreign vessels touch there, and a saunter about the streets and docks brought to light a number of introduced plants. *Urtica urens*, L. was everywhere, and *Lepidium ruderale*, L. and *Senebiera didyma*, Pers. fell little short of it in abundance. *Lamium purpureum*, L., *Fumaria officinalis*, L , and *Myosotis arvensis*, Hoff. were pretty common on ballast and seemed to be firmly established, while *Veronica Buxbaumii*, Tenore, and *Lamium amplexicaule*, L. were more localized, though also well fixed. *Papaver Rhoeas*, L., *Lepidium campestre*, R. Br., *Bellis perennis*, L., and *Achillea Ptarmica*, L. were noted, but very sparsely, and could not be considered as at all permanent. In the middle of a field, at least a mile from any house, was a large patch of *Primula veris*, L. in fine seed, but how it had got there we were unable to learn. A swamp just back of town proved a genuine "bonanza" in more ways than one. The black flies and mosquitoes were terrible,—so much so that from the extravasation of blood, the result of their biting there, my eyes were as black for some days as if I had come out second-best in a free fight. But if it abounded in insects it was also rich in plants, among others being *Aster nemoralis*, Ait., *Gaylussacia dumosa*, T. & G., *Eriophorum alpinum*, L., *Cladium mariscoides*, Torr., *Scirpus caespitosus*, L., *Rhyncospora fusca*, Roem. & Schultes, *Carex utriculata*, Boott, *Lycopodium inundatum*, L. var. *Bigelovii*, Tuck., and *Splachnum ampullaceum*, L. Careful search in a low wood brought to light a few specimens of *Pyrola minor*, L., and where pools had dried up on the sea shore was a form of *Callitriche verna*, L. *Euphrasia officinalis*, L. grew very freely both on the hillsides and in meadows, while boggy spots produced an abundance of *Juncus filiformis*, L. in good fruit.

Thinking it would never do to visit a coal region without inspecting a mine, we betook ourselves to the most extensive, known as the Old Sydney. After seeing all the works above ground, a descent was made of the shaft, seven hundred feet deep, and the subterranean wonders explored Some of the workings have been carried for a long distance under the sea, but I found it quite impossible to realize that the waves of the mighty Atlantic were actually rolling above my head. One of the most interesting sights was the spacious underground stable, where they not only keep, but breed, their stock for use in the mine. I had fancied that the sight of such animals might be defective in some way, but was informed that whenever they had been taken above ground, after a time sufficient to get accustomed to the light, vision seemed quite normal. Not far from the mine was one of the "barrens" peculiar to the country, and this, after jotting down *Gnaphalium sylvaticum*, L., we next proceeded to examine. "Barrens," or "bake apple barrens,"—as they are called in the neighborhood, from their being the favorite resort of the "bake apple," the name by which *Rubus Chamæmorus*, L. is here known,—are extensive mossy tracts bordered by a growth of scraggy spruce, and covered in places with a low brush of ericaceous plants. They favor the coast, and are said to owe their origin to bush fires which have in times past swept the country. The one visited was particularly rich in the Rubus in all stages, from perfect flower to nearly mature fruit, and also enlarged our collection with *Poterium Canadense*, Benth. & Hook., *Prenanthes serpentaria*, Pursh, var. *nana*, Gr. *Solidago Virga-aurea*, L. var. *humilis*, Gr., *Aster Radula*, Ait., and *Comandra umbellata*, Nutt. The sandy shore below the mine furnished us with *Cakile Americana*, Nutt, and the shallow water of a little lake a few miles from town, with *Lobelia Dortmanna*, L., *Limnanthemum lacunosum*, Griseb., *Sparganium simplex*, Huds. var. *fluitans*, Gr., *Sagittaria heterophylla*, Pursh. and *Isoetes Tuckermani*, *Braun*.

Canada possesses too few historically famous places to sanction the missing of so well-known a one as Louisbourg. Accordingly conveyances were engaged to carry us over the twenty-five miles intervening between that place and Sydney, and a most enjoyable drive was the result, the road, though hilly, being good, pleasantly diversified with hill and dale, and generally shaded. By the way, just after starting was seen *Blitum Bonus-Henricus*, Reich., and in fields a little farther along *Digitalis purpurea*, L. A dwarf state of *Sparganium simplex*, Huds. var. *angustifolium*, Gr. occupied wet places on the higher lands, and *Carex rostrata*, Mx. low swamps between the ranges of hills, while in Black Brook, just where it crossed the road, *Nuphar pumilum*, Smith, was abundant. One of our horses having broken down, our progress was so delayed that we did not reach our journey's end until toward evening, and it was the following morning ere we found ourselves among ruins rich in historical recollections and in floral treasures. Listening to the mournful surges of old ocean,—a fitting requiem,—what a world of thought on the vanity of all things earthly did the prospect open. Twenty-five years of labor and thirty millions of lives had the French expended to make this place one of the strongest fortresses in the world; now it was but a heap of grass-grown ruins. Captured first by the hardy New Englanders under Pepperal, it was restored by the treaty of Aix-la-Chapelle, and again became the strong-hold of France on the Atlantic coast, and a key to the Gulf of St. Lawrence. War re-opened, Wolfe sought the new world, and Louisbourg fell once more, and forever. A fiat was issued that the place should be destroyed. Buildings were blown up, walls torn down, and the once proud city reduced to a shapeless mass. Two years were needed to complete the work of destruction, and so thoroughly was it done, that to-day but a couple of stone arched casements remain unbroken, though the lines of many of the old fortifications may still be indistinctly traced. On our way along the shore a valuable find was made in *Iris tridentata*, Pursh. flourishing on a bank just above the sea, while some swampy ground skirting an outlying work known as the "Grand Battery," was literally a mass of *Microstylis ophioglossoides*, Nutt. The grass-slope back of the same work was white with the spikes of *Habenaria dilatata*, Gr., and *Lythrum Salicaria*, L. with *Carex panicea*, L. grew plentifully in the ditch surrounding it. *Hippuris vulgaris*, L. almost choked up the old moat encircling the main defenses and *Iris prismatica*, Pursh. enriched a low swale near by. A wet "barren" had added materially to the strength of the place on the seaward side, and in picking our way over this we stumbled across *Carex limosa*, L., *Calamagrostis Pickeringii*, Gr., and *Hypnum molle*, Dicks., while *Racomitrium lanuginosum*, Bird., was found on dry banks closer to the shore.

Retracing our steps to Sydney, and over the Bras D'Or, our next halt was made at Baddeck, with other Cape Breton scenes so well described by Charles Dudley Warner in his sketch "Baddeck and that Sort of Thing." Here, in a salt-water pond on the island forming the harbor were got *Zannichellia palustris*, L. and *Ruppia maritima*, L., and, on the sands surrounding it, a form of *Potentilla Anserina*, L., differing from our inland one in having a widely reflexed calyx and acheniæ forming dark purple heads as large as the ordinary run of wild strawberries. On the swampy shore of the mainland grew *Eleocharis pygmæa*, Torr., and *Poa serotina*, Ehrh., while the grassy hill slopes were gay with *Habenaria lacera*, R. Br., and, where at all shaded, with *Aspidium Noveboracense*, Swz.

Notes on Indiana Plants, 1883.

BY E. J. HILL.

The following notes have been selected from my note-book for 1883 as far as it relates to the flora of Indiana. Some of the species named are additions to those given in the Catalogue of the Plants of Indiana by the editors of the BOTANICAL GA-

ZETTE, and others are mentioned to extend their geographical range beyond that indicated in the same work.

Anemone triloba, Chaix. Michigan City. Found in abundance on the slopes of sand hills, mostly on their eastern sides. All have the lobes of the leaves rounded or very blunt, none with acute lobes being noticed. In the immediate vicinity of Chicago the lobes of the leaves of Hepaticas are all acute, as far as I have met with the species. Mr. Babcock, in his Flora of Chicago and vicinity (*The Lens*, vol. 1, p. 20), mentions the occurrence of *Hepatica triloba* on the hills at Joliet, Ill., and also at Michigan City. At the latter place it grows interspersed with *Epigæa repens*, L.

Hypericum Sarothra, Michx., Hammond, Lake county.

Pycnanthemum linifolium, Pursh., Whiting, Lake county.

Lycopodium lucidulum, Michx., Chesterton, Porter county.

In "Wolf Lake," a narrow pond in the northeastern corner of Lake county, the following Potamogetons were found; *P. amplifolius*, Tuckerman, *P. perfoliatus*. L. var. *lanceolatus*, Robbins.

There may be given for new localities:

Lespedeza reticulata, Pers., var. *angustifolia*, Gray., (*L. violacea*, Pers. var. *angustifolia*, Gray, Man.) Gibson, Lake county.

Floerkea proserpinacoides, Willd. Chesterton.

Gnaphalium uliginosum, L. Along the road between Hammond and Gibson. This is the first time I have seen this plant in the West. It is not given in Patterson's "Catalogue of the Plants of Illinois." I have found it as far north as Sault Ste. Marie, Ontario.

Cacalia atriplicifolia, L. Hammond; *Hieracium Gronovii*, L., sand hills at Hammond.

Gerardia auriculata, Michx., Sheffield, Lake county.

Poa annua, L., Hammond. With biennial root. Not a "frequent" plant or found "everywhere," as far as my experience goes, though often sought.

Potamogeton zosteræfolius, Schum. (*P. compressus*, L. ex Fries, Gray's Manual), *P. lonchites*, Tuckerman, *P. pectinatus*, L., *P. zizii*, Schum. (*P. lucens*, L. var. *minor*. Volte), "Wolf Lake."

Utricularia resupinata, Greene. This, noticed last year in the BOTANICAL GAZETTE, and identified from a single imperfect specimen found in flower late in September, and from some plants in fruit, was sought in August the past summer. Hundreds of plants were seen in blossom, so that there was no mistake as to the identification. As yet I have seen it in no locality except this "slough" at Whiting. *Utricularia* is well represented in the pine barrens of Lake county, where I have found besides the above, *U. vulgaris*, var. *Americana*, *U. gibba*, *U. purpurea*, and *U. cornuta*. *U. intermedia* has been reported, but I have not found it, except farther north in Michigan.

At Chesterton, in the low grounds by the Calumet river, occur plants of *Viola striata*, Aiton, with white flowers and crenate-serrate leaves, approaching *V. canina*, L. var. *Sylvatica*, Regel, in its leaves. *Lespedeza capitata*, Michx. var. Leaflets linear-lanceolate to oblong-lanceolate, strongly reticulated, glabrous above. Lower peduncles often elongated to ½ to ¾ inch; stem slender and but little branched. Approaches in character *L. angustifolia*, Elliott, (*L. capitata*, var. *angustifolia*, Gray), but has also characteristics of *L. capitata*,var. *longifolia*, Torr. & Gray (Flora of N. A., vol. 1, p. 368).

Lespedeza capitata, Michx., var. Leaflets linear-oblong, densely silky canescent on both sides, shining; stem densely villose, not much branched, but more so than in the common form of the above variety. Otherwise it does not seem to be distinct from *L. capitata*, var. *sericea*, Hook & Arnot, in Torr. & Gray's Flora of N. A. (vol. 1, p. 369). The shape of the leaflets is intermediate between the first variety and the common form. The peduncles of the lower flowers are inclined to lengthen, as in *L. angustifolia*, Elliott.

Both of these grow with the common *L. capitata*, on the dry sand ridges near Hammond, a station on the Mich. Cent. R. R. The three in some respects shade off into each other, especially in their lower leaves, and yet they were easily detected in the field before consulting the books for finding the distinctions between them and the well known *L. capitata*, everywhere abundant in this region. Whether the first of these should be called *L. angustifolia*, Elliott, and included with it, or *L. capitata*, var. *longifolia*, Torr. & Gray, is not easy to determine, but the former seems preferable. The range of *L. angustifolia* is given in Gray's Manual as "near the coast and southward;" that of *L. capitata*, var. *longifolia*, "Kentucky to Louisiana;" (Flora of N. A.) The second variety is so near *L. capitata*, var. *sericea*, that little is risked in classing it with that, the main discrepancy consisting in its being less branching. Its range is said to be "Louisiana," *Drummond;* Arkansas, *Nuttall! Dr. Pitcher!*" (Flora of N. A.) It would seem that we have near the head of Lake Michigan the connecting links between *L capitata* and two of its varieties and *L. angustifolia*, until lately regarded as a variety of *L. capitata* also.

All of these forms were obtained within a few rods, or even feet, of each other, under substantially the same conditions of environment. It is not easy to conjecture what forces should cause such modifications, if they originated here, and the varieties have spread elsewhere to become more modified under different conditions of climate, soil, or other external forces. If they originated elsewhere, and have been brought together here, the same environment might be expected to lessen their differences, and cause them to approach a common type.

GENERAL NOTES.

The Willow Basket.—Mr. Guthrie's story is not without a parallel. See Darlington's *Flora Cestrica*, ed. 3, p. 279, for the following: "In Watson's Annals of Philadelphia we are told that the Yellow Willow, in this State [Pennsylvania] came originally from some wicker-work found sprouting in Dock Creek. It was seen by Dr. Franklin, who took it out and gave the cuttings to Charles Norris, who reared them on the grounds now the site of the Custom House, or late Bank of the United States."

A basket of unpeeled willow, combining much strength with flexibility, is quickly, cheaply and easily made, providing the material is readily accessible. Somewhere along the canal bank the boatman might cut his bundle of green twigs, and a half-hour or less of evening work would give him an excellent thing for carrying his potatoes in the hold. But the weight, which is simply astonishing to persons accustomed to handling ordinary willow ware, would be likely to insure its staying there, and so long as it did stay it would continue to be a very good basket, and would also be in condition to sprout if thrown into a ditch. But a more shackly thing than a willow basket woven green and afterwards dried it would be difficult to imagine! I have seen, with my own eyes, a first rate half-bushel feed basket of unpeeled willow go to complete wreck on a western farm in less than a week—a brief period not at all inconsistent with the retention of vitality in the stouter frame-work. On the other hand I have had too much experience in unsuccessful attempts to revive carelessly packed willow cuttings to place much confidence in the vitality of dried and withered twigs coming to hand after only a few days of transit through the mails.

Please observe I do not question Mr. Guthrie's statement of facts. I simply would state express belief that he very much overestimated the character and extent of the service done by his basket before it landed in the ditch.—M. S. B.

Variation and Environment.—Is variation an indication of changed environment? The red cedars which flank the road-side to my house present the most dissimilar forms. No two of them are alike. What has environment to do in the case? And persimmons are often seedless in this part of the world, seldom, indeed, having their full complement of seeds. If I examine wild plants closely, I find few which do not vary in some respects from their neighbors of the same species. Either there is some ambiguity about the the terms "variation" and "environment," or Dr. Sturtevant's proposition that "variation is an indication of changed environment," needs revision.—THOMAS MEEHAN.

Notulæ Californicæ.—*Chrysanthemum Leucanthemum*, L. is mentioned in the Botany of California as occurring at Santa Cruz, in fields, and is remarked upon as not likely to become the troublesome weed here which it has so long been in the Atlantic States. Being a perennial, its troublesome spreading is hardly to be feared on lands that are subjected to the plow and harrow every year; and in all the western part of California even the cultivated forage plants are annuals, such as wheat, oats, etc. Meadows of perennials, such as timothy, clover, etc., where the white weed finds time and place to thrive, are here unknown. However, among the middle ranges of the Sierra there are not wanting considerable tracts of perennial meadow, and in this region of the State the white weed may possibly prove troublesome.

In Nevada county, not far from Grass Valley, I noticed in July last, abundance of it. It appeared to grow luxuriantly, not only in the moist meadow lands of the valleys, but was also well established on the dry hillsides, under the partial shade of the scattered pines. It was a surprising thing to behold the veritable ox-eye daisy making itself perfectly at home in the society of the *Eriogonums* and the *Hemizonias*, and blooming with them in the midst of the summer drought.

Convolvulus sepium, L., new to California, has been found by the writer, during the past season, growing in great abundance in the brackish marshes along Suisun Bay, and also in similar situations near the town of Napa. It looks rather unlike the eastern forms, having a narrower and paler foliage, and being slightly pubescent. Its roots are within reach of tide-water in both localities, and its stems, attaining a height of not more than two or three feet, support themselves on the weeds and rushes, among the masses of which it grows. The corollas are very large and deeply tinged with rose.

Typha angustifolia, L., thus far reported only from the south part of the State, is much more abundant in the marshes about Suisun than is the commoner species. Its leaves and stems here often attain the height of ten or twelve feet.—EDW. L. GREENE, Berkeley, California.

The Anomalous Cobæa.—I venture to inquire whether the anomaly of the seedling Cobæa, given on page 12, may not be differently interpreted. May not the notched leaf be formed of the two cotyledons, united and turned to one side, and the pinnate leaf be the leaf of the next node, the internode between nearly undeveloped?—A. GRAY.

Heliotropism in Sun-flowers.—It is well understood, I believe, that the sun-flower does not turn with the sun, and that the poetical associations of the ancient stories of the Heliotrope with our *Helianthus*, simply because it looks like the sun, is all there is in it. I have, however, shown, in the *Proceedings of the Academy of Natural Sciences, of Philadelphia*, by an actual observation and count of flowers as they opened, that *Helianthus mollis* has a southeasterly face on opening, and that it turns, not with the sun, but eastwardly as the head progresses towards maturity. These observations were made on a cultivated plant. Going across the continent last summer, I noticed this plant for several days from the car windows. It was then about opening its first heads of flowers, and I kept count of all I could well fix my eyes on. These also, with rare exceptions, faced horizontally to the southeast. The matter is one of some interest, and those who may have opportunities to watch *Helianthi*, as they open from day to day, would be pleased, I think, in making notes.—THOS. MEEHAN.

A Specific for Snake-bite.—While rambling among the mountains of Western North Carolina on a summer jaunt, we were startled to find that the inhabitants of those primitive wilds regarded the bite of one of the deadliest foes to mankind, the rattlesnake, with scarcely more concern than they did the sting of a bee or wasp. Strolling leisurely, gypsy-like, through that fresh, picturesque and beautiful region, we were halted one August morning in front of the toll-keeper's gate, at the entrance of the turnpike road over the grand chain of mountains known as Nantahala. A number of men came out of the house of the toll-taker; one of whom had his arm in a sling, but otherwise seemed in as perfect health and spirits as the most jovial of the group. It was ascertained that he had been bitten by a rattlesnake the day before, and that the remedy he had used was the chewing of the root of what he termed "Red Joint," or "Four Leaf." Taking a bit out of his vest pocket, he remarked, "With this, the rattlesnake's master, about me, I wouldn't mind being snake-bit every week." Curious to see the plant possessed of such wonderful virtues, for it was declared to be a positive antidote for the poison of any serpent or insect, we engaged him to accompany us until he could show us a specimen. Upon analysis it proved to be *Silene stellata*, the localisms of "red joint" and "four leaf" being readily explained by the red nodes at the junction of leaf and stem, and in the four-leaved verticels. We sometimes found a kindred species, the Fire Pink, *S. Virginica*, in its near neighborhood, whose cymes of crimson flame contrasted brilliantly with the panicles of delicate, white, fimbriate blossoms of the former.

The *S. stellata* seemed generally to seek cool, sheltered situations, yet not infrequently it was seen in company with its glowing sister, fire pink, on the high slopes of the mountains, their slender stems stirring with every light breeze, and gracefully nodding to ferns and flowers which flourished luxuriantly in the glens below. At Aquone, near the debouchment of Laurel creek into the Nantahala river, the banks of both streams being thickly set with Hemlock, Rhododendron, Azalea, Laurus, and *Kalmia latifolia*, the *S. stellata* grew in the damp, shady nooks beneath their branches, in rich profusion, and with finer fuller panicles than I had observed elsewhere. The *S. Virginica* is of somewhat common growth in the mountainous districts of Upper Georgia, but I do not remember to have seen the *S. stellata* except in the North Carolina mountains.

Had Dr. Darwin known of the extraordinary curative properties ascribed to the plant, he would not, perhaps, have written of

"The *fell* Silene and her sister fair,"

or, as "Skilled in destruction."

I will mention that there was very little viscidity about the species under consideration, not enough, I think, to entrap the feeblest insect. Quite the contrary, however, with the *S. Virginica*.—ELIZABETH L. H. WILLIS, *Charleston, S. C.*

The Genus Podophyllum.—This little genus is rapidly coming to the front in botanical interest and leaving far behind the idea that it is monotypical. Upon the very heels of the discovery of the Formosan *P. pleianthum* comes another new species from S. E. China. Dr. Hance, who describes it in the *Journal of Botany* for December, says that it agrees with "its insular ally in the color, number, and atrocious odor of its flowers, but differs in their extra-axillary position, just as the Himalayan *P. Emodi* disagrees with *P. peltatum*." The inflorescence of the four species now known would form an interesting morphological study. In *P. peltatum* and *P. pleianthum* the leaf stalks can easily be called petioles, but in the two other species the prolongation above the leaf indicates a stem, or rather a branch from the rhizome. In the new plant, which is called *P. versipelle*, the leaves vary in outline from a square, parallelogram, triangle or pentagon, to a circle, and are either with or without lobes. Dr. Hance gives the following arrangement of the species:

I. *Diplostemon.*—Stamens twice as many as the petals. Flowers white, solitary, terminal between opposite leaves. American.—*P. peltatum.*

II. *Isostemona.*—Stamens of the same number as the petals. Asiatic.

Flowers white, solitary, extra-axillary.—*P. Emodi.*

Flowers purplish, aggregated.

Flowers between opposite terminal leaves.—*P. pleianthum.*

Flowers extra-axillary.—*P. versipelle.*

EDITORIAL NOTES.

A NEW MANUAL of the flowering plants of the Northern United States is in course of preparation by Prof. W. A. Kellerman, of the Kansas Agricultural College.

W. N. SUKSDORF's third fascicle of Washington Territory plants is very attractive, and the price for sets or desiderata is so reasonable that many botanists will doubtless take this opportunity to fill up some gaps.

IN VOL. IV, of the Proc. Dav. Acad., Dr. C. C. Parry describes four new plants from Southern and Lower California. They are *Phacelia suffrutescens*, *Ptelea aptera*, the specific name referring to the wingless fruit, *Polygala Fishiæ*, and *Gilia Orcuttii.*

ALL OUR HERBARIA contain specimens from Mr. A. H. Curtiss, and we do not need to call attention to their value as species, nor their completeness of preparation. The successive fascicles, now numbering seven, have each brought many accessions eagerly sought for by botanists. This season Mr. Curtiss will collect such plants of North Florida as are ordered, and will send lists to purchasers for selection. He can be addressed at Jacksonville, Florida.

BREFELD DEVOTES the fifth part of his *Botanische Untersuchungen* to the development of the *Ustilagineæ*. By using nutritive fluids for his cultures he was enabled to obtain far more important results than those of other observers. By this means he found that the sporidia produced by the germinating spores have the behavior of conidia, and that the so-called conjugation in *Tilletia*, which is without sexual significance, does not occur when nutriment is abundant.

AS WE GO to press the death of Dr. Geo. Engelmann is announced, and to western botanists especially it comes like the shock of a family bereavement. So great and so kind, was the general thought in regard to him, and we hope soon to be able to give to our readers a suitable memorial notice.

PROF. EDWARD S. BURGESS, of the Washington High School, has published a "Syllabus of the Courses in Botany and Zoology," which rather surprises one accustomed to the ordinary High School biology. Of course the means of illustration in Washington are unusually good, thanks to the Botanical Gardens and National Museum. But the main point is, that use seems to be made of the materials within reach, which would work a revolution in probably nine-tenths of our schools. But the Botanic Gardens and National Museum are by no means the only things Prof. Burgess uses, but he depends largely upon what every teacher has, the inexhaustible Botanic Garden and Museum of Nature herself. One only needs Nature to teach pupils much natural science, but the trouble is that much of our school natural science is so very unnatural.

CURRENT LITERATURE.

Arctostaphylos, Adams. Notes on the U. S. Pacific Coast species, from recent observations of living plants, including a new species from Lower California. By C. C. Parry. From proceedings Davenport Acad. Science, vol. iv.

Some twenty-five species of *Arctostaphylos* are recognized by botanists, thirteen of which are found within the limits of this paper. The only one of general distribution is the well-known *A. Uva-ursi*. Five species are exclusively Californian, three of which Dr. Parry characterizes as doubtful, or imperfectly understood. Seven other species extend into Mexico, including the new species *A. oppositifolia*. This species, together with *A. nummularia*, Gray, are placed in a new section, *Micrococcus*, characterized by the fruit with thin pericarp, without mealy pulp, wrinkled at maturity, and the four or five nutlets easily separating. *A. oppositifolia* differs from all other members of the genus in its opposite or ternately-whorled leaves, and is noted for its two-celled nutlets.

BOTANICAL GAZETTE.

VOL. IX. APRIL, 1884. No. 4.

Antirrhina Prehensilia.

BY A. GRAY.

The Californian species of this group (in the section *Antirrhinastrum*) have been somewhat increased in number since the revision in the Synoptical Flora. The following key may help to a better understanding of them:

Flowers comparatively large, in a naked spike: lower lip of corolla (with very protuberant palate and comparatively short lobes) very much larger than the upper: seeds lightly reticulate-favose (truly mature seeds still a desideratum). A. COULTERIANUM, Benth.

Flowers smaller (not over 4 lines long), with lower lip of corolla not very much larger than the upper, and sepals not conspicuously unequal,

Approximate in rather loose spiciform racemes, which are naked, except for the tendril-like branchlets they often produce: leaves linear or lowest spatulate-lanceolate: plants glabrous up to the inflorescence.

Seeds tuberculate-favose. A. ORCUTTIANUM, n. sp.

Seeds longitudinally cristate-costate. A. NIVENIANUM, n. sp.

Scattered: leaves ovate or oblong: herbage glandular or viscid-pubescent: seeds longitudinally cristate-costate.

Leaves petioled, mostly subtending axillary slender-peduncled flowers: stems and branches at length diffuse. A. NUTTALLIANUM, Benth.

Leaves all sessile or nearly so, upper more reduced and bract-like: peduncles shorter than the more approximate and racemose flowers, often shorter than the calyx: stem erect. A. SUBSESSILE, n. sp.

Scattered, small, short-peduncled: leaves mostly narrowly linear: plant glabrous: seeds scrobiculate-tuberculate. A. KINGII, Wats.

Flowers not small, scattered, subsessile or short-peduncled in the axils of oblong or lanceolate short-petioled leaves: sepals very unequal, upper one larger: tube of the corolla rather longer than the lips, of which the lower is comparatively large but short: seeds undulately cristate and at length rugose-tuberculate.

Corolla half an inch long; upper lip nearly equalled by the oblong large upper sepal. A. VAGANS, Gray.

Corolla smaller and narrower; its tube surpassing the upper sepal. A. BREWERI, Gray.

A. ORCUTTIANUM has been collected within the last year or two, mainly by Mr. C. R. Orcutt, near San Diego, and also in adjacent parts of Lower California. At first it was thought to be possibly a small-flowered state of *A. Coulterianum.* Sometimes, as in that species, the spiciform raceme bears hardly any filiform branches: sometimes they are produced in extreme abundance.

A. NIVENIANUM was collected by the Rev. Mr. Nevin at San Juan Capistrano, Los Angeles Co., in 1882. I think we have an immature specimen of the same from near San Diego. It much resembles the foregoing except in the seeds.

A. SUBSESSILE we have from Santa Catalina Island, collected by Mr. Schumacher in 1878; from Chollas Valley, San Diego Co., by Mr. Orcutt, 1883; both in fruit; and specimens from near San Diego, collected by Mr. Cleveland in 1874 and 1875, young flowering plants, appear to be of the same species, although they had been taken for *A. Nuttallianum.* The sessile leaves and short-peduncled flowers ought to distinguish it.

Schedule of North American Species of Paspalum.

BY GEO. VASEY.

PASPALUM, Linn.

Section EUPASPALUM, Benth. Spikelets arranged alternately, singly or in pairs, along the central elevated ridge of the rhachis (not immersed in it), the lower empty glume and the flowering one facing the ridge or rhachis.

Subsection *Opisthion,* Benth. Two empty or outer glumes: the narrow rhachis of the spikes flat or rarely somewhat concave.

a. Spike single and terminal.

1. *P. rectum,* Nees, var. *longispicata* (P. monostachyum, Vasey).

b. Spikes in terminal pairs, or rarely 3 and approximate.

2. *P. conjugatum,* Berg. Mississippi and Louisiana.
3. *P. notatum,* Flugge. On ballast ground, Philadelphia.
4. *P. distichum,* Linn.
5. *P. variegatum,* Swz. (P. Reimarioides, Chapm.)

vaginatum, see infra, p. 81.

c. One terminal, and usually a second approximate spike, with remote lateral peduncled ones.

6. *P. setaceum*, Michx. and varieties.

d. Spikes 2 to 5, or rarely 7, approximate or the lower ones rather distant.

7. *P. racemulosum*, Nutt.
8. *P. læve*, Michx.
9. *P. Walterianum*, Schult.
10. *P. cæspitosum*, Flugge.
11. *P. remotum*, Remy.
12. *P. Floridanum*, Michx.
13. *P. giganteum*, Baldw. ined.
14. *P. lividum*, Trin.
15. *P. lentiginosum*, Presl.
16. *P. lentiferum*, Lam. (P. præcox, Walt.)
17. *P. dilatatum*, Poir. (P. ovatum, Trin.)
18. *P. elatum*, Richard in Herb. Paris.

e. Spikes more numerous, 7 to 20 or more.

19. *P. virgatum*, Linn., var. *platyoxon*, Doell.
20. *P. purpurascens*, Elliott.
21. *P. plicatulum*, Michx. (P. undulatum, Poir.)

Subsection *Pseudoceresia*, Benth. (*Ceresia*, Elliott.) Empty or outer glumes, 2. Spikes numerous, spreading, the rhachis more or less dilated, concave, thin and green: the spikelets small and smooth.

22. *P. fluitans*, Kunth. (Ceresia fluitans, Ell.)

Section Anastrophus, Benth. Spikelets on each side of the rhachis of the narrow subflexuous spike, sessile, alternate, mostly in two rows, the lower empty glume and the flowering one turned away from the rhachis (*Spiculæ inversæ*, Nees): the spikes often many, close, suberect.

23. *P. platycaule*, Poir. (P. compressum, Nees.)
24. *P. Digitaria*, Poir? Chapman's Flora.

Notes.—No. 1, collected by Dr. Garber, at Miami, Florida. The culm is much stouter and the spike much longer than in the typical plant.

Nos. 4 and 5. There is much confusion respecting these species if they are separate. Mr. Bentham makes them synonymous, but there certainly appear to be two species. The *P. vaginatum*, Swz., has prostrate or decumbent culms, growing in water or marshy ground, and *very* acute glumes. The other species has a running rhizome with erect culms, shorter and broader leaves, and barely acute glumes.

No. 6. It is difficult to separate *P. debile* and *P. ciliatifolium*, at least as species. They appear to be only varieties.

No. 10 includes *P. Blodgettii*, Chapm.

No. 11, No. 804 of E Hall's Texas collection, is thus named by Munro.

No. 13 is represented in the Philadelphia Academy collection from Baldwin. It has since been collected by Mr. Curtiss and appears to be a good species.

No. 14, No. 807 of E. Hall's Texas collection, named by Munro.

No. 15 is No. 364 of Drummond's collection, and is also in Herb. Gray from Key West, collected by Blodgett.

No. 19 is in Herb. Gray, ticketed by Munro from a specimen collected in Texas by Mr. Reverchon. It is, perhaps, the same as No. 20, which we have from Virginia and South Carolina, and appears very different from *P. virgatum*, Linn.

No. 21 is 801 of E. Hall's Texas collection. It occurs also from other sources.

No. 24 is the plant of Chapman's Flora, but his synonym should probably be excluded. Doell cites *Milium paspaloides*, Ell., *Digitaria paspaloides*, Michx., and *Milium distichum*, Muhl., as synonyms of *P. vaginatum*, Swz. It is nearly related to No. 23, but would seem to be specifically distinct. The *P. obtusifolium* of Chapman's Supplement is *P. platycaule*, Poir. *P. obtusifolium*, Raddi, and *P. barbatum*, Schultes, are both made synonyms of *P. furcatum*, Flugge, by Doell in Gram Bras., and it is possible that Chapman's *P. Digitaria* may also be that species.

A Botanical Holiday in Nova Scotia. IV.

BY T. J. W. BURGESS, M. D.

Twenty-six miles in the little steamer May Queen over another branch of the great inland sea, and we had reached mountain locked Whycocomagh, or, as it is generally called by the natives Hogomah. The greater part of the three days spent here was devoted to drying purposes, but a couple of very successful excursions were made. One up a rocky gorge in the mountains rewarded us with *Impatiens pallida*, Nutt., *Solidago thyrsoidea*, E. Meyer, *Milium effusum*, L., *Asplenium thelypteroides*, Mx., and two very peculiar forms of *Cystopteris fragilis*, Bernh. The first of these forms, found growing abundantly under the spray of a little fall, in deeply shaded crevices of the rock, fell under the var. *dentata*, Hook., and was remarkable for the great length of the fronds. Their general measurement was not less than eleven or twelve inches, but many of them were fifteen and sixteen, and some even nineteen inches long. The second form, gathered in another part of the same ravine, occupied the crevices of drier and but slightly shaded rocks, and approached the var. *angustata*, but the ends of the fronds, as well as of most of the pinnæ and some of the primales, showed a tendency to bifurcate. The forking was not confined to a single plant, but was common to all in the patch, which was of considerable extent. Prof. Eaton, to whom specimens were submitted, says that this form is unlike any that he has seen before, and suggests that it be called var. *multifida*, Wolleston, as Mr. Moore in his "Nature Printed British Ferns" has such a variety and says of it, "In this, which is not permanent, the apices of the pinnæ or of the frond are bifid or multifid, or the stipes divided." Excursion number two had for its object the climbing of Salt Mountain, from the summit of which we had a splendid view. The Bras D'Or with its myriad of radiating arms was spread before us like a network of silver threads, while Cape Porcupine, at the Gut of Canso, on the one hand, and the smoke rising from Sydney mine on the other, with all the country between, were quite readily discernible. The side of the mountain, very steep and partially wooded, was a grand conservatory for ferns, which were disposed in regular series with the boundaries of each quite sharply defined. *Aspidium marginale*, Swz., growing with which was *Asplenium Filix-foemina*, Bernh. var. *angustum*, D. C. Eaton, formed the lowest layer, and was succeeded by one of *Aspidium spinulosum*, Swz. var. *dilatatum*, Hook., while a magnificent growth of *Aspidium Filix-mas*, Swz. came next, and *Woodsia Ilvensis*, R. Br. occupied the exposed faces of the topmost rocks. The fronds of the male fern, many of which were fully three feet in length, differed from the form usually described in being rather narrowly lanceolate in outline, the tallest of them measuring only five inches across where broadest.

The time fixed for the Professor's leaving me to visit the Island of Anticosti was drawing speedily onward, and it became necessary for us to hasten back to Pictou where we knew several rarities were to be had. Flying glimpses were taken of Pirate's Harbor and New Glascow, *Campanula rapunculoides*, L. being seen growing plentifully along the railway track at the latter place, and on the evening of July 24th we had arrived. The early part of the next day was devoted to an examination of the ballast heaps along the quays, and *Senebiera Coronopus*, Poir., *Viola tricolor*, L., *Trifolium arvense*, L., *Vicia tetrasperma*, Loisel., *Carduus nutans*, L., *Polygonum lapathifolium*, Ait., *Mercurialis annua*, L., and a number of other introduced plants, not yet determined, were our prizes. Noon, however, came all too surely bringing the sundering of our very pleasant, and to me, instructive, two months' companionship; Mr. Macoun starting for Quebec where he was to catch the Government steamer, whilst I, having determined to work my way home by the White Mountains, remained over for a couple of days botanizing with Mr. McKay, Principal of the Pictou Academy, and an enthusiastic naturalist. In tramping about the vicinity *Senecio Jacobæa*, L., was found to be one of the commonest weeds, its golden heads brightening the fields and roadsides in every direction. It is locally known as "Stinking Willie," and the eating of it was at one time popularly believed to be the cause of a disease prevalent among the cattle about Pictou for the past forty years. Experiment, however, abundantly disproved this, and by proper sanitary precautions the disease has been just about stamped out. Plentiful, but not quite so much so as the Jacobœa, was *Senecio viscosus*, L., and *Matricaria inodora*, L. was not infrequent. *Bartsia Odontites*, Huds , just coming into flower, was poking its head up everywhere, while *Camelina sativa*, Crantz, and *Euphorbia Peplus*, L. were detected bordering some of the streets.

Leaving Pictou, a stop, long enough for a farewell visit to the falls, was made at Truro, which place was quitted on the 27th July for St. John, New Brunswick, on the road for my western home again.

The results of our work in Nova Scotia may be thus summed up. The names and locations of over 700 phænogams and vascular cryptogams were recorded, and specimens of most of them preserved. Of these, over 200 had not, so far as I am aware, been given in any published list of the Nova Scotia flora. Of the flowering plants, the orders to which, as mentioned by Dr. Sommers, an able Halifax botanist, in his "Introduction to a Synopsis of the Flora of Nova Scotia," least attention had been paid by local workers, the *Cyperaceæ* and *Gramineæ*, furnished, in proportion, by far the greater part of the additions, the number being 66 of the former and 34 of the latter. *Compositæ* came next, claiming 15, while *Cruciferæ* and *Juncaceæ* each had 8, and the remainder were scattered amongst the other orders. In vascular Cryptogams, the *Filices* having been very exhaustively studied by the Rev. E. Ball, our new finds were limited to *Botrychium matricariæ folium*, *Asplenium Felix-fœmina*, var. *angust-*

um, and *Isoetes Tuckermani.* Of the *Musci, Hepaticæ,* and *Lichenes* the bulk have still to be worked up, so that it is impossible as yet to give an anyway accurate report of the total number of species found or additions made.

Elihu Hall.

BY MRS. J. M. MILLIGAN.

For want of sufficient data the publication of this brief tribute has been delayed.

Mr. Hall was born June, 1822, in Patrick county, Virginia, and died September, 1882. As a young man Mr. Hall was strong, healthy and full of ambition. In the winter of 1846, by severe over-exertion, he brought on an almost fatal hemorrhage from the lungs, and during the following years of his life he was subject to hemorrhages whenever his physical strength was overtaxed. This weakened condition of his body induced him to seek out-door recreation, not only as a means of obtaining such moderate share of health as might be his, but to find occupation for his active mind. He knew nothing of text-books, had never attended school, or had any scholarly associates, but

"Nature, the old nurse, took
The child upon her knee,
Saying, 'Here is a story book
Thy Father has written for thee.'"

And the "child" turned the leaves with an industrious hand and read many things about the bird, insect and plant life around him. With enthusiasm he noted every plant within his reach, made himself familiar with the characteristics of each species, and soon learned to classify them according to their general resemblances. He had never heard of drying plants to preserve them for specimens. In order that others might see what he had seen, he set to work with patient diligence to learn to draw and color each species as he gathered it fresh from the fields. Naturally his first attempts were crude and stiff, but his progress was rapid, for he copied only from the works of the Great Master, and he was armed with a sturdy determination to succeed. Colored drawings of three hundred and fifty species of plants were the result of his first summer's work, besides a number of well-executed drawings of birds, also colored. Mr. Hall was not long in discovering that others must have gone over at least some of the same ground. He began to correspond with scientific men, sent for books, and a new world was opened to him. Botany, his favorite study, became more than ever a joy to him. He did not follow it for money or fame, never seeking to impress himself or his work upon others. He was one of Carlyle's pattern silent men, too occupied by his work to be drawn aside from it by the trivialities of social life. He became famous with scientific men at home and abroad, while his neighbors only knew him as the plain, honest "Eli" and a most trusty citizen. Mr. Hall had good mathematical abilities, and had made himself master of trigonometry and surveying. He was elected surveyor of Menard county, for which office he was fully competent. He ran his "lines" well, but on such tramps plants were his chief interest, and his field herbarium was more often consulted and added to than his "field notes." In his close observation of nature he resembled Thoreau, but his character in many things was rounded to a more agreeable perfection. His absorption in his loved science made no difference in the completeness with which he discharged all the duties of son, husband, father, neighbor and citizen. No labor that the comfort and welfare of others required was neglected in order that his favorite study might yield him its pleasures.

Although a member of no church organization, yet many instances are related of his Christian kindliness of character. It was said of him that there was no one whose friends would be more willing to send to heaven on his own merits than Mr. Hall, and no one who would be less willing to go on those grounds.

In the later years of Mr. Hall's life, when too feeble to go on collecting tours, he turned his attention to the study of shells. His collection of fresh water and land shells is probably the best in the State of Illinois. Some idea of the extent and value of his botanical collection may be gained from a mention of the sections of the United States that he had visited. He made extended trips into Colorado, Oregon, Texas, Arkansas and Michigan, and shorter trips into Missouri, Iowa, Kansas and Nebraska. He also made very complete collections of the plants of Central Illinois. His name is permanently associated with the plants of Oregon and Colorado. He discovered many new species, and the following list comprises a majority of the genera containing species named for him: Sticta, Rinodina, and Pilophorus, by Tuckerman; Bruchia, Campylopus, Conomitrium, Orthotrichum, and Archidium, by Austin; Juncus, by Englemann; Melica, by Vasey; Isopyrum, Viola, Aster, Aplopappus, Heuchera, Pentstemon, Dalea, Asclepias, Carum, Seseli, and Astragalus, by Gray.

Mr. Hall greatly enlarged his herbarium by extensive exchanges, both at home and abroad, and by additions from his botanic garden, in the cultivation of which he was wonderfully successful, making cuttings, seeds and roots grow that he collected on his various excursions and that were sent to him from all parts of the country. This garden was not only valuable scientifically, but was very lovely, even to those who had no botanical interest in it. On one side was a bank where those plants were placed that were sturdy enough to hold their own against native occupants, and these grew in the wildest luxuriance. For other plants, that could not unaided contend against the change of climate and soil, beds were carefully prepared and the foreigners alone were allowed to flourish in them. In other parts of the grounds curious and beautiful vines, shrubs and forest trees, in great variety, grew as if perfectly at home.

In a swampy hollow over fifty species of willow were planted. This garden afforded Mr. Hall much enjoyment. Many days of weakness and pain were made even beautiful to him while wandering among his plants with his wife and little ones, living over with them the delights of his pioneer collecting trips, when for the first time he saw this or that new species. Mr. Hall seemed indeed to be gifted with a more than usual share of that enthusiasm that envelops the possessor in an atmosphere of perpetual youth. It was said of him that be seemed two inches taller when he got into the woods, and his associates on his excursions used to declare that, although evidently far from strong, he tired them out, and it was difficult to keep up with him when on a botanical hunt.

There are some points in Mr. Hall's life which should not be passed over without special notice. One of these is the remarkable proficiency he attained through self-teaching; another, that he did not begin his education till after he had reached maturity; third, that he accomplished so much while contending against sickness. Curiously the love of nature slept within him unsuspected till the touch of suffering aroused his sleeping senses.

> " And he wandered away and away
> With Nature, the dear old nurse,
> Who sang to him night and day
> The rhymes of the universe.
>
> " And whenever the way seemed long,
> Or his heart began to fail,
> She would sing a more wonderful song,
> Or tell a more marvellous tale."

No doubt the sympathy and appreciation Mr. Hall met with in his home were potent aids to his success, but no one can see his herbarium and consider the labor, mental and physical, involved in amassing and classifying without being impressed with the great will power of this quaint, unconventional, manly character. "His work will not be forgotten or its effects lost."

NOTE.—Mr. Hall left his collections of plants, shells and insects in the care of Mrs. Hall, to be preserved by her till their youngest child is of age; then, if none of the children show a disposition to pursue these branches of study, all are to be disposed of.

GENERAL NOTES.

Bryanthus Gmelini, Don.—One of the most interesting re-discoveries of late is that of the above-named plant. Upon Behring Island, where it had long ago been found by Russian collectors, Dr. L. Steineger, U. S. N., last year collected a few specimens of this rare plant, which has afforded us an opportunity of examining the species. Three views have been held in respect to it. By Maximowicz it has been kept as the sole species of the genus; characterized by the 4-merous and octandrous flowers, with rotate and deeply 4-parted corolla. Bentham and Hooker keep up *Bryanthus*, adding to it the two American species of *Phyllodoce*, which have an open corolla, in one (*P. Breweri*) deeply 5-cleft, and stamens and style soon much exserted; in the other (*P. empetriformis*), merely 5-lobed, and stamens included. In the third place, I had brought the whole of *Phyllodoce* into the genus, making it a collective group of three sections. In this I was influenced by the analogy of *Cassiope*, in which the flowers are either 4-merous or 5-merous, and the corolla varies from 4 to 5-parted to 4 to 5-lobed. Now that I have seen the original *Bryanthus*, I should say that either the first or the third view may consistently be maintained. I should still prefer the latter. But the first has the advantage of giving us a genus which may be fairly distinguished from *Phyllodoce* on the one hand, while on the other it may be set against the nearly related *Loiseleuria*, distinguished by its 5-merous and 5-androus flowers, the corolla not so deeply parted, and the anther-cells dehiscent for their whole length.

Dr. Steineger's botanical collection from Behring Island and Copper Island (the Commander Islands, off the coast of Kamtschatka) contains many other plants of interest.—A. GRAY.

Cement for Mounting Plants.—Bisulphuret carbon, 4 ozs.; crude India rubber, sufficient quantity to make of the proper thickness. This is the best combination for the purpose of holding plants to mounting paper, as well as for other purposes, that can be made. It is always ready for use.—DR. J. H. OYSTER, *Paola, Kansas.*

Schweinitz and American Hepaticæ.—The paper on Schweinitz as a mycologist, in the February GAZETTE, suggests his relation to the study of American Hepaticæ. Michaux was the earliest writer on this group, describing 13 species, five of which were new (*Flora* II, 276–280), but Schweinitz published the first work devoted entirely to the hepatics. The work is now rarely seen, having been printed at Raleigh in 1821. Its full title is as follows: "*Specimen Floræ Americæ Septentrionalis Cryptogamicæ sistens Muscos Hepaticos huc usque in Am. Sept. observatos.*" As its title indicates, the work is entirely in Latin, and contains in its 27 pages descriptions of 77 species, of which 12 are regarded as new, if we include *Targionia orbicularis*,[1] which had been partially described by Michaux as *Jungermannia orbicularis*. Of these, 58 belonged to the single genus *Jungermannia*, not broken up then, as now, into so many genera. Of the eleven described as new, one, *Riccia lutescens*, has remained unchanged; one, *Jungermannia clypeata*, remains as *Phragmicoma clypeata*, Sulliv., while the remainder, viz., *Jungermannia ciliifera*, *J. distans*, *J. bipinnata*. *J. platyphylloidea*, *J. transversalis*, *J. oblonga*, *J. sinuata*, *Anthoceros laciniatus* and *A. jungermanioides* are consigned to the fellowship of other synonyms which so sadly mar(k) American botany, representing, as they do, an over ardent ambition unaccompanied by sufficient patient investigation.—LUCIEN M. UNDERWOOD, *Syracuse University*.

[NOTE.—In this connection it seems appropriate to say that Mr. Eugene Rau writes that Schweinitz was born in 1780, not 1794, as the February GAZETTE has it.—ED.]

"Four-leaved" Red Clover.—It may interest some of the readers of the BOTANICAL GAZETTE to hear of a plant of Red Clover which has come under my notice, which has borne a large number of leaves with four and five leaflets. It was taken up and potted in September, 1883, when it had some 15. It has now (January 28, 1884,) between 50 and 60, and fully 30 have been picked from it.—N. T. KIDDER, *Milton, Mass.*

Missouri Notes.—*Ammannia latifolia* has six and seven stamens in all the plants I have seen here.

Æsculus glabra almost always has seven leaflets in our plant.

Quercus Muhlenbergii is a large tree here, sometimes growing to the height of 60 or 70 feet, with a circumference of 10 feet at the foot.

Salix lucida grows very tall here, sometimes reaching the height of 60 feet, and is very abundant along the Missouri river; the flowers at the base of the ament have 6 to 9 stamens, while those of the apex have but five.

Verbena stricta with leaves whorled in threes, often in fives, with flowers white, blue, purple, or rose colored, are not uncommon.

Silphium integrifolium has the leaves often in threes.

Cnicus lanceolatus occurs with cream colored flowers.

Delphinium tricorne flowers abundantly here; on one specimen were counted 43 blossoms.

Dioscorea villosa has three cotyledons in our plants.

Vernonia Noveboracensis often has white flowers.—FRANK BUSH, *Independence, Missouri.*

---

[1] *Notothylas orbicularis*, Sulliv.

EDITORIAL NOTES.

PROF. L. F. WARD has completed the preparation of index slips for a catalogue of fossil plants.

PROF. JOHN H. BALFOUR, Professor of Botany in the University of Edinburg, died in February, aged 76.

MR. I. C. MARTINDALE has published an obituary notice of Chas. F. Parker, in the *Proc. Philad. Acad.* for 1883.

THERE WILL be printed in the next issue of the GAZETTE a complete list of Dr. Engelmann's contributions to botany.

PROF. J. MACOUN, botanist to the Geological Survey of Canada, is preparing a report on Canadian fungi, to be fully illustrated with plates.

DR. PARRY has gone to St. Louis to consult with Dr. Engelmann's son in regard to the disposal of his father's valuable collection and notes.

THE FOURTH VOLUME of Proceedings of the Davenport Academy of Sciences, now printing, will contain an unusual number of botanical papers.

ACCORDING TO RECENT studies of M. Cornu, the oospores of *Peronospora*, when buried at a considerable depth, may retain their vitality from two to five years.

PROF. J. C. ARTHUR has accepted the position of botanist to the New York Agricultural Experiment Station, and has already entered upon his duties at Geneva.

IN THE LAST REPORT of the Ottawa Field-Naturalists' Club, we note that the botanical branch report twenty-four additions to the *Flora Ottawaensis* during the last season.

S. E. CASSINO announces that he will soon issue a translation of Dr. Behren's book "On the use of the Microscope in Botany," translated by Rev. A. B. Hervey, and assisted by Prof. R. H. Ward.

"A BRIEFER COURSE IN BOTANY," by Professor C. E. Bessey, will soon be issued from the press of Henry Holt & Co. It is to be a concise introduction to the science, adapted to the use of common and high schools.

THERE IS A CURIOUS but rather appalling mistake in proof reading in the last GAZETTE. On page 44 it says that the French expended 30,000,000 "lives," when it should have said "livres," which makes some difference.

DR. A. S. BALDWIN FINDS that the number of growth rings in trees of Northern Florida can be explained by reference to the weather record, a ring being formed whenever the growth is checked, whether by cold or drought.

THE BILL BEFORE Congress for the establishment of "National Experiment Stations" ought to pass. The provisions of the bill are probably as good as could be expected, and if the work is in the hands of a competent director, the results can not fail to be very profitable to agriculture, and botanical science in general.

ACCORDING TO A recent note in *Science*, the Harvard College Herbarium has received during the past year 8,755 sheets of plants, over 5,000 of which came from the rich herbarium of the late George Curling Joad, of Wimbledon, near London.

SCIENCE OF FEBRUARY 15th says some earnest words regarding the value of the botanical researches which may be undertaken by agricultural experiment stations, and the high position which their great practical importance should secure.

DR. E. L. STURTEVANT has published for private distribution a pamphlet entitled, "Maize: an attempt at Classification." It is profusely illustrated with cross-sections of seeds, which show plainly the characters upon which the classification is based.

LIEUT. SCHWATKA collected some plants about the headquarters of the Yukon, which have been determined by Sereno Watson. *Erysimum parviflorum, Amelanchier alnifolia, Pentstemon confertus*, and *P. glaucus* (?) are mentioned as new to so northern a latitude.

PROF. BESSEY, in the March *Naturalist*, suggests a neat demonstration of the flow of sap. If a small branch is cut from a maple tree during a cold day, and warmed quickly, the water will flow freely. On cooling it the flow ceases, and warming again causes the flow to be resumed.

DR. J. B. DE LACERDA has been investigating the disease known in Brazil as "beriberi." The work has been done in the physiological laboratory of the National Museum of Rio de Janeiro, the method of Pasteur being employed. The conclusions are that it is a parasitic disease, and that it seems to be conveyed to its victims by rice, apparently the same microphyte being obtained in the blood culture from beriberi patients and the culture of contaminated rice grains.

AT A RECENT meeting of the Ottawa (Canada) Field Naturalists' Club, Prof. J. Macoun read a paper on "Edible and Poisonous Fungi," stating that owing to the difficulty of distinguishing between good and bad kinds at sight, it is always advisable to partake lightly at first of such as are not certainly known to be non-poisonous. Those with an agreeable taste and odor will usually prove, however, to be harmless. He advised the more extensive use of these plants, and described a number of the more abundant alimentary species, such as *Coprinus comatus, Morchella esculenta, Gyromitra esculenta*, and the Lycoperdons.

DR. C. C. PARRY has in press a revision of the genus *Chorizanthe*, of which we have been permitted to see some advanced sheets. With this revision Dr. Parry intends to send out specimens, as can be seen from his advertisement. All the species but one have been examined by him, and most of them seen growing. With such facilities for study it is surprising that no more changes have to be made. Three species are reduced, *C. diffusa, C. cuspidata, and C. Wheeleri*; the monotypic genus *Lastarriæa* becomes *C. Lastarriæa*; and one new species is described, *C. Clevelandi*. We shall defer a more extended notice until the publication of the revision.

IN SCIENCE of Feb. 29, Joseph F. James gives an interesting account of the expulsion of water from a Caladium leaf. A new leaf being ready to expand by the side of an old one, the latter was cut off. Afterwards, from the stump end, jets of water began to be thrown to a height of an inch, and with a regular pulsation of about 180 per minute. This was kept up for two or three days, the rate gradually diminishing. It seems that other members of the Aroid family have been caught in the same performance, and in 1672 an account was published describing water expelled from the leaves of some aroids, resembling a fountain. These large stories are always the oldest.

MR. FRANK M. DAY has published, in the proceedings of the Am. Phil. Soc., Philadelphia, a paper on "The Microscopic Examination of Timber with regard to its strength," accompanied by four plates. It is a subject opened up recently by Dr. J. T. Rothrock, and developed by Mr. Day under his advice and with his assistance. It is well done, and comes from the Eli K. Price Botanical Laboratory of the University of Pennsylvania. We should have more such laboratories, and existing ones should be better equipped for exact and profitable work. The trouble is that boards of managers generally belong to the last generation and seem to be unable to conceive of the importance of such work.

IN A PAPER PRESENTED to the Royal Society of London, Prof. Alexander Dickson called especial attention to a series of remarkable glands which occur in the corrugated annulus which forms the rim of the pitcher of *Cephalotus*. If the inflexed rim of the pitcher be examined a number of openings may be found, alternating with the corrugations of the annulus. Each orifice is continued inwards as a canal-like fossa, at the bottom of which projects a nipple-shaped body. This body is the free apex of a gigantic gland, the bulk of which is imbedded in the parenchyma of the annulus. These glands may be truly denominated gigantic, as they range from .68^{mm} to 2.11^{mm} in length, according to the species. The function of these glands is probably the secretion of honey as a lure to insects.

PROF. WILLIAM BUCKHOUT, of Agricultural College, Pa., has been cultivating some of Mr. Lemmon's Arizona potatoes, and gives the first results in the March *Gardener's Monthly*. His first crop he pronounces to be simply diminutives of the cultivated potatoes. They changed color and quality so quickly when exposed to light that no fair test of their edibility could be made. As Prof. Buckhout says, it is absurd to expect any immediate results from the cultivation of this potato. If anything is going to be made of it, it must be by a long-continued series of carefully selected cultures. The queer thing is, though, that in the very same number is a letter from Prof. Lemmon, in which he gives the experience of E. S. Mumford, of Portlandville, N. Y., and his experience is that the tubers do not change color soon upon exposure to light, and that they are double the size of the one planted. As between the Pennsylvania and New York crops, the latter is the one to be further cultivated.

THE TIME has now come when botanists should be arranging to visit Philadelphia next summer. The delightful personal intercourse enjoyed last summer at Minneapolis makes those who were there very desirous of its repetition in greater measure in Philadelphia. The Botanical Club that was organized with as little organization as possible will try to make it very profitable to botanists in the way of becoming acquainted with fellow-workers and examining under competent guidance the interesting plants of the vicinity. We venture to say that the ballast grounds will be well ransacked and many of its waifs added to our collections. Questions of postage are also to be discussed, and it is to be hoped that something definite can be arranged with the postal authorities. Many instances of mismanagement and injustice have already been reported to the committee, and we doubt not that some are yet to be heard from. With such definite complaints something can be accomplished.

PROF. T. CARUEL, of Florence, in 1881 presented to the Linnean Academy a treatise upon the classification of plants. It has now been re-edited by the author, in French, under the title, *Pensées sur la Taxonomie Botanique*, and published last year in Engler's Botanische Jahrbücher. So far as Phanerogams are concerned, Gymnosperms are given their proper position in relation to the higher Cryptogams, and Angiosperms begin with Monocotyledons. As every one now consents to this arrangement, the question naturally arises, When are we going to begin to use it? Prof. Caruel also discards our old divisions of *Polypetalæ*, *Gamopetalæ*, and *Apetalæ*, which every systematic botanist has long seen are too artificial to stand, and substitutes the cohorts *Dichlamydanthæ*, *Monochlamydanthæ*, and *Dimorphanthæ*. We would suggest that when the change has to come that shorter names be devised, for they must be used by many who could neither spell nor pronounce such names as the above. According to Dr. Gray, the first cohort includes Gamopetalous and Polypetalous orders generally; the second all the Candollean orders from Ranunculaceæ to Fumariaceæ, the Cactaceæ, Portulacaceæ, etc.; the third has Begoniaceæ, Euphorbiaceæ, Urticaceæ, etc., and the Amentaceous orders. Some Jussieu or DeCandolle must arise and give us a new arrangement.

CURRENT LITERATURE.

Elementary Botany, with student's guide to the examination and description of plants. By George Macloskie, D.Sc., LL.D., Professor of Natural History in the J. C. Green School of Science, Princeton, N. J., etc. New York: Henry Holt & Co., 1883. pp. VIII, 373.

One who receives a new elementary botany now-a-days, turns to its examination in a somewhat skeptical frame of mind, hardly daring to hope that he will find in it any thing fresh or new, so often have former hopes been disappointed. But any one who begins to peruse this book will speedily become roused to the consciousness that here is really something far above the average run of text-books. It is doubtful, indeed, whether this one should be called a text-book, because the author tells us that he has aimed "to supply a readable sketch of botany, followed by a guide to work in the field and in the laboratory." It is not always that a book corresponds to the aim of an author, as stated in his preface. This, however, surely does, for it is one of the *most readable* books yet come into our hands. The style is admirably clear and vigorous, the pages unencumbered with technicalities (though technical terms are never dodged when needed), and the subject matter permeated with a subdued ætiological philosophy, which adds vivacity to the whole. Moreover, the book embodies the latest views of botanists in all departments of the science. Best of all, it is made evident to every reader or student at the very outset, that he is not expected to get his knowledge of botany from the pages which follow, but by personal investigation. Part I, treating of the parts of plants, is wholly occupied with the thorough examination of the "morning-glory" as preliminary to Part II, the structure of flowering plants. Part III discusses the flowerless plants; IV, herborizing and manipulation; V, the vegetable kingdom, including chapters on the external relations of plants, classification and a synopsis of classes and orders; VI, is a general guide for examining and describing plants; VII, special schedules for Cruciferæ, Umbelliferæ, Compositæ, Gramineæ and Ferns; VIII, contains alphabetical lists of Latin and Greek root words, numerals and prefixes. The last part is an admirable thought, helpful alike to teacher and pupil. In connection with parts six and seven, we wish heartily to indorse this remark in the preface, that "it is better and more interesting to spend the leisure of a whole season on a single species than to hurry over a great number merely for the sake of discovering their names." Would that every student could be impressed with that idea.

Possessing these many good qualities, there are unavoidably some defects, but these are so comparatively unimportant that they do not need special mention. Dr. Macloskie is to be congratulated that he has produced a book which is sufficiently complete, reliable and interesting to be placed in the hands of students; one which directs them to observe for themselves and not to memorize; and one, withal, quite original in manner and arrangement.

Characeæ Americanæ Exsiccatæ, distributæ a T. F. Allen, M. D. Fasciculus IV., No. 31–40[a].

The work of Dr. Allen in investigating and making known our Characean flora is worthy of high commendation. His well illustrated papers in the *Bulletin of the Torrey Club*, supplemented by the present series of exsiccatæ, which are distributed with much liberality, make it possible to collect and study the American species in quite an intelligent and satisfactory manner; and none of the lower plants commend themselves more favorably to the attention of collectors. The present fasciculus contains four species of *Nitella*, three of *Tolypella*, three of *Chara*, and an additional extra-American species of *Nitella* from New Zealand. *Nitella minuta*, a new species, is accompanied by a description.

A Catalogue of the Native and Naturalized Plants of the City of Buffalo and its Vicinity. By David F. Day. 8vo., 215 pp. Buffalo.

This is surely the most complete local American catalogue we have yet seen, for it includes both Phænogams and Cryptogams. It is prefaced by a dozen pages defining the region covered and describing all the necessary surface features, and closes with a tabular view of the orders, an important supplement, and an index of genera. Considering that the list embraces only those plants which have been satisfactorily identified, growing within a radius of 50 miles around Buffalo, 2739 species show a most commendable amount of exploration. The fungi are from the hands of Mr. Chas. Peck, a fact which gives this unusual portion of the catalogue an authentic character. Mr. Day is certainly to be congratulated upon such a successful completion of a work which must have taken a great amount of time and labor. Among Phænogams, the Compositæ number 143 species, Cyperaceæ 105, Gramineæ 88, Rosaceæ 52, Leguminosæ 45, Labiatæ 39, Ranunculaceæ and Cruciferæ 36 each, Orchidaceæ 34, Liliaceæ 31, Scrophulariaceæ 30, etc., an order of abundance decidedly different from that found in the flora of Indiana.

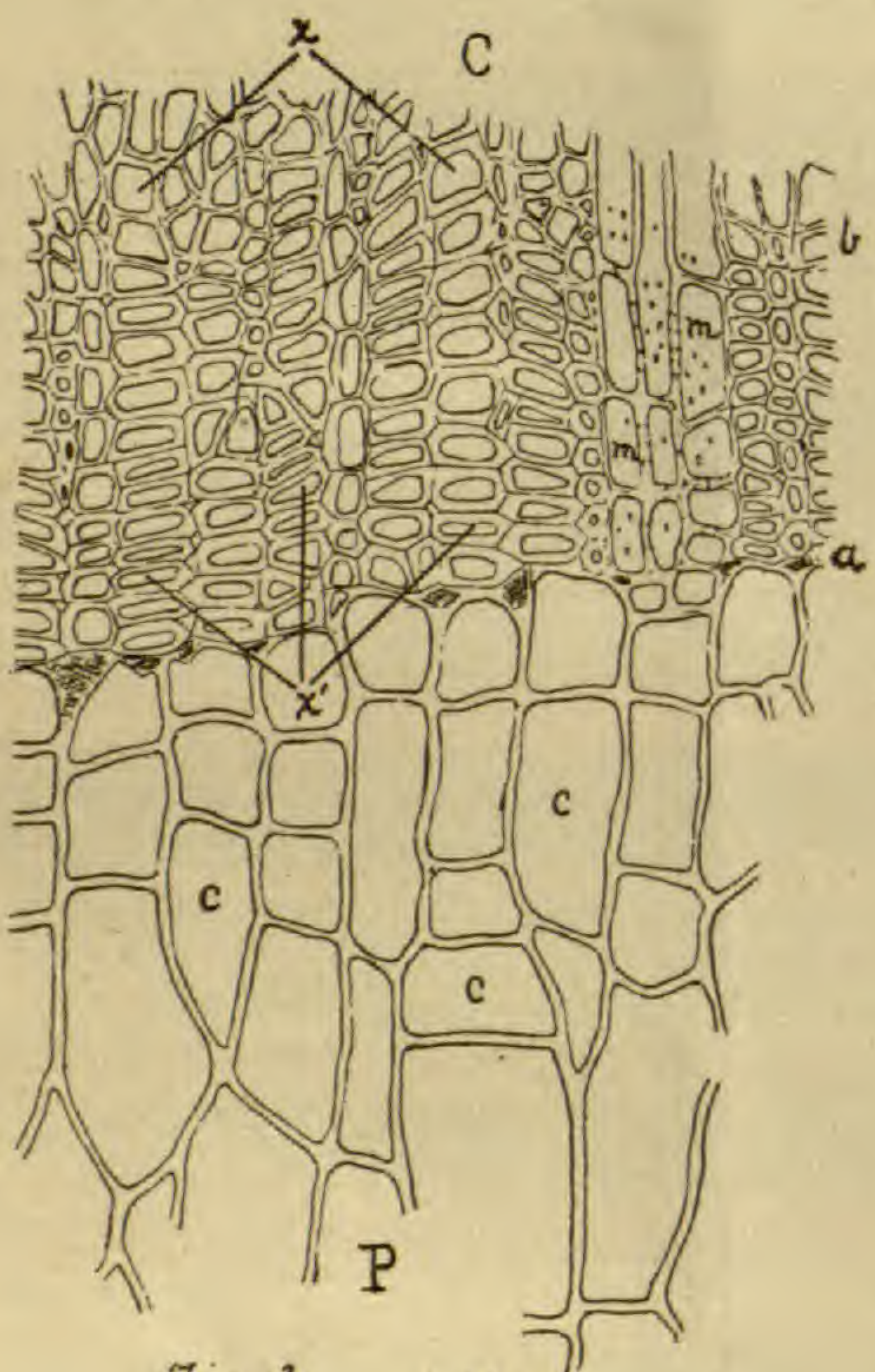


Fig. 1. x 230.

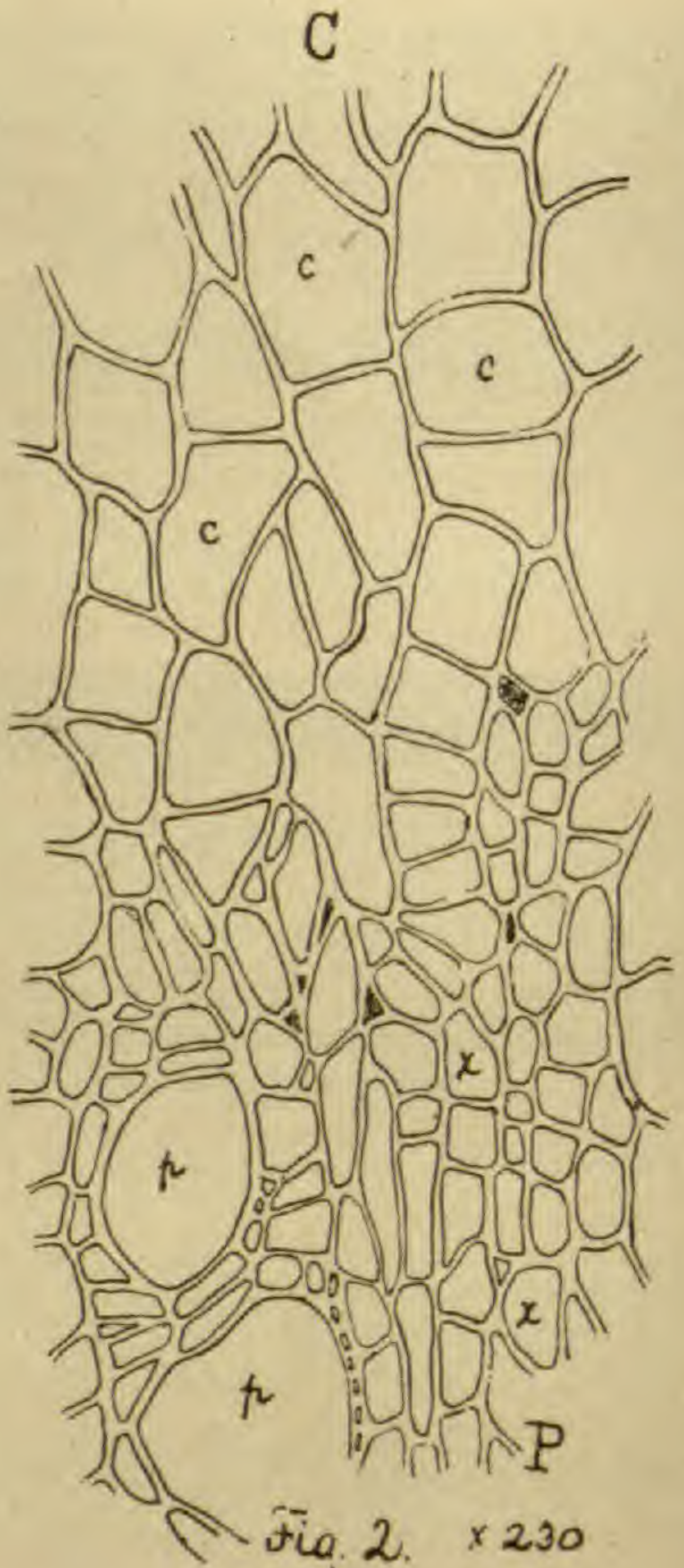


Fig. 2. x 230

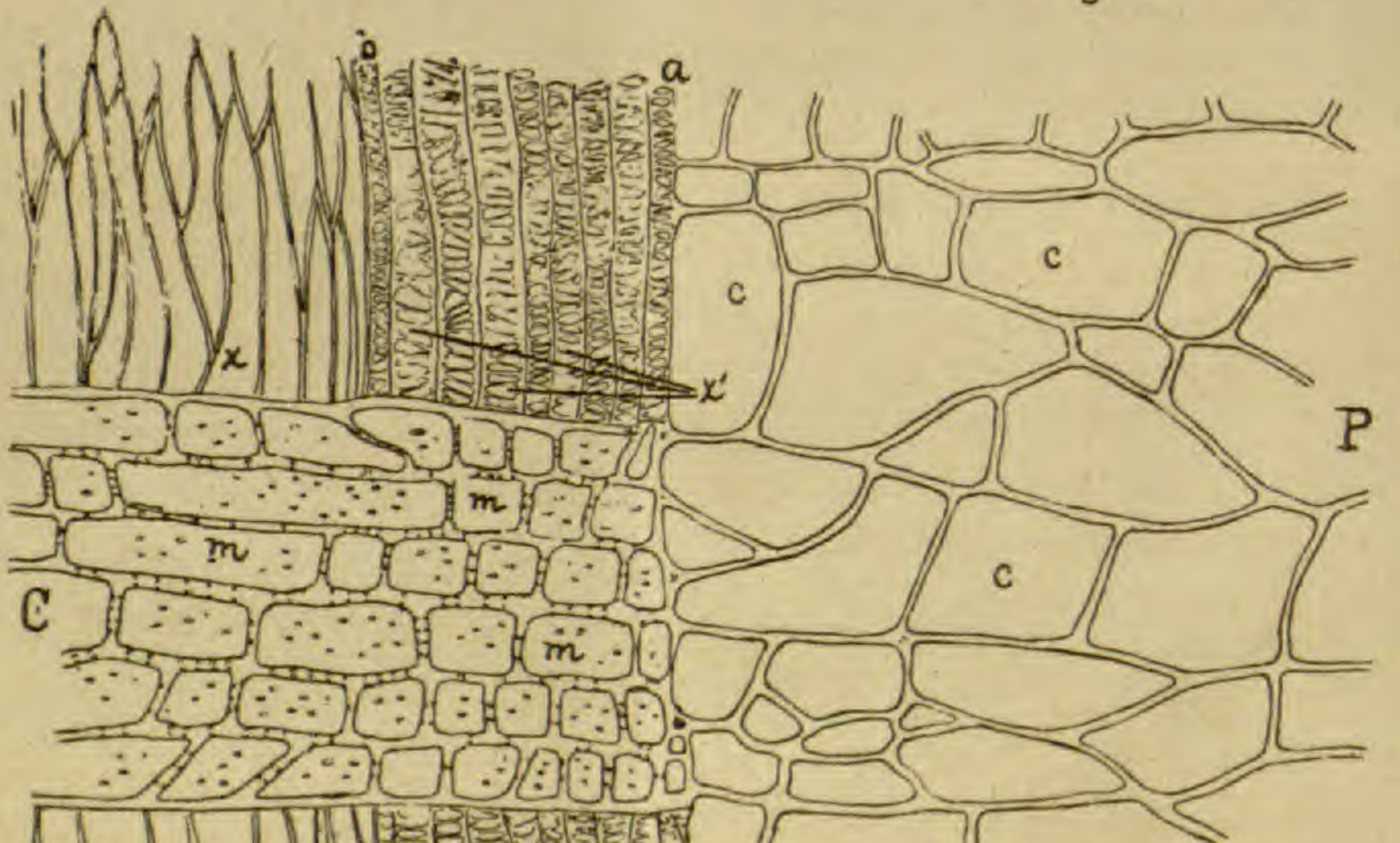


Fig. 3. x 230.

BARNES ON CORK IN CATALPA.

BOTANICAL GAZETTE.

VOL. IX. MAY, 1884. No. 5.

Botanical Papers of George Engelmann.

PREPARED BY C. S. SARGENT.

The following list contains, so far as I know, all the botanical papers published by Dr. Engelmann. A few short notes in the *Gardener's Chronicle*, of London, to which Dr. Engelmann was an occasional contributor, may have escaped notice. If this is the case, the editor of that journal will, no doubt, supply the omissions. It will be seen that the publication of these papers extended over a period of fifty-one years, the last having appeared only a few weeks before the death of the author.

De Antholysi Prodromus. Dissertatio inauguralis phytomorphologica.
    Frankfort. 5 tab. 1832.

A monography of North American Cuscutineæ.
    Am. Jour. Sci. 1. 43. 333–345, 1 tab. 1842.

Corrections and additions to the same.
    Am. Jour. Sci. 1. 45. 73–77. 1843. (Bot. Zeit. 2. 553–555, 1844; 4. 273–281, 1846; London Jour. Bot. 2. 189–199, with original additions and corrections, 1843.)

Notes and additions to a monography of the North American species of the genus Equisetum by Alexander Braun.
    Am. Jour. Sci. 1. 46. 81–91. 1844.

Introductory note to a brief notice of the Charæ of North America by Alexander Braun.
    Am. Jour. Sci. 1. 46. 92–93. 1844.

Catalogue of a collection of plants made in Illinois and Missouri by Charles A. Geyer, with critical remarks, etc.
    Am. Jour. Sci. 1. 46. 94–104. 1844.

Plantæ Lindheimerianæ; an enumeration of the plants collected in Texas, etc., by F. Lindheimer, with remarks and descriptions of new species (with A. Gray).
    Boston Journ. Nat. Hist. 5. 210–264. 1845.

*See list, with some additions, in Der Deutsche Pionier (Cincinnati), XVI. 366–370.

Notes on the North American species of Isoëtes and Marsilea by Alexander Braun.
Am. Jour. Sci. 2. 3. 52–56. 1847.

Notes on some Ferns of the U. S. by Professor Kunze of Leipsic; with notes by A. Braun and G. Engelmann.
Am. Jour. Sci. 2. 6. 80–89. 1848. Y. B. Z. 1847, 621–630.

Sketch of the Botany of Dr. A. Wislizenus' Expedition.
An appendix to the Memoir of a Tour to Northern Mexico connected with Col. Doniphan's Expedition in 1846–1847, 87–115. Senate Publication. 1848. Germ. Journal, by von Roes, Braunschweig, 1850, p. 40–117.

Plantæ Fendlerianæ, Drymaria nodosa, n. sp. 12; Talinum calycinum, n. sp. 14; N. Am. Gerania, 26; Calliandra Chamædrys, n. sp. 39; Cactaceæ, p. 49; Loranthaceæ, 58.
Mem. Am. Acad. Arts and Sci. 4. 1849.

Plantæ Lindheimerianæ, Part 2, Vesicaria recurvata, n. sp. 147; Paronychia Lindheimeri, n. sp. 152; Eysenhardtia spinosa, n. sp. 174; Prunus minutiflora, n. sp. 185; Passiflora tenuiloba, n. sp. 192; Cactaceæ, 195; characters of Daucosma (with A. Gray), 210; Loranthaceæ, 212.
Boston Jour. Nat. Hist. 6. No. 11. 1850.

On the character of the vegetation of S. W. Texas.
Proc. Am. Ass. Sci. 5. 223–229. 1851.

Notes on Cereus giganteus of S. E. California and some other Californian Cactaceæ.
Am. Jour. Sci. 2. 14. 335–339, 446. 1852.

Plantæ Wrightianæ, Part 1, Notes upon Linum, 25; Rhus microphylla, 31; Desmodium Wislizeni, 53; Characters of Fendlera (with A. Gray).
Smithsonian Contrib. to Knowledge. 3. Art. 5. 1852.

Further notes on Cereus giganteus of S. E. California, with a short account of another allied species of Sonora.
Am. Jour. Sci. 2. 17. 231–235. 1854.

Cactaceæ of Pacif. R. R. Expedition.
Pacif. R. R. Rep. 4. Pt. 5. No. 3, 27–58, 24 tab. 1856.

Elaboration of Cuscuta, Euphorbia, Alisma, Sagittaria, Echinodorus.
Gray's Manual Northern United States, 2d ed. 1856.

Synopsis of the Cactaceæ of the U. S. and adjacent regions.
Proc. Am. Acad. 3. 259–314, 345–346. 1856.

Account of the western part of Texas.
Boston Jour. Nat. Hist. 6. 34–40. 1857.

Two new diœcious grasses of the United States.
Trans. St. Louis Acad. Sci. 1. 431–442, 3 tab. 1859.

Systematic arrangement of the species of the genus Cuscuta, with critical remarks on old species and descriptions of new ones.
Trans. St. Louis Acad. Sci. 1. 453–523. 1859.

Cactaceæ of the Mexican Boundary.
U. S. and Mexican Bound. Surv. 2. Pt. 1. 1–78, 76 tab. 1859.

The Grape Vines of Missouri.
Trans. St. Louis Acad. Sci. 1. 660–662. 1860.

Remarks on the hybrids of Verbena.
Trans. St. Louis Acad. Sci. 1. 675–676. 1860.

Botany in Rep. Geol. and Nat. Hist. of the Upper Missouri, by F. V. Hayden.
Trans. Am. Phil. Soc. n. ser. 12. 182–212. 1861.

Cactaceæ and Euphorbiaceæ of Ives Report.
Colorado of the West, Part 4, 12–14, 26–27. 1861.

Notes in the Enumeration of the Plants of the Rocky Mts., by Asa Gray.
Am. Jour. Sci. 2. 34. 256–257; Supplements, 1 and 2, 330–335. 1862.

Remarks on Nelumbium luteum, 136; on the dimorphism of Draba brachycarpa, 154; on 2 species of fungi destructive to vineyards, 165; on the nature of the pulp of Cactus fruit, 166; on the structure and fruit of the genus Ribes, 180.
Trans. St. Louis Acad. Sci. 2. 1862.

Additions to the Cactus Flora of the United States.
Trans. St. Louis Acad. Sci. 2. 197–204. 1862.

On Pinus aristata, a new species of Pine discovered by Dr. C. C. Parry in the alpine regions of Colorado Territory; and on some other Pines of the Rocky Mts.
Trans. St. Louis Acad. Sci. 2. 205–214, 2 tab. 1862. (Linnæa, 33, 383–394.)

Note on Polygonum tenue.
Proc. Philad. Acad., March, 1863, 75.

New species of Gentiana from the alpine regions of the Rocky Mts.
Trans. St. Louis Acad. Sci. 2. 214–218, 5 tab. 1863.

Remarks on the fruit and seed of different species of Viburnum and Cornus.
Trans. St. Louis Acad. Sci. 2. 269–271. 1865.

New plants from the Rocky Mts.; Nuphar polysepalum, etc.
Trans. St. Louis Acad. Sci. 2. 282–285. 1865.

Elaboration of Cillitriche, Pinus, Juncus, Sparganium, Isoëtes. Wolffi
Gray's Manual Northern U. S., 5th ed. 1867. In addition to genera in 2d ed.

A Revision of the North American species of the genus Juncus, with a description of new or imperfectly known species.
Trans. St. Louis Acad. Sci. 2. 424–498, 590. 1868.

u Ueber der Charactere der Abietinen genera. ie, een
Bot. Zeit. 26. 484–487. 1868.

Speirodela.
Bull. Torr. Bot. Club. 1. 42–43; 2. 10–11, 46–47. 1870, 1871.

Notes on Opuntia and Speirodela.
Bull. Torr. Bot. Club. 2. 34–35. 1871.

Cactaceæ, Yucca, Agave, Hesperaloe.
King's Rep. Geol. Surv. 40th Par. 5. 115–120, 496–497. 1871.

The flower of Yucca and its fertilization.
Bull. Torr. Bot. Club. 3. 33. 1872.

Agave.
Bull. Torr. Bot. Club. 3. 37. 1872.

Arceuthobium minutum.
Trans. St. Louis Acad. Sci. 3. 83. 1872.

The true Grape Vines of the old United States.
Am. Naturalist, 6. 539–542. 1872.

Notes on the genus Yucca.
Trans. St. Louis Acad. 3. 17–64, 210–214, 371–372. 1873.

Juncus maritimus.
Bull. Torr. Bot. Club. 4. 40. 1873.

Vitis.
Bull. Torr. Bot. Club. 5. 233–234, 310–311. 1874.

The true Grape Vines of the United States.
Sixth Ann. Rep. State Entomologist of Mo., 70–76. 1874.

Lecture on the Forests of the Rocky Mountains.
Reported in St. Louis Democrat, March 6, 1875. (Meehan's Gardener's Monthly, 17. 151–153, 181–184, 214–217.)

The true Grape Vines of the United States.
Bushberg Cat. 2d ed. 4–11, 1 tab. 1875.

About the Oaks of the United States.
Trans. St. Louis Acad. Sci. 3. 372–400, 539–543. 1876, 1877.

Characters of Abies subalpina.
Am. Naturalist, 10, 553–555. 1876.

Notes on Coniferæ.
Proc. Philad. Acad., 1876, 173–175. (Meehan's Gardener's Monthly, 19, 308.)

Report of an Expedition across the Great Basin of Utah Terr. in 1859, by Capt. J. H. Simpson (Engineer Dept. U. S. Army).
Appendix M. Botany, 435–447, 3 tab. 1876.

Oak and Grape Fungi.
Trans. St. Louis Acad. Sci. 3. 215–216. 1876.

Morphology of the carpellary scale of Coniferæ.
Am. Jour. Sci. 3. 12. 469. 1876.

Geographical range and migration of plants and animals.
Trans. St. Louis Acad. Sci. 3. 219–232. 1876.

A new Cuscuta, 69; Cuscuta racemosa, 80; Pinus serotinæ, 125.
Botanical Gazette, 2. 1877.

On Abies Menziesii and A. Engelmanni.
Gardener's Chronicle, London, n. ser. 7. 790. 1877.

Geographical Distribution of North American Flora.
Trans. St. Louis Acad. Sci. 3. 270–271. 1877.

The American Junipers of the section Sabina.
Trans. St. Louis Acad. Sci. 3. 583–592. 1877.

Ag ve, with 2 photographs, 291–322, 370–371; Flowers of Agave Shawii, 579–582, 1 tab.
Trans. St. Louis Acad. Sci. 3. 1878.

The species of Isoëtes of the Indian Territory.
Bot. Gazette, 3. 1. 1878.
Baptisia sulphurea.
Bot. Gazette, 3. 65. 1878.
A Synopsis of the American Firs (Abies of Link).
Trans. St. Louis Acad. Sci. 3. 593–602. 1878.
Cactaceæ, Asclepiadeæ, Gentianeæ, Cuscuteæ, Euphorbiaceæ, Cupuliferæ, Loranthaceæ, Coniferæ, Amaryllideæ, Junceæ.
Wheeler's Rep. U. S. Geog. Surv., 6. 1878.
Pine.
Johnson's Univ. Cyclopædia, 3. 1256–1275. 1878.
Cuscuta.
Gray's Syn. Fl. N.A. 1. 219–224. 1878.
The Gymnospermy of Coniferæ. (Review of a paper by Dr. L. Celakovsky in Flora for June, 1879.)
Am. Jour. Sci. 3. 18. 311–313. 1879.
Wild Grapes.
Trans. St. Louis Acad. Sci. 4. 44. 1880.
Revision of the genus Pinus, and description of P. Elliottii.
Trans. St. Louis Acad. Sci. 4. 161–193, 3 tab. 1880.
The Acorns and their germination.
Trans. St. Louis Acad. Sci. 4. 190–192. 1880.
Catalpa speciosa, Warder.
Bot. Gazette, 5. 1. 1880.
Vitality of the seeds of serotinous cones.
Bot. Gazette, 5. 62. 1880.
Fraxinus quadrangulata.
Bot. Gazette, 5. 63. 1880.
Cupuliferæ, Loranthaceæ, Abietineæ.
Rep. Geol. Surv. California. 2. 1880.
Notes on Abies amabilis and A. grandis.
Gardener's Chronicle, London, n. ser. 14. 720. 1880.
Some account of the vegetation along the Great Lakes.
Trans. St. Louis Acad. Sci. 4. 20. 1880.
Some additions to the North American Flora.
Bot. Gazette, 6. 223–225, 238. 1881.
Western Conifers.
Bot. Gazette, 7. 4–5. 1882.
Some additions to the North American Flora.
Bot. Gazette, 7. 5–6. 1882.
Texas Oaks.
Bot. Gazette, 7. 14. 1882.
Yucca elata, n. sp., Y. macrocarpa, n. sp.
Bot. Gazette, 7. 17. 1882.
Female flowers of Coniferæ.
Bot. Gazette, 7. 101–105. 1882.
The Black-fruited Cratægi, and a new species.
Bot. Gazette, 7. 127–129. 1882.

Additions to the Flora of the United States (Cratægus arborescens, Sagittaria natans).
Bull. Torr. Bot. Club, 9. 4–5. 1882.
Rosa minutifolia, n. sp.
Bull. Torr. Bot. Club, 9. 97–98, 127. 1882.
Note on Picea Engelmanni and P. pungens.
Gardener's Chronicle, London, n. ser. 17. 145. 1882.
Pinus latisquama, n. sp.
Gardener's Chronicle, London, n. ser. 18. 712. f. 125. 1882.
The Female flowers of Coniferæ.
Am. Jour. Sci. 3. 23. 418–422; 24. 233–235. 1882.
The genus Isoëtes in North America.
Trans. St. Louis Acad. Sci. 4. 358–390. 1882.
Note on Catalpa speciosa.
Trans. St. Louis Acad. Sci. 4. 50. 1882.
Euphorbia deltoidea.
Chapman's Fl. S. States. Suppl. 647. 1883.
Plantago pusilla.
Bot. Gazette, 8. 175. 1883.
Vitis palmata.
Bot. Gazette, 8. 254. 1883.
Brooks' Wood Specimens.
Bot. Gazette, 8. 337, 338. 1883.
Morphology of Spines.
Bot. Gazette, 8. 338. 1883.
The true Grape Vines of the United States, and the Diseases of Grape Vines.
The Bushberg Cat. 3d ed. 9–20, 47–48. 1883.
A new Aristida, p. 76 of this number.
[Collecting] Cactuses (Cactaceae), B. Gaz. XI. 1886. 135–6.

The Occurrence of Cork between the Annual Layers in the Stem of Catalpa speciosa, Warder.

BY C. R. BARNES.

Mr. W. H. Ragan, Secretary of the Mississippi Valley Horticultural Society, handed to me recently a small section of *Catalpa speciosa* (fig. 4), grown from the seed by A. H. Gaston, at Lacon, Ill. The specimen was cut from the lower end of a tree three years old, and was intended to show the great rapidity of growth of this species. Truly the growth had been rapid, as the following measurements show:

First year's growth,	average radius,	7.5^{mm}		
Second "	"	"	thickness,	12.5^{mm}
Third "	"	"	"	11.5^{mm}
Bark		"	"	3^{mm}

Average diameter of stem, 67.5^{mm}

But the rapidity of growth is by no means the most remarkable feature of this specimen. The yearly rings are separated by zones, more or less complete, of cork tissue. Around the first year's growth the cork zone (*a*, fig. 4) is narrow but continuous, and is traversed by numerous medullary plates. Around the second year's growth the cork zone (*b*, *c*, *d*, *e*, fig. 4) is of greater width, in places, but is not continuous. By the aid of a lens, the more prominent medullary plates may be seen to traverse this outer cork zone. The second year's growth shows (more distinctly since oiling the section with linseed oil) three truncated wedges (*f*, *g*, *h*, fig. 4) appearing darker than the rest of the wood, and occupying about 30° of the circles which form their central and peripheral ends.* The portions of the cork zone opposite these areas are considerably wider than elsewhere, as shown at *c*, *d* and *e*, fig. 4. At *e* the thickness amounts to 2.8^{mm}. Just beyond *e* the cork zone tapers out quite abruptly, and from this point to the edge of the removed sector is entirely absent, the difference between the annual layers being here marked only by the difference in the texture of the spring and autumn wood. This gap in the zone (at *i*, fig. 4) occurs opposite to the area which should be occupied by a fourth wedge (corresponding to *g*, fig. 4), were it present.

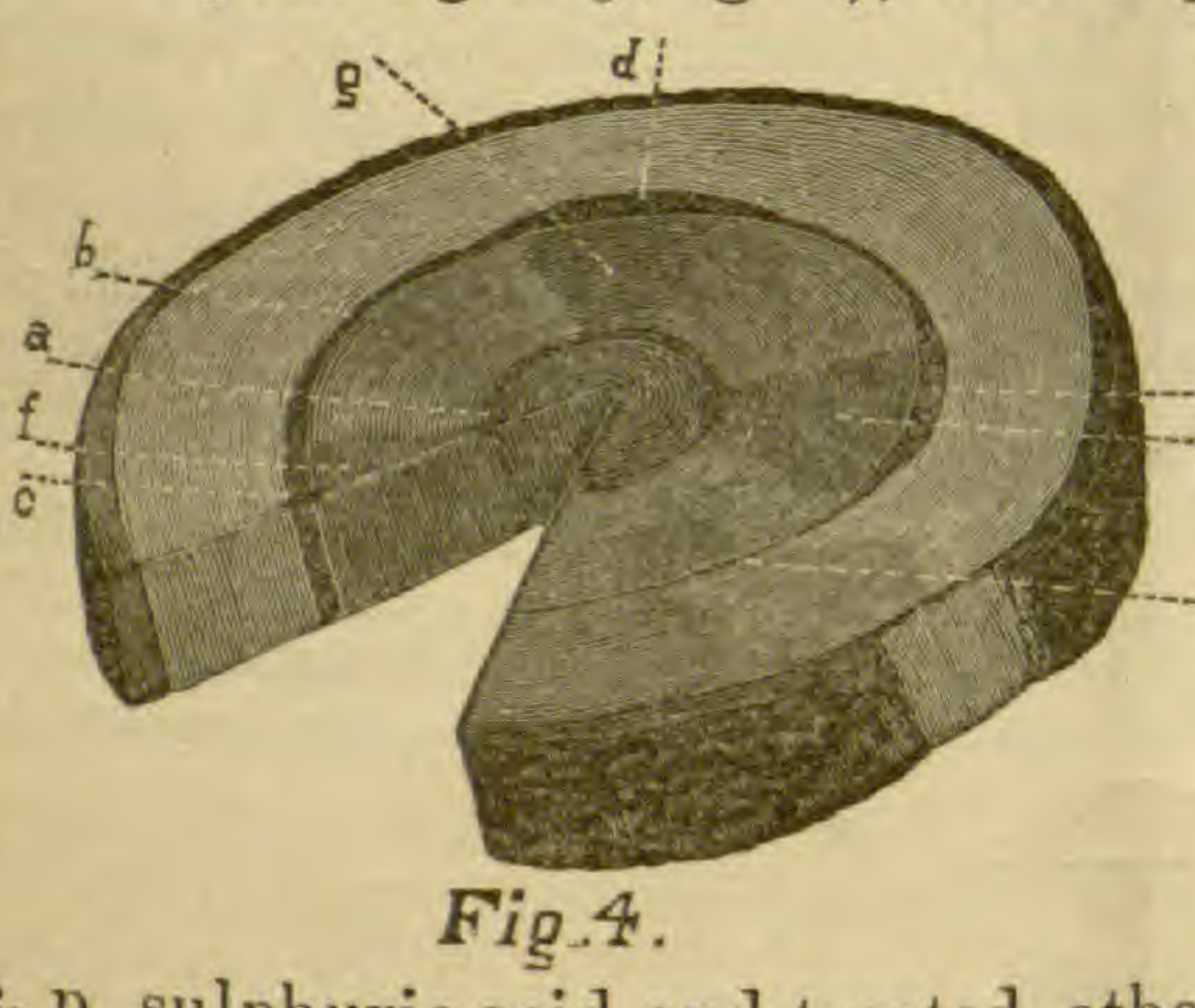


Fig. 4.

Although these zones which have been described had every appearance of cork, I could hardly believe that cork could occur in such an anomalous place. Having cut transverse sections of the tissue in question (near *c*, fig. 4) and part of the adjacent wood on each side, I submitted some to the prolonged action of c. p. sulphuric acid and treated others with an ammoniacal solution of copper oxide.† In both cases the tissue remained unchanged. In the first case the wood cells (excepting the middle lamella) were dissolved. In the second case the whole section

[*I have not been able to discover any difference in structure between these wedges and the intervening wood, and am unable to account for their presence, unless they be three of four normal (?) groups of fibro-vascular bundles, indicating kinship with *Bignonia capreolata*.]

†Poulsen's Bot. Mikrochemie, Germ. tr. by Müller, pp. 14, 16 and 61.

was unchanged. Both reagents when applied to cotton fibers quickly destroyed them.

Figs. 1 and 2, Plate I, represent transverse sections, and fig. 3 a longitudinal radial section of this tissue, taken near *c*, fig. 4. The transition between the wood cells centrad of the cork and the cork cells is remarkably abrupt (fig 1). On the peripheral side of the cork there is no such abruptness, the cork cells, *c*, *c*, *c*, fig. 2, shading imperceptibly into the wood cells, *x*, *x*.

In all the sections the cork cells are seen to be quite irregular, much more than this tissue normally is. Some sections from other parts of the stem showed a more regular tissue; in several instances radial series of rectangular cells were observed, though fig. 1 is about the average as to regularity.

The wood cells last formed in autumn are quite different from the earlier ones. In fig. 1 the last .12^{mm} of wood cells (from *a* to *b*) are thicker walled and have less angular cavities than the older portion. In fig. 3 the difference is still more marked, the wood from *a* to *b* consisting of greatly elongated fibers with irregularly thickened walls; whereas the majority of the wood consists of shorter, smooth-walled fibers with oblique ends (*x*, fig. 3).

I am unable to present any satisfactory explanation of the formation of cork in the positions described. Numerous theories have suggested themselves, but all are open to too grave objections to be worth presenting.

EXPLANATION OF PLATE.—Figs. 1 and 2. Transverse sections of a portion of the stem of *Catalpa speciosa*, Warder.
Fig. 3. Longitudinal radial section of the same.
The reference letters are the same in all the figures.
c, cork cells; *C*, central side of the section; *m*, cell of medullary ray, with pitted walls; *p*, large pitted vessel; *P*, peripheral side of the section; *x*, smooth walled wood fibers; x^1, younger wood fibers with irregularly thickened walls.
All the figures were drawn with a camera, under Beck's ¼ objective and A eyepiece.

GENERAL NOTES.

A New Aristida.—ARISTIDA BASIRAMEA, Engelmann in a letter to W. Upham.—Annual: culms erect, 6 to 15 inches high, slender, much branched at the base (some of the branches very short but floriferous), and with short floriferous branches enclosed in the upper leaf sheaths: leaves comparatively long (3 to 6 inches), narrowly linear, flat, becoming involute toward the apex, sparsely hairy on the margins below, the upper ones nearly equaling the panicle; sheaths striate, loose; ligule very short, truncate: panicle 1½ to 3 inches long erect, rather lax, its base sheathed by the upper leaf; branches of the panicle short, mostly single, the lower in twos or threes: glumes linear, unequal, 1-nerved, lower one 4 lines, upper one 6 lines long including the short bristle-like point; flowering glume nearly terete, spotted with black, about ·5 lines long including the short, acute and hairy callus; middle awn about 6 lines long, the lateral ones about 4 lines long, spirally twisted below (when mature). The sheathed flowers are somewhat smaller.

This species was discovered last season by Mr. Warren Upham, at Minneapolis, Minn. The late Dr. Engelmann suggested the name, in a letter, as indicative of its habit, and would have published it if he had lived. It is closely related to *A. dichotoma*, from which it differs in its shorter, erect (not dichotomous) culms, and in its much larger flowers, and especially in the much longer, spreading, lateral awns. From *A. gracilis* it differs in the shorter panicle, the longer upper leaves with sheathed flowers, and in the flowers being twice as large. From *A. ramosissima* it differs in wanting the larger size, the diffusely branched habit, the much larger flowers with 3 to 5-nerved glumes, and the strong recurved middle awn of that species. It is probably widely diffused in the prairie region of the Northwest, Mr. Upham having received it from St. Cloud and other places in Minnesota, with reports of it from Iowa and Manitoba. It appears also to be the same as specimens collected in Kansas by Mr. E. Hall and distributed as *A. gracilis*.—GEO. VASEY.

Fungi Hungarici.—The third Century of this exsiccata has recently been issued by the publisher, Prof. George Linhart, Altenburg, Austro-Hungary The specimens are neatly mounted on heavy papers of the size of eight by ten inches; each Century being enclosed in a light box with an alphabetical index of the specimens on the cover. The habitats and notes on the labels are given, both in Hungarian and German, and to each is added the name of the collector and author by whom the specimen was determined. Several new specimens have appeared in each Century, accompanied by descriptions in Latin. Each Century is furnished with from 15 to 20 illustrations of the microscopic characters of specimens therein contained. Two Centuries are to be issued annually, and at the close of each five Centuries the author intends furnishing descriptions of the species, both in Hungarian and German. Among foreign exsiccata this work appears to merit the favorable recognition and encouragement of Mycologists. The original cost of 11 marks per Century is increased to American subscribers by expenses of transportation, etc., to nearly five dollars. Subscriptions may be addressed direct to the publisher. —EUGENE A. RAU, *Bethlehem, Pa.*

The pasque flower.—This plant (*Anemone patens*, var. *Nuttalliana*) is stated in *Drugs and Medicines of N. America* to have so acrid a juice that the hands have been blistered in handling it, and the eyes temporarily closed by its irritating vapors. The writer hereof has passed most of his life where it grows abundantly, and is surprised to hear of its harmful nature. If crushed between the fingers it gives a nasal sensation and watering of the eyes similar to strong ammonia, and on this account is sometimes locally known as "hartshorn plant." To those who like the smell of ammonia it is rather agreeable than otherwise. —J. C. A.

American Forests.—Dr. J. T. Rothrock, of the University of Pennsylvania, recently delivered one of the course of University lectures in Association Hall, Philadelphia, taking for his subject "The relation of American Forestry to American Industry." Some of its salient features are brought out in the following synopsis from *The American:*

His University lecture was a summary of the latest development of the necessity of forestry laws to protect the future timber trade of the country. He showed the percentages of timber land to other productive territories, from the three per cent. of Great Britain to the forty-five per cent. of Sweden, and that the lowest ratio that can be called self-sustaining is fifteen per cent., while we have only a margin of one and a half per cent. between dearth and supply. At the rate at which our forests are being destroyed, this small advantage will soon disappear, and then there will be a timber famine throughout the land. Great Britain, between 1872 and 1876, imported seventy-seven million dollars' worth of timber—about $2.60 for each individual—while the supply was only about $1.30 from native sources. In the United States, besides using about $19.90 per head, we exported six hundred million dollars' worth. How long this can last is a questton of time, and very little time, too. There ought to be as large a proportion of woodland to clear land for atmospheric purification as for timber supply. The rain-fall is not necessarily affected by clearing off the timber; but failing springs and falling rivers do result from it, for forests diminish evaporation over eighty per cent.

What is the practical remedy within reach? Professor Rothrock points to Germany, with its nine forest schools, their high standard, and their able teachers and growing classes of pupils. One man in this country, Professor Sargent, of Massachusetts, is the only person employed and paid by a State to look after our vast empire of timber. He has worked hard to secure active measures to protect the interest entrusted to him. An exemption of preserved forests from taxes would soon return the loss of revenue in the enhanced value of the timber. The reckless destruction of trees is the first thing to be cured. Even if Congress withdraws national timber land from sale, it will be only a palliative, and there are no trained men to which this enormous source of future wealth can be safely entrusted. Within five years, our best white pine will all be gone; within thirty-five or forty years, all the rest of our good timber will have been exhausted. Can there be any question about the necessity of such legislation, State and National, as shall protect the country from a timber famine?

Variation and Human Interference.—EDITORS BOT. GAZETTE:—I see that Mr. Meehan, in your March number, does not get the idea that I wish to convey concerning variation. It seems to me that when variation *of a nature favorable to man's wishes* is found in plants, and not especially beneficial to the plant, that such variation *suggests human interference* and points towards *a prehistoric cultivation.* That the persimmon occasionally bears seedless fruit is well known, and I append a list of seedless fruits, or of reputed seedless fruits, that I have found mention of in my readings, arranging my material alphabetically. For further particulars and references, I would refer to my articles on "Seedless Fruits," published in the Transactions of the Massachusetts Horticultural Society, Part I., 1880.

Apple:—Fewer seeds in improved varieties than in the wild apples of Thoreau. Second crop apples rarely contain seed; quite numerous records of seedless fruit.

Azarole (*Cratægus azaroleus.*):—The best varieties bear no or few seeded fruit. (Darwin, An. & Pl.)

Banana :—A seedless fruit.

Barberry :—Has a stoneless variety.

Breadfruit :—The cultivated varieties usually seedless; the wild fruit and the poorer varieties bearing seed.

Cherries:—The cultivated varieties in part seedless. Of five varieties examined in 1882, 140 pits had 62 abortive, and one variety 28 out of 30 abortive.

Chamærops stauracantha :—Has the character of producing sterile fruit, but mixed with fertile in the same panicle. The pulp of the fruit is of a peculiar delicate, spongy consistence, and of a pure white and shining on the outside. The fruit is oblong, about one inch in largest diameter. It has probably been brought under a certain amount of cultivation from very remote times. (H. Prestoe, Rept. Trinidad Bot. Gard. 1880, p. 39.)

Citron :—Gallesio mentions the Long orange, and the Chinese orange citrons as seedless, or nearly so.

Cucumbers :—Are frequently seedless, especially when grown under glass.

Cycads :—In Focke's work, Die Pflanzen Mischlinge, he states that female plants often produce apparently perfect cones in green-houses of Europe. yet their seeds contain no embryos.

Date :—Seedless varieties are named by a number of writers.

Diospyros Kaki:—Varieties often seedless, and Brandis mentions a cultivated variety of *D. melanoxylon*, Roxb. as without stones.

Fig:—This bears seedless fruit in one crop at least, and Brandis says many varieties attain maturity with sterile seed.

Grapes:—So far as I have examined, diminution of seed accompanies progressive improvement in the grape. Many varieties of *Vitis vinifera* are absolutely seedless; the cultivated varieties of the American *Vitis* bear fewer seed in general, and smaller seed, and more variable in number, than the wild species from which they have originated.

Guava :—This is frequently seedless.

Lemon :—Seedless varieties are mentioned by several writers.

Lime :—Seedless varieties mentioned by Gallesio.

Lucuma bifera, Mol. of Chile, bears fruit twice a year. The early set have no kernels, the autumn set have two kernels (Molina, Hist. of Chile, I, 129).

Mangosteen :—In its wild state contains four seed; in the cultivated, much larger fruit, rarely more than one seed (Burbridge).

Medlar:—A stoneless variety is advertised by a French nurseryman, and is mentioned by Loudon.

Mulberry:—Seedless varieties are mentioned in the Orient, where the fruit is appreciated.

Opuntia Davisii, Engelm.:—All the fruit seen on the route on the Upper Canadian, eastward and westward of Tucumcari hills, near the Llano Estacado, were sterile (Engelmann, Pac. R. R. Rept. IV, 49).

Orange:—Seedless varieties mentioned by numerous observers.

Otaheitie Apple (*Spondias dulcis.*):—Commonly has no seeds (Forster Obs. p. 179), and Firminger (Gard. in India, p. 234) says he is told that the seeds never germinate, and young plants are usually obtained by graftings on seedlings of other species.

Peach Palm (*Guiliema speciosa*):—Generally devoid of seed (Humboldt); in most instances the seed is abortive (Seemann); is extremely prolific, bearing two crops a year, sometimes more, and one season all seedless fruits are produced, and the other season only seeded fruits; the seedless fruits are highly appreciated (Prestoe); it nowhere grows wild, but has been cultivated by the Indians from time immemorial (Bates).

Pear:— Second crop pears are invariably seedless (R. Manning) and there is a seedless variety; many varieties have seed usually abortive.

Persimmon:—Seedless fruits and fruit with diminished seed reported by all with whom I have talked who have lived in the region of their best growth. See also T. Meehan's testimony in March BOTANICAL GAZETTE.

Pineapple:—A seedless fruit.

Pistacia:—At Cabul is on record as having one year perfect fruit, the next a seedless fruit.

Pomegranate:—Seedless varieties and those with diminished seed mentioned by writers, and cuttings from a seedless form distributed from the U. S. Patent Office in 1860.

Service (*Pyrus lanuginosa*, Die C.):—According to Loudon, the fruit, when it is produced, is generally without seeds.

Strawberry:—Mr. Saunders, Superintendent of the gardens of the U. S. Dept. of Agr. at Washington, on Feb. 16, 1880, mentioned to me a plat of seedless strawberries that he once had growing, and Thomas Knight also mentions growing seedless fruit (Phys. & Hort. Papers, p. 276).

Tomato:—The improved varieties contain fewer seed than do the unimproved, so far as I have observed, and a variety called "Seedless" is described by Burr as containing but few seeds.

This hasty summary from my notes—not originally collected for the purpose of an article of this tenor—would seem to justify the assertion that seedless fruits is an improvement brought about, in the majority of cases, by human agency, and, as I have shown in my essay on "Seedless Fruits," is usually accompanied by improvement in quality. It is therefore quite logical to assume that when we find a wild fruit, very variable, and varying in a direction more beneficial to man than to the plant, that this plant has obtained its variable property from a sometime human interference.

Has not the doctrine of evolution and causation a sufficient hold upon our thought to justify an attempt at interpreting the plant's story? This attempt to question the plant is what I am doing, and I earnestly beseech the favor of obtaining co-workers in this scheme.—E. LEWIS STURTEVANT, M. D., *Geneva, N. Y.*

Tribute to Dr. Engelmann.—The following preamble and resolutions, indicative of the appreciation of the high scientific and personal character of the late Dr. George Engelmann, were unanimously adopted by the Botanical Section of the Academy of Natural Sciences of Philadelphia, April 14, 1884:

WHEREAS, The Botanical Section of the Academy of Natural Sciences of Philadelphia has heard with profound regret of the death of Dr. George Engelmann; therefore,

Resolved, We regard this as a calamity to botanical science, and to those who were in any way associated with him in its study; also,

Resolved, That in his life he furnished an example of industry in his profession, of devotion to science, of thoroughness in investigation, and of success in labor, which will always command our admiration and respect; and be it further

Resolved, That by his readiness to aid all who were seekers after the truths of nature, by the conscientious answers to the botanical questions referred to him, no less than by his goodness as a man, we believe he has attached many to the science in whose service he died.

Resolved, That as a mark of respect to the memory of the deceased, these resolutions be entered upon the minutes of the Section, a copy to be transmitted to his family, and also a copy of them be furnished to the *Bulletin of the Torrey Botanical Club* and to the BOTANICAL GAZETTE, with the request that they be published therein.

JOS. T. ROTHROCK.
THOMAS MEEHAN.
JOHN H. REDFIELD.

Collections from Porto Rico.—Herr P. Sintenis (known through his journey in the Orient), is to begin a botanical examination of Porto Rico during the coming summer, under direction of the undersigned. The specimens will be offered at 30 marks ($7.50) a century. The undersigned will receive the names of subscribers to this collection, but prefers that payments should *not* be made in advance. DR. T. URBAN, *Schöneberg bei Berlin, Germany*.

EDITORIAL NOTES.

IN DR. VASEY'S Schedule of N. Am. species of *Paspalum*, in the last GAZETTE, p. 55, No. 5 should read *P. vaginatum* instead of *P. variegatum*.

MR. DAVIS L. JAMES recently read before the Cincinnati Society of Natural History a memorial notice of Thomas W. Spurlock, a botanist of considerable local reptuation.

THE MARCH NUMBER of *Grevillea* is accompanied with pages 17 to 32 of the new edition of Cooke's Handbook of Fungi, carrying the genus *Agaricus* through to the eighty-seventh species.

IN THE APRIL *Am. Naturalist* Prof. Bessey gives an account, with figures, of the discovery of glands upon the pedicels of *Sporobolus heterolepis*, to which some minute insects had stuck fast. In fact the victims led to the discovery of the trap.

THE BULLETIN of the Natural History Society of New Brunswick, No. III, contains the report of the Botanical Committee, with additions to the New Brunswick Flora, edited by Mr. G. M. Hay. In the list we note *Montia fontana* and *Potamogeton obtusifolius*.

THERE IS MUCH need for more common names for injurious fungi, and a more accurate use of those we now have, so that the terms "mould," "mildew" and "blight," shall not be made to do duty for scores of fungi more diverse in their affinities than oaks, oranges, and pumpkins.

IN THE POSTAL CLUB BOXES of the *Am. Monthly Micr. Jour.*, we note that one contains a slide said to represent "Eleters and spores of *Asterella remisphærica*," whereupon the editor suggests that it would be better to explain what "eleters" are, in which suggestion botanists will heartily concur.

WE NOTE in the April *Gardener's Monthly* the announcement of the death of Prof. S. B. Buckley, which occurred at his home in Austin, Texas, February 18. His name is very closely connected with Texas botany, and *Buckleya distichophylla*, Torr., is a memorial of his work in the mountains of North Carolina.

IN *Science*, April 4, there is given a capital biographical sketch, with portrait, of Dr. Engelmann. It tells the story so exactly as the GAZETTE would like to have it told, that we refer our readers to it, and in place of a biographical sketch publish in this number a list of Dr. Engelmann's botanical papers.

PAIPALOPSIS IRMISCHIÆ Kühn, the representative of a new genus of smuts inhabiting the flowers of *Primula officinalis* and *P. elatior*, which was described by the discoverer in *Irmischia* for May, 1882, is thought by Winter (*Hedwigia*, Jan., 1884) to be the conidial condition of a *Urocystis*. He hopes to decide the question by means of cultures during the coming season.

IN THE *Edinburgh Medical Journal* for March there is a very interesting sketch of the late Prof. J. H. Balfour. He was born in Edinburgh in 1808, and for thirty-four years filled the chair of botany in the University of Edinburg. It is said that nearly 8,000 students have been under his tuition, many of whom are scattered over the globe occupying important scientific positions.

THE STATISTICS relating to the present knowledge of the occurrence of wheat rust in England and its dependence upon soil, temperature, moisture, methods of cultivation, etc., are very fully given in the second part of the *Journal of the Royal Agricultural Society* for 1883. The sixty pages devoted to the subject are full of interesting and valuable information, and we regret our space will not allow of a more extended notice.

A CURIOUS INSTANCE of the inconvenience arising from the diversity of language spoken by botanists in different parts of the world, occurs in the February number of *Hedwigia*. Prof. Saccardo, wishing to notice the criticisms made by Mr. Cooke upon his mycologic work, sent a reply written in French, to that journal. Thus an Italian, in order to publicly communicate with an Englishman, clothes his thoughts in the French language, and makes them known through the medium of a German periodical. And yet there are some among us who think it unnecessary to be familiar with any but the mother tongue!

IT IS DOUBTLESS not generally appreciated that the association of barberry bushes with wheat rust is no new thing, even in our own country. Massachusetts in 1755 passed an "act to prevent damage to English grain arising from barberry bushes" (Province Laws of Mass., 1736–61, p. 153), which provided for all manner of contingencies such as the removal of the bushes from public highways, undivided property, division lines, and lands of careless tenants or proprietors. Any one, after giving due notice, might extirpate any remaining bushes whatever, and charge the expense of the same to the owner of the land, and upon his refusal or neglect to pay, might collect twice the sum by process of law.

THE RESULTS of the study of peach yellows during 1881 and 1882, by Prof. D. P. Penhallow, are given in series III. of the Houghton Farm reports. The attempt has been, not so much to ascertain the cause of the disease, as to establish a satisfactory diagnosis, and to provide a remedy. In these respects, the research has been most painstaking and successful. The report is accompanied by three colored plates, showing healthy and diseased leaves and tissues of the stem, while a fourth gives the appearance of affected trees. The results have been verified by the observations of 1883, lately published in the same series of reports.

MR. L. H. BAILEY, JR., of the Botanic Gardens, Cambridge, has just published a catalogue of North American Carices. This list includes 293 species and 84 varieties, and the latest changes in synonymy are given, as well as the general distribution of each species. Among the many exasperating groups of plants *Carex* holds high rank, and botanists will be very thankful for any help in unravelling what seems often an inextricable tangle. This catalogue is a step in the right direction, and Mr. Bailey has the opportunity of laying botanists under great obligation by his studies in *Carex*. Copies of the catalogue can be obtained from the author at five cents a copy, or fifty cents a dozen.

NINE SPECIES of barberry are now known to harbor the æcidium of *Puccinia graminis*. Two of these are sometimes referred to the genus *Mahonia*, one of which, *Berberis* (*Mahonia*) *aquifolium*, has through the observations of Mr. C. B. Plowright been but recently connected with wheat rust. Of this list *B. Canadensis* is a native of our Southern States, *B. aquifolium* is native of Oregon, and the common barberry is widely although sparsely grown throughout our territory. We have besides two native western species and an ornamental species from Japan. The wheat rust does not seem to be lacking for an opportunity to occasionally reinvigorate itself by the production of cluster-cups, yet it is the opinion of many that some still more common host will yet be detected.

IN SACH'S *Vorlesungen über Pflanzenphysiologie* he discards the four plant elements as given in his text-book, and refers all plant organs to two categories, root and shoot. In a review in the last *Am. Jour. Sci.* Prof. Goodale thus defines the two: The former (the root) comprises that part of the plant which on or in a substratum serves as a hold-fast, and in the latter case acts as an organ for conducting into the plant nutritive matters held in the substratum. The shoot is that part which unfolding outside of the substratum produces plant-substance and serves for propagation, bearing organs of reproduction which are never seen on roots. According to this the rhizoid of a thallophyte and the root of a vascular plant are the same. It is to be hoped that these lectures will speedily find a translator.

THE COMMITTEE appointed by the American Botanical Club of the A. A. A. S., to make suitable preparations for the meeting at Philadelphia, are arranging a programme as rapidly as the movements of the local committee of the association will permit. They are taking every means to make the occasion one of pleasure and profit. This committee consists of Messrs. J. C. Arthur, of Geneva, N. Y., and J. H. Redfield, of Philadelphia, as originally appointed, who have selected as the third member Mr. Thomas Meehan, of Philadelphia. At a late meeting of the Philadelphia Academy of Sciences, five botanists were appointed to co-operate with this committee, and especially to assist in carrying out the details of the programme during the meeting. They are Isaac C. Martindale, Prof. Joseph T. Rothrock, Dr. J. Bernard Brinton, Wm. C. Stevenson, Jr., and Jos. O. Schimmel.

AT A RECENT meeting of the Botanical Section of the Philadelphia Academy Mr. Meehan exhibited some nuts of *Carya glabra* which had two or three nuts in a single exocarp, as in the common chestnut. Dr. Asa Gray remarked that such specimens were of much morphological significance, and that the conclusion to which they inevitably pointed was as follows: The husk, or so-called exocarp, of *Carya*, is an *involucre*, usually containing a single female flower, and connate with its ovary; its true morphology is revealed when, as in this case, it contains two or three flowers. The stone or shell of the nut is the whole pericarp in *Carya* as much as in *Corylus*. In the former genus it becomes free from the four valved involucre at maturity; in *Juglans* the congenital union is more permanent, forming a drupaceous accessory fruit, of which the fleshy part is involucre, the bony part is pericarp. This view directly homologizes the *Juglandaceæ* with the *Cupuliferæ*.

A NEW PERIODICAL of considerable interest to botanists and lovers of plants in general has just made its appearance. It is edited and published by J. M. and C. G. Lloyd, of Cincinnati, Ohio, under the name "*Drugs and Medicines of North America*," and is to be, according to the title page, "a quarterly devoted to the historical and scientific discussion of botany, pharmacy, chemistry and therapeutics of the medicinal plants of North America, their constituents, products and sophistications." Let no one be frightened by this formidable cognomen, for its dryness and shoppy flavor scarcely extend beyond the cover. The number before us, consisting of thirty-two royal octavo pages, treats of *Clematis Virginiana*, *Thalictrum dioicum*, *T. anemonoides*, *Anemone nemorosa* and *A. patens*, var. *Nuttalliana*, and is illustrated with thirteen cuts, of which four are full page, one of the latter containing microscopic details of structure. The treatment of each plant is accurate, varied and interesting, and embraces little that every general student of plants would not be glad to know. The heavy paper, fine engravings, and excellent typography leave nothing in this line to be desired. All this in connection with the low annual subscription ($1.00) should heartily commend it to botanists as well as to physicians and pharmacists.

BOTANICAL GAZETTE.

VOL. IX. JUNE, 1884. NO. 6.

Notes on Cyperaceæ.

BY WILLIAM BOOTT.

SCIRPUS (BLYSMUS) RUFUS, Schrad. Culmo filiformo lævi, 3–15 poll. longo. Foliis 2–4 angustissimis canaliculatis culmo brevioribus. Spica simplici, oblonga, e spiculis 3–8 contiguis, sessilibus, apice culmi spicatis, nuda vel bractea foliosa culmum sæpe superante suffulta. Spiculis distichis lanceolatis, 2–5 floris, 3 lin. longis. Squamis castaneis membranaceis ovatis paucinervatis. Achenium ellipticum, biconvexum, acuminatum, stylo longo continuo bipartito apicatum, basi acutum. Stamina 3. Setis sæpius nullis.

Salt marshes, Manitoba, July 20, 1881. Common on the seashore, Gaspé, Dom. of Canada, Aug. 9, 1882. Macoun. Also native of the north of Europe.

Stem filiform, smooth, 3–15 inches long. Leaves 2–4, very narrow, channeled, shorter than the stem. Spike oblong, simple, of from 3–8 contiguous sessile spikelets at the summit of the stem, naked or subtended by a narrow leaf-like bract that often exceeds the stem. Spikelets 2 ranked, lanceolate, 3 lin. long, 2–5 flowered. Scales chestnut, membranous, ovate, few-nerved. Nut elliptical, biconvex, acuminate, tipped by the long continuous bipartite style, acute at base. Bristles commonly none. Stamens 3.

RHYNCOSPORA HARVEYI, sp. n. Glauca. Culmo 1½–2 ped. alto, gracili, triangulo, lævi, basi plurifoliato. Foliis 1 lin. latis, 6–10 poll. longis, apice scabro attenuatis; culmeis 2, supremum medio culmo ortum. Vaginis 1 poll. longis. Bracteis herbaceis, angustis corymbis longioribus. Corymbis 2–3, remotis, suprema majore composita, brevi 2–3 ramoso (ramis ½ poll. longis vel brevioribus), reliquis subsimplicibus pedunculatis. Pedunculis 1–1½ poll. longis. Spiculis orbiculari-ovatis, acutis, ramulosum apice 3–6 aggregatis, bracteolis angustis brevioribus. Flos unica fertilis. Squamis castaneis margine angustissimo albidis; inferioribus 2 parvis oblongis obtusis emarginatis vel acutis mucronatis; reliquis magnis, concavis, mediis rotundo-obovatis obtusis marginatis e sinu mucronatis (mucrone albo recurvato); superioribus ovatis acutis vel mucronulatis achenia paulo superantibus. Achenium castaneum, obovatum biconvexum, circa 1 lin. longum, transverse recte rugulosum, tuberculo depresso conico basi ovali soluto ⅔ longius. Setis 6 antrorsum denticulatis achenis 3-4 plo. brevioribus.

Grand Prairie, E. Arkansas, *F. L. Harvey*, 1883.

Glaucous. Stem 1½–2 feet high, slender, triangular, smooth, several leaved at base. Leaves 1 line broad, 6–10 inches long, tapering to a rough point; stem leaves two, the upper at the middle of the stem. Sheaths 1 inch long. Bracts green, narrow, longer than the corymbs. Corymbs 2–3, remote; the uppermost the largest, compound, 2–3 short branched, branches ½ inch long or less; the others nearly simple, peduncled. Peduncles 1–1½ in. long. Spikelets orbicular-ovate, acute, aggregated 3–6 together at the top of the branchlets, shorter than their narrow bractlets. Only one fertile flower. Scales chestnut, with a very narrow white border; the lower two small, oblong, obtuse, emarginate or acute; the others large, concave, the middle ones round, obovate, obtuse, emarginate, a white recurved mucro inserted in the sinus; the upper ovate, acute or short mucronate, a little longer than the nut. Nut chestnut, obovate, biconvex, about 1 line long, finely transversely wrinkled in straight lines, ⅔ longer than the depressed-conical, oval, free based tubercle. Bristles 6, upwardly toothed, ⅓–¼ the length of the nut.

Very like *R. cymosa*, Nutt. It differs from that species in its narrower leaves, its monocarpous spikelets, its larger, more tumid nut, and its finer, not wavy wrinkles.

CAREX STRAMINEA, Schk., var. INVISA, var. n. Cæspitosa multiculmis. Culmis gracilibus, angulis acutis scabris, infra medium foliatis. Foliis longe vaginatis, lineam latis, sursum attenuato-filiformibus, culmis longioribus vel brevioribus. Bracteis e basi lanceolata margine albida filiformibus, 1-6 poll. longis, inferioribus 1-2 culmum proximis spiculas suas superantibus. Spica solitaria oblonga vel subobovoidea erecta, cernua vel apice pendula, 3–5 poll. longa, e spiculis 3–12 congestis, contiguis vel alternatis subdistantibus; vel spicis 1–3, inferioribus remotis pedunculatis apice spiculas 1–4 gerentibus. Pedunculis 1–12 poll. longis læviusculis. Spiculis ellipticis, basi acutis, apice apertis, 4–6 lin. longis. Squamis membranaceis, argenteis, demum pallide castaneis, lanceolatis, acutis, breve scabro-aristatis, perigyniis angustioribus, inferioribus iis longioribus superioribus brevioribus. Perigyniis pallide viridibus, 2½–3 lin. longis, ½ lin. latis, ovalibus vel subobovatis alatis acuminato-rostratis, rostro bidenticulato margine serrato dentato, dorso fisso, tenui nervatis, lateribus corrugatis. Achenium castaneum, oblongum, lenticulare, stipitatum perigynio laxe inclusum, eo duplo brevius et angustius.

Common on margins of ponds and in ditches in sandy soil, E. Massachusetts. Mt. Desert, Maine.

Well distinguished by its long, thread-like bracts.

Tufted, bearing many stems. Stems slender, the sharp angles rough, leaved below the middle. Leaves long-sheathed, a line broad, tapering to a thread-like summit, longer or shorter than the stem. Bracts thread-like from a white margined lanceolate base, 1–6 in. long; the lower longer than the stem; the next above than their spikelets. Spike solitary, oblong or subobovoid, erect, nodding or pendulous at the top, 3–5 in. long, composed of 3–12 congested contiguous or alternate subdistant spikelets; or spikes 1–3, the lower remote, peduncled, bearing at the top 1–4 spikelets. Peduncles 1–12 in. long, smoothish. Spikelets elliptical, acute at base, open above, 4–6 lin. long. Scales membranous, silvery, becoming pale chestnut, lanceolate, acute, roughly short-awned, narrower and the lower longer and the upper shorter than the perigynia. Perigynia pale green, 2½–3 lin. long, ½ lin. broad, oval, or subobovate, winged, acuminate, beaked, the beak bidenticulate, serrate-toothed on the margin, fissured on the back, delicately nerved, the sides wrinkled.

Carex prægracilis, sp. n. Culmis (ima parte et foliis culmeis deficientibus) 26 poll. longis, strictis tenuissimis, lateribus vix ½ lineam latis, angulis acutis spura scabris. Foliis sterilibus attenuato filiformibus, convolutis, sectione transversa perfecte circulari. Spica ferruginea oblongo-lineari, ½ poll. longa, e spiculis 3–4 contiguis sessilibus, suprema majore claviformi basi mascula, cæteris femineis ellipticis paucifloris. Bracteis e basi ovata, margine hyalina complectente, attenuato aristatis, aristis scabris, subexcurvis spiculis longioribus, culmo plerumque brevioribus. Squamis bracteis conformibus, marginibus latioribus, aristis brevioribus, perigynia tegentibus. Perigyniis cartilagineis-ferrugineis, basi pallidis, glabris, ovatis, accuminato-rostratis substipitatis 1½ lin. longis, ¾ lin. latis, rostro antice alte fisso, fissuræ marginibus albidis, facie exteriore convexis, faciei interioris marginibus incurvis, supra serratis; obscure nervatis. Achenium castaneum rotundo-ovatum biconvexum perigynium implens. Stigmata duo, stylus inclusus.

San Diego, California, *Miss Scott*, 1880.

Stem (the lower part and stem leaves wanting) 26 in. high, straight and slender, scarcely half a line broad on the side, the sharp angles rough above. Sterile leaves thread-like, convolute, the cross section exactly circular. Spike ferruginous, oblong linear, ½-inch long, of 3–4 contiguous, sessile spikelets, the uppermost club-shaped, male at base, the others elliptical, female, few-flowered. Bracts from an ovate hyaline-margined base which encircles the stem, tapering to rough, somewhat spreading awns, that are longer than their spikelets and commonly shorter than the stems. Scales similar to the bracts, with broader margins and shorter awns, covering the perigynia. Perigynia cartilaginous, ferruginous, pale at base, glabrous, ovate, acuminate-beaked, slightly stalked, 1½ line long, ¾ line broad, long fissured on the outer face (the margins of the fissures whitish), convex on the outer face, the margins of the inner face incurved and serrate above; obscurely nerved. Nut chestnut, round-ovate, biconvex, filling the perigynium. Stigma, 2. Style included.

Resembling *C. glareosa*, Wahl., but a much taller plant, with very different bracts, scales and fruit.

CAREX SPICULOSA? Fries. Cæspitosa. Culmo 1½–2½ ped. alto, acutangulo, scabro, basi vaginis aphyllis tecto. Foliis 1–1½ lin. latis, longe attenuatis, marginibus apiceque triangulari scabris, culmo brevioribus; vaginis fibro-reticulatis. Bracteis foliatis, infimo culmum paule superante, sequentibus gradatim brevioribus. Spica 5–6 poll. longa, e spiculis 5–6 approximatis; masculis 1–3, ⅓–2 poll. longis, linearibus; reliquis femineis vel apice masculis. cylindricis basi angustatis laxifloris, 1½–2 poll. longis, 2 lin. latis, exserte pedunculatis arrectis, infima subremote subnutanta. Pedunculis ⅓–1 poll. longis. Squamis triplinerviis, masculis oblanceolatis abrupte acutis; femineis purpureis carina pallida acutis, vel plus minus scabro-aristatis perigyniis longioribus. Perigyniis stramineis 1¼ lin. longis, ½ lin. latis, obovatis, oblongis, vel ovatis, acuminatis rostellatis, rostri ore integro, pauci-nervatis, plano convexis, marginibus superne parce dentatis. Achenium pallide castaneum, obtusum, marginibus indentatum perigynio ½ brevius. Stamina 3. Stigmata 2.

Salt marshes Medford and Arlington, Massachusetts. *C. spiculosa* is a native of the shores of the White Sea, Russia.

Cæspitose. Stem 1½–2½ feet high, sharply angled, scabrous, covered at base with leafless sheaths. Leaves 1–1½ lines broad, tapering to a long, slender summit, rough on the margins and the triangular apex, shorter than the stem, their sheaths fibrous-netted. Bracts leafy, the lowest a little longer than the stem, the succeeding gradually shorter. Spike 5–6 in. long, of 5–6 approximate spikelets; the male 1–3, $\frac{1}{3}$–2 in. long, linear; the rest female or male at top, cylindrical, narrowed and loosely flowered at base, 1$\frac{1}{2}$–2 in. long, 2 lines broad, exsertly peduncled, ascending, or the lowest a little remote and somewhat nodding. Peduncles $\frac{1}{3}$–1 in. long. Scales three-nerved, the male oblanceolate abruptly acute, the female purple, with pale keel, acute or more or less roughly awned, longer than the perigynia. Perigynia straw-colored, 1$\frac{1}{4}$ lines long, $\frac{1}{2}$ line broad, obovate, oblong or ovate-acuminate, short-beaked, the orifice of the beak entire, few nerved, plano-convex, sparingly toothed on the upper margins. Nut pale chestnut, obtuse, indented on the margins, half as long as the perigynium. Stamens 3. Stigmas 2.

Carex spiculosa is known only by a short description by Fries in his Summa, and by a fuller but still incomplete one by Andersson in his Cyper. Scand. and by a figure without text in Dr. Boott's Ill. Car. The plant above described has a close resemblance to *C. salina*, Wahl. It differs from it in the fibrous reticulation of the sheaths of the leaves. The lowest spikelet is more distant on a longer peduncle and somewhat nodding. If, upon a more complete knowledge of *C. spiculosa*, the Medford plant shall be proved not to belong to that species, it may perhaps be considered as a hybrid. It grows in company with *C. salina* and *C. maritima*, Murray, and quite near to *C. angustata*, Boott, and *C. vulgaris*, Fries.

Carex hispida, Willd. (*C. echinata*, Desf. Boott.) Glauca. Rhizomate crasso, lignoso, squamis fuscis imbricatis tecto. Culmo valido, obtusangulo, lævi, basi plurifoliato, 2–6 ped. alto. Foliis 3–6 lin. latis, sursum longe attenuatis, culmo brevioribus, lævibus, carinatis, lateribus recurvatis, marginibus et carina dentatis, basi fuscis complicatis, vaginis antice sæpe reticulato-fissis, fibris coloratis. Bractea infima plerumque culmo longiore evaginata, vel vagina $\frac{1}{2}$–3 poll. longa prædita. Spica 9–18 poll. longa e spiculis 4–10 cylindricis, densifloris, arrectis; masculis 3–6, 1–3$\frac{1}{2}$ poll. longis, gracilibus, contiguis, sessilibus vel breve pedunculatis; inferioribus nunc ternatis; reliquis femineis, vel superioribus supra plus minus masculis, 2–4 poll. longis, 3–4 lin. latis; singulis vel mediis geminatis vel ternatis (una earum omnino vel apice mascula); extremis singulis; inferioribus nunc remotis, raro basi attenuatis, nutantibus, pedunculatis. Pedunculis plerumque brevibus, subinde 1–13 poll. longis. Squamis membranaceis, purpureis, hyalino-marginatis, trinerviis; masculis oblongis vel obovatis, obtusis vel breviaristatis; femineis lineari-lanceolatis, truncatis vel acutis, plus minus aristatis; arista pallida, lata, marginibus serrata. Perigyniis membranaceis, stramineis vel ferrugineis, circa 2 lin. longis, 1 lin. latis, ovalibus vel obovatis, abrupte cylindrico-rostellatis, rostri ore pertuso, integro vel emarginato dilatato, antice planiusculis, dorso convexo angulatis, paucinervatis, maturitate apice inflatis, divergentibus scabris, marginibus ciliato-dentatis, squamis latioribus longioribus vel (arista) brevioribus. Achenium castaneum, triquetrum, ovoideum vel obovoideum, stylo æquali apicatum, stipitatum, perigynio ½ brevius, et eo laxe inclusum. Stamina 3, et (f. Drejer) 4. Stigmata 3–2.

S. Arizona, *Lemmon*, April, 1880. *Pringle. M. E. Jones*, 1882. Littorum maris Mediterranei in Europa et Africa incola.

Glaucous. Rootstock thick, woody, clothed with dark imbricated scales. Stem stout, obtusely angled, smooth, several leaved at base, 2–6 feet high. Leaves 3–6 lines broad, tapering to a long slender summit, shorter than the stem, smooth, keeled, recurved on the sides, toothed on the margins and keel, dark-colored and conduplicate at the base, the inner face of the sheaths often breaking up into colored netted fibres. The lowest bract commonly longer than the stem, not sheathed, or sometimes furnished with a sheath ½–3 inches long. Spike 9–18 inches long, of from 4–10 cylindrical, densely flowered, ascending spikelets; the male 3–6, 1–3½ inches long, slender, contiguous, sessile or short peduncled, the lower sometimes grouped in threes; the rest female, or the upper more or less male above, 2–4 inches long, 3–4 lines broad, single, or the middle ones in pairs or threes (one of them male or male at top), the highest and lowest single; the lower sometimes remote, rarely attenuated at base, nodding, peduncled. Peduncles generally short, sometimes 1–13 inches long. Scales membranous, purple, hyaline-margined, three-nerved; the male oblong or obovate, obtuse or abruptly short-awned; the female linear-lanceolate, truncate or acute, more or less awned; the awn broad, pale, serrate on the margins. Perigynia membranous, straw-colored or ferruginous, about 2 lines long, 1 line broad, oval or obovate, abruptly cylindrically short-beaked; the orifice of the beak open, entire or emarginate, dilated; nearly flat on the inner face, angled, few nerved on the outer, inflated at maturity, and diverging, rough, the margins ciliate toothed, broader, longer, or, including the awn, shorter than the scales. Nut chestnut, three-sided, ovoid or obovoid, tipped by the equal style, stalked, loosely inclosed in and half as long as the perigynium. Stamens 3 and (according to Drejer) 4. Stigmas 3–2.

Carex hispida was discovered about a hundred years ago by Desfontaines, on the coast of Barbary, and named by him *C. echinata*. As this name had been previously given, by Ehrhart, to another species since named *C. stellulata* by Goodenough, Willdenow changed it to *C. hispida*, and he has been generally followed by caricologists, with the exception of Dr. Boott. *C. hispida* is a not uncommon plant on the shores of the Mediterranean Sea, and has received different names from different collectors. Drejer, who has discussed the species at length in his Symbolæ, quotes thirteen synonyms. He characterizes it as extremely variable. The perigynium of the Arizona specimens is at first plano-convex, agreeing with the European plant, but at full maturity is inflated at top and divergent. Willdenow's character was taken from immature specimens, as he allows. The only roughness of the perigynia mentioned by him is "capsulis marginatis hispidulis" which exactly describes the Arizona specimens. The affinity of *C. hispida* is, according to Drejer, with *C. glauca*, Scop., *C. trinervis*, Desgl., and *C. setigera*, Don; while Dr. Boott sees a closer resemblance to his *C. laciniata*.

Carex Assiniboinensis, sp. n. Culmo 2–2½ pedes alto, filiformi, debili lævi basi vaginis lineari lanceolatis, purpureis, laxis, efoliatis, margine sparse reticulato-fissis tecto, fibris capillaribus. Foliis 4–6 poll. longis, 1 lin. latis, margine et apice attenuato-triangulari scabris, culmo brevioribus. Bractea mascula squamæformi aristata spicula breviore, bracteis femineis linearibus, apice longe attenuatis, spiculas suas superantibus, culmo brevioribus, vaginatis. Vagina 1–1½ poll. longa. Squamis membranaceis, pallide ferrugineis, nervo medio angusto viridi, lanceolatis, acuminatis vel aristatis; femineis basi amplectentibus perigyniis aequilatis longioribus vel brevioribus. Spica 7–11 poll. longa e spiculis 3–4 distantibus suprema mascula, lineari-oblanceolata pollicem longa, ceteris femineis anguste cylindricis, ½–1¼ poll. longis alternatum remotiuscule pauci (5–6) floris flexuosis nutantibus, pedunculatis. Pedunculis 1½–3 poll longis scabriusculis. Perigyniis crustaceis lanceolatis, trigonis, obtusangulis, 3 lin. longis, 1 lin. crassis, basi substipilatis in rostrum longum oblique sectum attenuatis, ore longo integro acuto hyalino; tuberculis acutis dentatis apice setigeris asperatis, infra sordide flavis, supra viridibus, basi grosse nervatis. Achenium ellipsoideum, obtusum, arete inclusum, perigynii dimideo brevius. Stylus elongatus. Stigmata 3.

Assiniboine Rapids, June 14, 1879, *Macoun*. Lake Manitoba, June 9, 1881, *Macoun*.

Stem 2–2½ feet high, filiform, weak, smooth, clothed at the base with loose, linear-lanceolate, purple, leafless sheaths, their margins breaking up into fine, hair like netted fibres. Leaves 4–6 in. long, 1 line broad, rough on the margins, and at the very slender, triangular summit, shorter than the stem. Male bract, scale-like, awned, shorter than its spikelet; female bracts linear, tapering to a very slender point, longer than their spikelets, shorter than the stem, sheathed. Sheaths 1–1½ inches long. Scales membranous, of a pale, rusty color, the midnerve narrow, green, lanceolate, acuminate or awned; the female clasping at base, longer or shorter than, and as broad as the perigynia. Spike 7–11 in. long, of 3–4 distant spikelets, the uppermost male linear oblanceolate 1 in. long; the others, female, narrowly cylindrical, ½–1¼ in. long, alternately, and rather remotely few (5–6) flowered, flexuous, nodding, peduncled. Peduncles 1½–3 in. long, roughish. Perigynia crustaceous, lanceolate, obtusely 3 angled, 3 lines long, 1 line thick, somewhat stalked, tapering to a long, obliquely cut beak, the long, entire sharp orifice hyaline; rough, with sharp, toothed, bristle tipped tubercles, dull yellow below, green above, coarsely nerved at base. Nut ellipsoidal, obtuse, closely invested by the perigynium and not half its length. Style elongated. Stigmas, 3.

Like *C. debilis*, Mx. in habit, but distinguished from it and others of the *debilis* group by the sculpture of the perigynium and its long, entire sharp pointed orifice.

Carex acutata, Boott. Rhizomate repente, stolonifero. Culmo 1½–2 ped. alto, valido, basi foliis amplectentibus clauso. Foliis 3–5 lin. latis, culmo longioribus, planis, carinatis, reticulato-venosis. Bractea infima 6–15 poll. longa, nunc vaginulata; reliquis spiculis duplo triplo longioribus, nisi summa brevis. Spica 1–7 poll. longa, e spiculis 4–6 oblongis vel cylindricis; superioribus vel omnibus aequialtis, contiguis, subsessilibus, vel spicatim dispositis; masculis 1–2 fusco-ferrugineis, subinde abbreviatis, vel 1–2¼ poll. longis, 1–1½ lin. latis; reliquis femineis, vel superioribus apice masculis, densifloris, subsesselibus, vel inferioribus pedunculatis, 8 lin. to 2½ poll. longis, 4 lin. latis. Pedunculus infimus ½–1½ poll. longus. Perigyniis ovalibus rostratis, acute bifidis, ventricosis, modice biconvexis, costato-nervosis, glabris, lucidis, tesselatis, pallide viridibus, $1\frac{9}{10}$ lin. longis $\frac{6}{10}$ lin. latis, squamis purpureis, nervo pallido, ellipticis vel ovalibus, acutis, muticis, ciliatis, vel hispido-aristatis longioribus vel brevioribus. Achenium oblongo-ellipticum, triquetrum, ferrugineum, basi styli contorta vel depresso-curvato apiculatum.—Ill. Car. p. 138.

Arizona, Santa Rita Mts., May 28, 1882, *C. G. Pringle.* Huachuca Canon, June 24, 1882, *J. G. Lemmon.* Previously described as a native of West South America and of Brazil.

Rootstock creeping, stoloniferous. Stem 1½–2 feet high, stout, concealed below by the clasping leaves. Leaves 3–5 lines broad, longer than the stem, flat, keeled, netted-veined. Lowest bract 6–15 in. long, occasionally short sheathed, the rest, with the exception of the short uppermost one, two or three times longer than their spikelets. Spike 1–7 in. long, of 4–6 oblong or cylindrical spikelets; the upper or all of equal height, contiguous, subsessile, or disposed in spikes; male spikelets 1–2, of a dark, rusty color, either short or 1–2¼ in. long, 1–1½ lines broad, the rest female, or the upper male at top, densely flowered, subsessile, or the lower peduncled, 8 lines to 2¼ in. long, 4 lines broad. Lowest peduncle ½–1½ in. long. Perigynia oval, beaked, sharply bifid, ventricose, somewhat biconvex, ribbed, smooth, shining, checkered, pale green, $1\frac{9}{10}$ lines long, $\frac{6}{10}$ line broad, longer or shorter than the purple, pale nerved elliptical or oval, sharp-pointed, ciliate, or hispidly awned scales. Nut oblong elliptical, three-sided, ferruginous, tipped by the contorted or depressed curved base of the style.

Allied to *C. tentaculata* and its allies.

Carex Lemmoni, n. sp. Cæspitosa. Culmis 2 ped. altis, latere ½ lin. latis, obtusangulis lævibus, vaginis omnibus foliiferis, infra medium foliatis. Foliis lineari-lanceolatis, apice subulato triquetris, erectis, vaginatis, 1½ lin. latis, culmeis 3–4, sterilibus 6–10 poll. longis. Bracteis foliatis vaginatis, spiculis longioribus, culmis brevioribus. Vaginis ½–1¼ poll. longis. Ligula oppositifolia obtusa. Squamis pallide-ferrugineis, membranaceis, margine hyalina, oblongo-obovatis, obtusis, mucronatis, perigynia æquantibus. Perigyniis ferrugineis, membranaceis, lævibus, triquetro, oblongis, basi acutis, acuminato rostratis, 1¾ lin. longis, ½–¾ lin. latis, rostro bidentato margine serrato dentato, nervatis. Achenium atro-castaneum, triquetro obovoideum, basi productum apice obtusum stylo æquali apiculatum. Stigmata 3.

J. G. Lemmon, 1875.

Tufted. Stem two feet high, half a line broad on the sides. obtusely angled, smooth, leaved below the middle, all the sheaths leaf bearing. Leaves linear-lanceolate, triangular awl pointed at top, erect, sheathed, 1½ lin. broad; stem leaves 3–4, the sterile 6–10 in. long. Bracts leafy sheathed, longer than their spikelets, shorter than the stems. Sheaths $\frac{1}{2}$–$1\frac{1}{4}$ inches long. Ligule opposite to the blade, obtuse. Scales pale rusty, membranous, with hyaline margins, oblong-obovate, obtuse, mucronate, equaling the perigynia. Perigynia ferruginous, membranous, smooth, triangular-oblong, acute at base, acuminate-beaked, $1\frac{3}{4}$ lin. long, $\frac{1}{2}$–$\frac{3}{4}$ lin. broad, the beak bidentate, serrate toothed on the margins, nerved. Nut dark chestnut, triangular obovoid, tapering to the base, obtuse at the top, tipped by the equal style. Stigmas, 3.

Allied to *C. distans*, L. Stem and leaves of a tawny yellow color.

In a specimen of *Rhyncospora* (*Ceratoschœnus*) *macrostachya*, Torr., from Arkansas, the perianth consists of short, stout, awl-shaped bristles, thus destroying one of the characters supposed to distinguish it from *R. corniculata*, Gray.

Carex glauca, Scop., was found growing in sterile clayey soil near London, Ont., in June, 1881, by Dr. T. J. W. Burgess, and in a railway cutting near Windsor, Nova Scotia, by Prof. Macoun, in June, 1883.

Carex hirta, L., is occasionally met with near Boston and in ballast heaps at Philadelphia. Both species are probably immigrants from Europe.

Notes on Phoradendron flavescens, Nutt. I.

BY J. SCHNECK.

Although this parasite is common throughout the southern half of our Union, the dates of the different stages in the evolution of its bud to the mature fruit appear to be still imperfectly understood. The following observations are taken from notes made during the past eighteen months, and may help to develop the facts in the case.

Dec. 25, 1882—Fruit abundant and ripe. Mature pistillate flowers on the same plants, but these are always toward the distal extremity from the fruit. Staminate flowers, on separate plants, withered, but the stamens clearly visible, in the more perfect, on pressing back the sepals. *Buds in the axils of the leaves.*

Jan. 15, 1883—Staminate spikes withered and dropping off, but no change in the pistillate.

April 20, 1883—Could find no male spikes, but many plants that have no spikes at all. Pistillate flowers larger and more prominent on the rachis than at previous observation. Old fruit all gone. *Buds in the axils of the leaves not changed.*

June 26, 1883—Ovaries still larger and more prominent. The *buds in the axils of the leaves* of Dec. 25, 1882, have developed into vigorous young stems, *bearing an abundance of young spikes.*

July 27, 1883—Fruit near the size of white mustard seed. *The new shoots still larger and their spikes further developed* than at last observation.

Sept. 15, 1883—Berries near two-thirds natural size, still green. Calyx on the summit of the ovaries. Staminate and pistillate *flowers, on this season's growth, about to open;* here and there one is open, exposing the full grown anthers. There is a very marked difference in the shape and size of the staminate and pistillate spikes. The former are from 1 to 1½ inches long; rachis bare at several points, so as to give the appearance as if two to four short spikes were joined together; this is still more forcibly impressed by the fact that between each cluster of flowers, in both the staminate and pistillate plants, is found an entire sheath or bract. The pistillate spikes are only three-fourths inch, or less, in length, and are also divided into two to four clusters; but the number of flowers in a cluster is less than in the staminate plants.

Oct. 23, 1883—Berries full grown and nearly ripe. *The flowers that have been since June developing are now in full anthesis.* The older ones are beginning to wither, but the majority are shedding pollen. The color, shape of the leaves and length of the spikes, serve to distinguish the staminate and pistillate plants at sight. In the former the color of the whole plant is a pale green, leaves oblong spatulate, spikes twice the length of those in the pistillate plants. In the latter the color is a deeper green, leaves ovate or obovate. So marked and constant are these differences in the color of the plant and shape of the leaves, that one can, without close inspection, select from a pile of plants either sex at will.

Dec. 6, 1883—Fruit ripe. *The male flowers withering and dropping off, while the pistillate have made little change since October.* From the above observations we may draw the following conclusions: The buds which are found in the axils of the leaves, in late fall and winter, develop into young shoots during the following spring and summer; these bear spikes of flowers which are in anthesis during October and November. The male spikes drop their flowers, and by March have themselves fallen. The fructified pistillate flowers make very little growth from October to the following spring, at which time the fruit begins to develop, and by November is mature; being near twelve months from the first appearance of the bud until full anthesis, and twelve months more from anthesis to the perfect fruit.

Notes on Eriochloa.

BY GEORGE VASEY.

Kunth founded the genus *Eriochloa* on the specimens of Humboldt's American collection, and in Humboldt's Nov. gen. et sp. vol. 1, p. 94, states that the spikelets are one-flowered. But in his *Enumeratio Plantarum*, vol. 1, p. 71, published many years afterwards, describing the genus, he says the spikelets are two-flowered, the upper flower hermaphrodite with two palets; the lower flower neuter with one palet similar to the glumes, or *rarely male* with two palets. The term palets he applies to both envelopes of the flower, now called flowering glume and palet, and in the statement of the lower flower neuter with one palet, he considers one of the outer glumes as a palet, or as belonging to a flower of which the other parts are suppressed. The change in Kunth's description was probably made so as to include the *Panicum molle* of Michaux. An examination of our specimens, as distributed by Mr. Curtiss, show two-flowered spikelets, the usual perfect flower, and a male one with three stamens and a thin, membranaceous two-nerved palet. In Kunth's description this character is referred to in his expression "varius bipaleaceo, masculo."

Mr. Bentham in the *Flora Australiensis* describing *Eriochloa* says, spikelets one flowered. Benth. and Hook., in *Genera Plantarum* say the same. The question arises as to where did Mr. Bentham refer our *Eriochloa mollis*, the *Panicum molle* of Michx. He does not refer to it by name, and has either ignored it or has referred it to *Panicum*. But it does not fit in any of the sections of *Panicum*, and is in all respects a good *Eriochloa* with a second flower, and the character of the genus should be altered to admit it.

The *Eriochloa annulata* No. 3,600* of Curtiss's distribution agrees with the *E. mollis* in having two-flowered spikelets. When I first received it from Mr. Curtiss I was inclined to call it a variety of *E. mollis*, but Mr. Curtiss said there was a great dissimilarity of appearance, and I, hesitatingly, and improperly referred it to *E. annulata*, specimens of which we have from the W. Indies. The spikelets of our plant are nearly twice as large as those of the W. Indian plant, and have two flowers, while that has one. The general appearance of *E. mollis* and *E. annulata?* of Curtiss's distribution is quite dissimilar, but the flowers can hardly be distinguished, and a specimen from Florida collected by Dr. Garber seems almost to connect the two.

In my published list of grasses I made *E. mollis* a variety of *E. punctata*. This, I suppose, must be changed, for our Texas specimens of *E. punctata* have smaller, one-flowered spikelets, with much more pointed glumes. Therefore *E. mollis* must be restored as a species. As to our *E. annulata?* it must either become a species, or be considered a variety of *E. mollis*. They need to be further observed, perhaps, before this point can be clearly determined. Our species of *Eriochloa* then will need to be divided into two sections, one with one flower, the other with two flowers, and will stand as follows:

§ 1. Spikelets one-flowered.

1. *E. sericea*, Munro; 2. *E. punctata*, Hamilton; 3. *E. grandiflora* (Helopus grandiflorus, Trin.)

§ 2. Spikelets two-flowered.

4. *E. mollis*, Kunth; and var. *longifolia* or a new species.

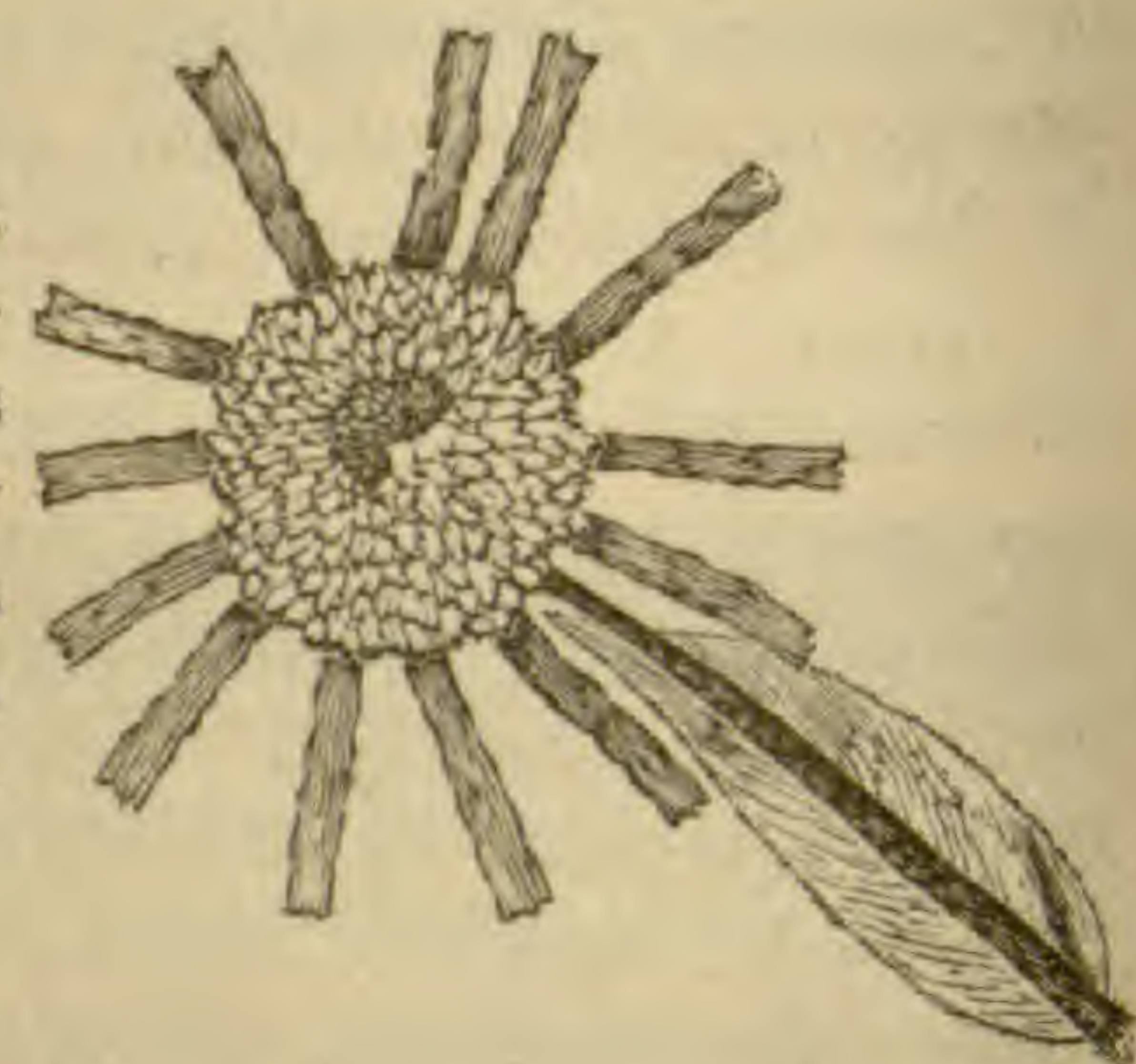
GENERAL NOTES.

Erythræa.—Professor Wittrock, of Stockholm, is publishing *Exsiccatæ* of the genus *Erythræa*. He wishes to include the North American species and forms, and no less the European species as naturalized in the United States. I am to ask American botanists, who can do so, to prepare for this work a set of a hundred or two hundred specimens (enough for thirty-five copious sets), of any species within their reach. For compensation, by exchange or otherwise, they should correspond with Dr. N. Wittrock, Royal Academy of Sciences, Stockholm, Sweden.—A. Gray.

Notes on Economic Botany.—*Ascyrum Crux-Andreæ*, L.—The crushed leaves, and especially the half ripe pods of "St. Andrew's Cross," are used quite extensively by the country people for checking bleeding at the nostrils. The parts used are crushed in the hand and the aromatic emanations inhaled, which seem sufficiently astringent to contract the capillaries and check the flow of blood.

Cotton Seed.—Before the manufacture of cotton-seed oil became so great an industry in the Southern States, the seeds of the cotton plant were largely a waste product. Cattle were fed on the fresh seeds, to some extent, and sustained no injury, but swine were killed by them. It was the custom among some planters to throw the seed into the water during the rainy season, in such situations as became dry during the summer. Maceration for several months placed the seed in a condition to be used by swine as food, and during the dry season the seeds were eaten by them greedily without injury.—F. L. HARVEY, *Fayetteville, Ark.*

Rudbeckia hirta, L.—I collected July 28, 1882, in Shelburne, N. H., a specimen of *Rudbeckia hirta*, in which the tubular disk flowers were all changed to ligulate flowers, nearly twice their ordinary length. The ray flowers were as usual. The accompanying sketch illustrates the flower.—WALTER DEANE, *Cambridge, Mass.*



Variation and Human Interference.—DEAR EDITOR—I have this spring received from one source wild specimens of *Thalictrum anemonoides*, with full double flowers; from another, *Epigæa*, in the same condition. As these variations can not well be regarded as advantageous to the plants themselves, will you report the case to Dr. Sturtevant, who has made an acute suggestion about such things, and ask him if we are to infer that the aborigines of Maryland and New Hampshire were in former times floriculturists?—A. G.

What a Lilac Bush did.—Two cut stones forming a part of a corner foundation of Dr. Gray's residence at Cambridge have been misplaced by a lilac bush which some years since insinuated itself into a very close joint in the stone-work. The lower stone which has been misplaced is three feet long, about a foot high, and eight inches deep. Upon this rests a stone of similar shape, two feet long. These stones form one end of the wall. In the joint between the lower stone and the main body of the wall the lilac sprout established itself. The bush, now scarcely more than an inch in diameter, has forced the lower stone an inch away from the remaining wall in a horizontal direction. Moreover, the upper stone, being attached to the lower by mortar and being held down by the weight of the building, has shared equally in the displacement.—L. H. BAILEY, JR.

EDITORIAL NOTES.

POLYEMBRYONY, arising probably from the formation of more than one germ cell in the embryo sac, has been noticed in *Trifolium pratense*.

MAXIME CORNU, the distinguished botanist, has recently been appointed *Professeur de culture* to the Jardin des Plantes at Paris, as successor to the late M. Decaisne.

A strong popular interest is manifested in England in the scientific results of the study of the diseases of cultivated plants.

Prof. W. W. Bailey, of Brown University, reports finding a raceme of *Cytisus Canariensis*, a common hot-house plant, terminated by a well-marked leafy branch.

In Mr. L. H. Bailey's supplement to his catalogue of N. Am. Carices several additions and emendations are made, making the whole number of species catalogued 200, varieties 85.

"The botanists of this country need arousing, they are far behind their zoological brethren," says a cotemporary. This is lamentably true, but not to the extent that the page devoted to the subject in *Science Record* would lead one to believe.

The notable botanists from across the Atlantic who may be quite confidently expected to attend the American Association at Philadelphia are, so far as now known, Sir Joseph Hooker, Prof. W. R. McNab, Mr. John Ball and Sir J. Lubbock.

The preparations for the entertainment of botanists at the Philadelphia meeting are steadily progressing. Among the special excursions decided upon is one to the Bartram house and garden at Kinsessing, and another to the pine barrens of New Jersey.

Pulverized plants dissolved in distilled water have been used recently in some experiments in plant physiology. It is suggested that the solution will probably prove useful in many cases where it is desired to determine the amount and quality of plant food.

Warming opposes Ludwig's theory that *Philodendron bipinnatifidum* is fertilized by snails (Bot. Gaz. viii, 230), and considers that it is effected by "small black bees." During the flowering of this Aroid a rise of temperature to the extent of 18.5° C. takes place.

By studying their development, Urban has concluded that the axillary spines of the *Aurantiaceæ* are the metamorphosed lowermost leaves of a theoretical axillary shoot. This explanation is confirmed by finding intermediate forms in some species of *Citrus*.

Rev. Francis Wolle's new work on the *Desmids of the United States* will contain fifty-three colored plates, and descriptions of nearly five hundred species. It is published at the very low price of five dollars; subscriptions should be sent to the author at Bethlehem, Pa.

The colors of the various parts of plants is not always due to the presence of pigments in the cell-sap. The dark violet-blue of the roots of *Pontederia cordata* is owing to the color of the cell-wall itself. The pigment of the bright red roots of *Wachendorfia thyrsiflora*, though diffused in the cell-sap, is formed even in absolute darkness. The bright red of the fruit of *Rivina humilis* and the bracts of *Euphorbia fulgens* is produced by the superposition of cells having different pigments.

L. W. Russell records in Random Notes a specimen of *Sassafras officinale* having the following dimensions: Circumference at the ground, 14 ft., 3 in.; 2 ft. up, 11 ft., 10.5 in., holding its size with little diminution to the first limbs, 11 ft. up. The height of the tree computed from its shadow was 49.5 ft.

Busgen has repeated Darwin's experiments made some years ago on *Drosera rotundifolia*, and has obtained even more decisive results. From three to five times as many pods were produced on those plants whose leaves were fed with insects as on those unfed, though the latter had an abundance of nutriment about the roots.

Profs. Coulter and Barnes are engaged in a special study of the North American species of the genus *Cyperus*. Any specimens that they can beg, borrow or buy will be thankfully received. Loaned specimens will be retained for as short a time as possible and carefully returned. Any assistance rendered will be fully acknowledged.

There has been a sharp conflict in England between theory and practice, in regard to the question whether the spores of *Peronospora infestans* can filter through five inches of soil and infect uninjured potatoes with the rot, or not. We sincerely hope that the puerile and undignified tone of the controversy will not be adopted by botanists on this side of the Atlantic.

The result of experiments with 21,000 specimens of *Mercurialis annua* and 6,000 of *Cannabis sativa* show that external influences have little or no influence on the production of seedlings of one or the other sex in these diœcious species. In the former species the number of male flowers was greater and in the second species less than the number of female flowers. Similar experiments with monœcious plants gave similar results.

A careful study of the differences between the aerial and subterranean parts of the same stems has revealed the fact that the differences are to be attributed to environment rather than to hereditary tendencies. The chief differences are in the greater development of the protecting tissues; the reduction or disappearance of collenchyma, liber-fibers, etc.; great development of cortex and reduction of pith, and feeble lignification.

Cyperaceæ, Pollen Grains, and Vegetable Monstrosities are botanical subjects lately presented before societies; the first by the Rev. E. J. Hill, with herbarium and microscope illustrations, before the State Mic. Soc. of Ill., the second by Mr. Joseph F. James, with lantern illustrations, before the Cincinnati Soc. of Nat. Hist., and the last by Dr. G. L. Goodale, with illustrations from the Cambridge Botanic Garden, before the Boston Soc. of Nat. Hist.

"The Milk in the Cocoanut" is the title of a racy paper by Grant Allen, reprinted in the May *Popular Science Monthly* from *Cornhill Magazine*. In a charming popular way he explains not only the existence of the milk, but also the significance of the three scars and the triangular shape of the fruit. The latter he supposes indicative of liliaceous ancestry, which may be true and may be not. Like all his deductions, however, it is well worth reading.

BOTANICAL GAZETTE.

VOL. IX. JULY, 1884. NO. 7.

Notes on Phoradendron flavescens, Nutt. II.

BY J. SCHNECK.

The northern limit of this species, so far as I can ascertain, is near 40° N. lat., except near the Atlantic and Pacific coasts. Gray[1] and Wood[2] both give its habitat as New Jersey to Illinois. and southward. Wm. M. Canby[3] reports it as "frequent" on the peninsula between Delaware and Chesapeake Bay. Lester F. Ward[4] reports it from the vicinity of Washington, D. C.; John M. Coulter and C. R. Barnes[5] for the State of Indiana, as "common south." H. N. Patterson[6] reports it from Wabash and Jackson counties, in Illinois. The most northern station given in the Pacific R. R. Rep., is Benicia, California. It is not mentioned in Bot. King's Exped.; while in Bot. Wheeler's Surv. W. of 100th meridian var. *villosum* is reported from Oregon. Mr. W. M. Canby writes me that he has observed it between Trenton and New Brunswick, N. J. These last two are the only stations of which I have any knowledge north of 40° N. lat. Mt. Carmel, Ill., is near 38° 30′ N. lat., with a range of temperature from +104° to —26° Fahr. When we have several consecutive mild winters the mistletoe becomes common, but is again almost exterminated by the return of continuous cold weather, in which the thermometer remains at or below zero for a number of consecutive days. The winters of 1878–79 and 1880–81 were remarkable for the great number of continuous cold days, and came near exterminating the species from our flora. The two following winters were comparatively mild, and as a result the mistletoe was quite abundant last fall. But the unusually severe January we have just passed through has killed most of the bunches.

Does the mistletoe injure the host upon which it grows? My

[1]Manual, 1868. [2]Class-Book, 1860. [3]Bot. Gaz. 6. 271. [4]Flora of Washington and vicinity. [5]Cat. of Indiana Plants. [6]Cat. of Illinois Plants.

observations lead me to answer this question in the affirmative, but in a limited degree. When a thrifty bunch infests a limb, the distal extremity soon ceases to grow and finally dies, unless it be a very large limb; but the tree itself seems to be little, if at all, affected in its growth.

The host on which this parasite is found is peculiar in some localities. During the past eighteen months I have observed it on the trees in this vicinity, as follows: *Acer dasycarpum*, on 6 trees; *A. saccharinum*, 5 trees; *Ulmus fulva*, 1; *Quercus palustris*, 1; *Gleditschia triacanthos*, 28; *Ulmus Americana*, many thousand. In the lower portion of Delaware it is reported as having been found only on *Nyssa multiflora* and *Acer rubrum*[7]; in the vicinity of Washington as "exclusively on *Nyssa multiflora*[8]." The American Elm is not a rare tree in either of these localities, while on the other hand the Black Gum is a common tree in this vicinity, and I have never found a single bunch of mistletoe upon it. I have observed the Elm and Black Gum interlock branches, the former bearing mistletoe and the latter not. In this vicinity it is generally found on trees that grow along streams and on bottom lands, and is rarely seen on the uplands. I made the following notes from the car windows on a visit to Washington, D. C., in February, 1883, starting from Mt. Carmel, Ill., and traveling via Louisville, Ky. "Abundant, but only on the American Elm, until we came to Winslow, Ind. Here for the first time I observed it on the Black Gum. From this on I found it on this species as often as on the Elm. In the blue-grass region of Kentucky I found it common on the Black Walnut and Wild Cherry. In West Virginia it was common on the Red Maple, but had disappeared from the walnut and cherry. East of the Blue Ridge I observed it on a Beech."

Prof. John Collett[9] gives the following list of trees on which he has observed it in Vanderburg county, Indiana, and the relative frequency of its occurrence on them for 1,000 trees: Black Gum, 500; Red Elm, 420; Water Birch, 20; Black Walnut, 15; Honey Locust, 10; Blue Ash, 10; Soft Maple, 10; Hackberry, 5; Yellow Willow, 5; Shell-bark Hickory, 2; Spanish Oak, 1; White Oak, 1; Wild Cherry, 1. In addition to the above I find records of its growth as follows: Prof. J. M. Coulter[10] reports it as occurring on the Elm and Black Walnut, near Louisville, Ky., and on the "Elm, Walnut, Honey Locust and various other trees," in the vicinity of Hanover, Ind. A. H. Curtiss[11] says "it

[7]Bot. Gaz. 6. 271. [8]Flora of Washington and vicinity. [9]Ind. Geol. Surv. 1875, p. 241. [10]Bot. Gaz. 2. 116. [11]Bot. Gaz. 3. 36.

abounds in Florida, where it may be found on nearly every kind of tree. We know of one plant growing on a low *Prunus Chicasa* only eight feet from the ground." Dr. J. S. Newberry[12] reports var. *pubescens* as being found on *Æsculus Californica*, at Benicia, California. Dr. J. Torrey[13] states that var. *orbiculatum* was found on *Quercus Emoryi*, in New Mexico, and var. *pubescens* on *Q. agrifolia* in Southern California. In Bot. Mex. Bound. he reports var. *glabriusculum* as being found on *Algarobia glandulosa* along the Rio Grande. Dr. George Engelmann[14] says of var. *macrophyllum* that it was found on soft woods, the Ash, Willow, Poplar, Sycamore and Sapindus, along the Gila and Bonita rivers; and of var. *villosum*, that it was found on hard woods, principally Oaks, in Oregon, California and Arizona, and in the mountains of Arizona on *Q. undulata*. I am informed by perfectly reliable authority that it is common on the Persimmon in the southernmost counties of Illinois. L. F. Ward informs me he has observed it on *Acer rubrum* in the Dismal Swamp.

Notes on the Flora of W. Dakota and E. Montana Adjacent to the Northern Pacific Railroad.* I.

BY JOHN B. LEIBERG.

While in the service of the Northern Pacific Railroad Company during the past year in the interest of tree culture, I had abundant opportunity to examine the interesting and, to some extent, peculiar flora of Western Dakota, and to a limited degree the eastern portion also, and the eastern part of Montana as far west as the Yellowstone river at Glendive, and to make large and full collections of the same. Copious and interesting notes were made respecting the botanical features of the region, and a few of the more prominent are here presented.

The climate of Eastern Dakota, in both rain-fall and temperature, does not appear to present any great variation from that of the prairie region of Western Minnesota, except, perhaps, a somewhat longer winter. The climate of the western portion is very different. The summer is very dry; showers are of rare occurrence, and the temperature varies excessively. Thus in the month of July the mercury rose to 115° Fahrenheit, and fell to 32°.

[12]Pacif. R. R. Rep. [13]Pacif. R. R. Rep. [14]Bot. Wheeler's Expd. 252.

*Read before the Minnesota Academy of Natural Sciences, March 4, 1884.

Such great variations can not fail to modify plant life to a very great extent. The hot, scorching winds that generally accompany the high temperatures quickly dry up all vegetation, except along the water-courses. The extreme dryness of these hot winds is remarkable. During the great heat which prevailed in the early part of July, I saw the grass on the prairie, which was green and fresh as prairie grass usually is, completely dried up and converted into hay within a period of two hours. As a consequence of this dry weather, we find no annuals in summer. They only appear during the spring while the ground is still moist. The perennials all have long root-stocks, which penetrate deeply into the ground and enable them to withstand the drouth effectually.

The surface of the country west of the Red river valley is more rolling than in Minnesota, and is found still more so as the Missouri river is approached. Numerous stony knolls and long ranges of rocky, pointed hills mark the ancient glacial moraines. The flora here shows plain indications of the proximity of the dry, treeless plains west of the Missouri, though at the same time the climate is humid enough to permit species of plants to grow and flourish, whose principal habitat is much farther eastward. Here and there alkaline pools appear with their peculiar plants, adding largely to the variety of the flora of this region. Many species are found whose home in the southwest is at a high elevation, proving that as we go north the increase in latitude compensates for a decrease in elevation.

Scattered over the drift hills in great abundance, and the first flower to appear in spring, is *Anemone patens*, L., var. *Nuttaliana*, Gray, attaining a luxuriance of growth never met with in Minnesota. After crossing the Missouri and the western boundary of the glacial drift, this plant wholly disappears. In the moist places of the prairies is found *Ranunculus glaberrimus*, Hook., and around alkaline ponds *R. Cymbalaria*, Pursh, the latter being very abundant west of the Missouri river. Another representative of this genus resembles *R. rhomboideus*, Goldie, but differs from that in its more erect and taller growth and much smaller flowers. It appears to be some undescribed species.

A *Draba*, probably *D. nemorosa*, L., is quite plentiful. Early in the spring, and flowering until late in the summer, we find *Vesicaria Ludoviciana*, DC. *Erysimum asperum*, DC., var. *Arkansanum*, Nutt., is abundant as we proceed westward, becoming a very conspicuous plant. Around the alkaline ponds grows a *Nasturtium*, near *N. sinuatum*, Nutt. It may prove to be only a variety of this species.

Cleome integrifolia, Torr. & Gr., which is found here and there in Minnesota as an introduced plant, is first met with in its indigenous state in Pyramid Park, near the Little Missouri river. There also, and nowhere else in the territory under consideration, *Cleome lutea*, Hook., was observed. *Polanisia graveolens*, Raf., was frequently noticed along the water-courses, differing somewhat from its character in Minnesota, in having a more clammy pubescence and longer and more turgid pods.

Viola Nuttallii, Pursh, was met with abundantly, but does not extend to any great distance west of the Missouri river, and was not observed east of Jamestown. *Viola cucullata*, Ait., was not rare in the region covered by the drift, but was confined to the borders of the numerous small ponds.

A *Cerastium* and two species of *Arenaria*, not determined, were very common. One of the Arenarias was met with only on the top of the buttes west of the Missouri, forming dense tufts, the short stems closely covered with small rigid leaves, giving it a spiny appearance.

A rather common and showy plant was *Malvastrum coccineum*, Gray, the only one of the *Malvaceæ* seen.

Two species of *Linum*, *L. rigidum*, Pursh, and *L. perenne*, L., were found. The latter grows very rank, with showy blue flowers, often more than an inch in diameter. The seed-vessels were observed later in the season and were found to be nearly as large as in the cultivated flax (*L. usitatissimum*, L.), with seeds about half as large, of a shining dark brown color, and apparently containing a considerable proportion of oil. The question arises, whether this wild flax could be improved by cultivation so as to equal in fiber, if not in oil, the *L. usitatissimum*. It is well worth experiment to determine these points, more especially as it is a perennial, while the cultivated flax is an annual.

Polygala verticillata, L., and another species, of which no published description could be found, were frequently collected west of the Missouri, extending into Montana.

As might be expected, the *Leguminosæ* were well represented, but a lack of authorities and published descriptions prevented full and complete determinations of the many interesting species collected. Fourteen species of *Astragalus* were observed, among them *A. simplicifolius*, Gray, and *A. triflorus*, Gray. The former was observed only in Montana, on the hills between McClennan and Hodges stations on the Northern Pacific Railroad. *Psoralea argophylla*, Pursh, *P. esculenta* Pursh, and *P. lanceolata*, Pursh, were noted. The latter possesses the peculiarity of forming at maturity a perfect joint on the stem near the ground. A light wind will then cause the plant to break off and go rolling along in the same manner as happens with *Amarantus albus*, L. (commonly called "tumble-weed"), on the prairies of Minnesota. *Psoralea argophylla* and *esculenta* also break off near the ground, but do not appear to form a distinct joint. The separation in these species is effected by means of a constriction on the stem, which cuts off, as it were, the nourishment from the root, and causes the stock to shrivel at that point, when the least touch or gust of wind releases the plant. On the hills near Mandan, and in no other place along the route, *Petalostemon macrostachyus*, Torr., was collected. Here also *P. villosus*, Nutt., was quite abundant. *Amorpha fruticosa*, L., and *A. canescens*, Nutt., were both well represented, but a little farther westward they were largely replaced by *A. microphylla*, Pursh. *Oxytropis, Desmodium, Vicia, Lathyrus* and *Hosackia* were found in abundance throughout the territory. *Lupinus perennis*, L., was met in the valley of the Green river; also an apparently undescribed species of this genus was collected.

Eleven species of *Potentilla* were collected, among them *P. Pennsylvanica*, L., and *P. fruticosa*, L., the latter nowhere except in Pyramid Park. Only one species of *Prunus* was seen west of the Missouri river, namely, *P. pumila*, L. Growing abundantly on the rocky buttes was *Chamærhodos erecta*, Bunge. So far as I know, this plant has not before been referred to this region. Our most common species of strawberry (*Fragaria Virginiana*, Duchesne) abounds east of the Missouri, but is very infrequent farther west. The hot dry weather prevailing during June and July doubtless proves unsuitable for its growth.

A gooseberry (*Ribes*) near *R. Cynosbati*, L., of a low bushy form, thickly armed with long stout prickles, grows on the summit of the dry baked clay hills of Western Dakota and Eastern Montana. Although growing in these extremely dry localities, it was heavily loaded in the month of July with large ripe juicy fruit, possessing a sweet and agreeable taste. Aside from scattered patches of *Shepherdia*, this was the only native edible wild fruit that was observed along the route after crossing the Missouri.

Hippuris vulgaris, L., rare in Minnesota, is plentiful in every little stream west of the Missouri, provided it is not alkaline and contains water sufficient to prevent complete evaporation during the dry season.

Of the *Onagraceæ*, *Epilobium palustre*, L., and *E. molle*, Torr., were sparingly found; more common were *Œnothera cæspitosa*, Nutt., and *Œ. albicaulis*, Nutt., the latter extending as far as to Muskoda station east of the Red river. Much more rare was *Œ. Missouriensis*, Sims. *Gaura coccinea*, Nutt., was very abundant.

Three species of *Cactaceæ*, *Mamillaria vivipara*, Haw., *Opuntia Missouriensis*, DC., and *O. Rafinesquii*, Engelm., were plentiful. *O. Missouriensis* was first observed, in going westward, on the hills around Mandan.

The *Umbelliferæ* were mostly represented by species of *Peucedanum*, *Cymopterus* and *Musenium*. Of these only one, *Peucedanum nudicaule*, Nutt., extends as far east as Minnesota.

On the Formation of Starch in Leaves.

In a recent communication to the *Arbeiten des Botanisches Institut*, in Wurtzburg (Bd. III), Prof. Sachs gives the results of his work during the past summer in connection with the above subject. The investigations were made with the object of determining the formation and disappearance of starch in the leaves of plants growing in the open, and under normal conditions of vegetation, and were carried on chiefly during the months of June, July and August on a large number of Dicotyledons from various families. Some twenty-two years ago Prof. Sachs showed that the presence of starch in chlorophyll grains could readily be detected by means of the now well-known iodine test, a modification of which was employed in these researches.

If fresh, green leaves are plunged in boiling water for ten minutes or so, certain soluble substances are extracted, but the starch and coloring matter of the chlorophyll grains remain in the still unbroken cells of the mesophyll. A short immersion in alcohol now removes the green coloring matter and certain bodies soluble in alcohol, leaving the starch behind in the colorless tissue. The presence of acids affects the degree of whiteness of the decolorized leaf; and the decolorization proceeds more rapidly in sunlight or warm alcohol than in the dark and cold. Leaves of *Tropæolum* may be rendered completely white, like writing paper, in two or three minutes.

If the decolorized leaf be now placed in a strong solution of iodine in alcohol, the presence or absence of starch may be demonstrated in a few minutes. If no starch is present, the cellular tissue simply presents the well-known yellow color; if a large quantity of starch exists in the cells, the tissue appears blue black, the venation appearing as a pale network in the dark ground. Paler colors result if but little starch is present at the time of the experiment.

It will readily be seen how useful the above method is for the purpose of demonstrating the absence of starch from etiolated leaves, the white portions of variegated foliage, etc , and the sequel shows that the method affords means of obtaining far more delicate results, without the trouble of a microscopic examination.

In the first place the same leaf may be found to contain very different quantities of starch at different periods of the day, or according to the weather; and secondly, the increase and decrease of the quantities of starch in a given leaf may be very rapid.

Sachs showed long ago that if a plant is placed in the dark, starch disappears from the leaves; and it has also been known for some time that if a piece of tin foil is placed on a leaf, the covered portion forms no starch although the parts exposed to light may become filled with that substance. Moreover, Kraus showed how very rapidly starch can be formed in direct sunlight.

Sachs now demonstrates on a number of plants that the starch formed in the leaves during the day may disappear completely during the night, and that the leaves shown to be full of starch in the evening may be quite empty of starch the next morning. This depends upon the temperature and health of the plant, but occurs normally during the summer in plants growing in the open. A large number of experiments are given in support of this, showing how the rapidity and completion of the process depends upon the weather.

The experimental proof is very simple. A leaf is halved longitudinally at night, after a fine sunny day, and the excised half is shown to be filled with starch by the iodine test described; the remaining half is tested early next morning, and shows at once if any material diminution has occurred during the night. A simple and obvious modification of this experiment gives an idea of the quantity of starch formed between sunrise and sunset. The half leaf tested before sunrise shows no trace of starch; the other half left on the plant during the day is found to be more and more filled with starch towards the afternoon.

Some curious results were arrived at as to the effect of growing parts on the rapidity of the emptying of the leaves; some of these matters still require investigation.

Differences in the weight of the leaves and in the intensity of the color produced by the iodine test, as well as some other observations, lead to a better understanding of a fact already known generally, viz., that the starch disappears from the leaves in the form of glucoses, which travel by way of the vascular bundles into the stems, and thus pass to the places where they are used up in growth.

Some very telling observations were made in this connection, and the dependence of the processes on temperature again show forth clearly.

These results lead to the conclusion that the process of metamorphosis into glucoses and translocation of the products of assimilation are also going on during daylight, though they are less evident, because more starch is then being formed and accumulated than is abstracted at the time. Moll proved that such is the case by exposing leaves to the sunlight, but in an atmosphere devoid of carbon dioxide, the starch already in the leaves disappeared and no more was formed to replace it. Sachs repeated Moll's experiment, and proved the correctness of his conclusions by means of the iodine test. Half leaves were shown to be full of starch; the companion halves were put into closed atmospheres, deprived of carbon dioxide by means of potassium hydrate, and were exposed to sunlight. In an hour the latter halves were tested and found to be nearly emptied of starch. Other experiments proved that depletion occurred in a few hours, the time depending on the temperature.

Further experiments demonstrate that the starch travels in the form of glucoses in all the above cases, but it is not proved whether the metamorphosis is effected by forces in the chlorophyll grains themselves or by means of diastatic ferments in the cells of the leaf.

Perhaps the most ingenious part of the paper is that which now follows. It is well known that Weber's patient and thorough researches on the energy of assimilation led to two important results among others: (1) that the quantity of starch formed by a certain area of leaf surface in a certain time may be relatively very large, and (2) that different plants probably differ specifically as to the quantity of starch formed in their leaves.

Sachs proposes to apply his method to the solution of this question, i. e., how much starch is produced in, say one square meter of leaf surface by assimilation during, say ten hours of bright sunlight? The great difficulties in Weber's researches were connected with the enormous labor necessary to measure the leaf surface accurately.

Sachs resolved the matter in a manner which we may summarize thus: He cut off portions of large leaves found to be empty of starch, measured them rapidly by laying them on pieces of board cut to the size of one square meter, and weighed the measured portions very rapidly. Certain precautions as to the area of fibro-vascular bundles, the possibilities of absorbing hygroscopic moisture, etc., may here be passed over. Supposing these portions of the leaves to be estimated in the morning, a quantity of the same leaves of equal area gathered in the evening was then compared, an l the increase in weight gives the quantity of starch formed in the interval. By weighing large areas, and frequently, and by paying attention to the times and other circumstances, a large number of results were obtained, showing that the quantities given by Weber, for instance, are within the mark. Of course these results are not absolute. Starch is being changed into glucose, and passing away during the day, and some must be burnt off in respiration; moreover, a certain minute quantity of mineral ash should be allowed for. Of course it is an assumption that equal areas of mesophyll of the same leaves contain approximately the same amount of substance; nevertheless, if a large number of experiments are made, the error is probably small.

Experiments were made to show both the quantity of starch which disappears during the day and the quantity which is formed during the day. A few of the numbers may be given. In *Helianthus*, 9.64 grms. of starch disappeared in ten hours from one square meter of leaf-surface.

In the same plant 9.14 grms. were formed in the same time by the same area of leaf-surface.

In another case *Helianthus* was used, but the leaves were removed from the stem to prevent the passage back of the starch from the mesophyll into the stems.

A square meter was found to produce starch at the rate of 1.648 grms. per hour.

By combining his experimental results and taking note of all the circumstances, Sachs concludes that 20 to 25 grms. of starch may be produced per day by one square meter of leaf-surface as an ordinary occurrence, and these numbers are not only not excessive, but experiments show that there are plants which produce much more than those investigated here.

Some remarkably interesting and important results follow from the consideration of these experimental data.

They explain why plants are so vigorous during warm nights following upon hot, bright days. The more readily the products of assimilation (formed in large quantities during the day) can pass into the growing organs, the better these are nourished, etc.

Leaves used as fodder, etc., must differ in nutritive value to a very great extent if their starchy contents vary so largely during the day and night; it thus becomes of primary importance whether such leaves are gathered in the morning or the evening, in cold or warm weather, etc. The same applies to *tobacco* and *tea*, etc. It must make a vast difference to the smoker whether his tobacco abounds in carbohydrates or is relatively richer in the alkaloids. It appears that tobacco is habitually cropped in the morning in some countries, a fact which suggests what experience has already shown that a difference in the quality exists; it will be interesting to inquire further into these matters.

Sachs' results will also materially affect the physiological value of the analysis of leaves. Some of us know how great are the variations met with in the analysis of the ash contents of leaves of the same plant. It is clear that in addition to the age of the leaf, the soil, manure, etc., it is important to know the amount of starch present. It can not but happen that the mineral matters ebb and flow as well as the starch. The analysis of leaves will also be more valuable for the purposes of physiology if the numbers are stated not in simple percentages, but in terms of one square meter of leaf-surface.

The above brief summary of the results obtained by Prof. Sachs by no means does justice to the beauty of his methods, and the masterly way in which they are carried out; it must be admitted by all who understand the value and importance of this work that it is worthy of the great pioneer of vegetable physiology. Moreover, it suggests several matters which require further investigation, and no doubt would yield valuable results to those fortunate enough to have a botanical garden at hand.—*H. Marshall Ward, in Nature, XXIX., 554.*

GENERAL NOTES.

Necrology.—Augustus Fendler died on the island of Trinidad, November 27, 1883, at the age of seventy-one. This we learn only at the present date, by a memorandum which was found on the table of the lamented Dr. Engelmann who was so soon to follow him. Fendler was born in Eastern Prussia, somewhere near Königsberg, received a good ordinary education, came to this country not far from the year 1840, was selected by Dr. Engelmann and the present writer to make a botanical collection in the northern part of New Mexico on the occasion of the movement of the United States troops to Sante Fé in 1846. Afterwards (1856-7) he, with a younger brother, migrated to Tovar, a German settlement in the mountains of Venezuela, where he made a large collection of dried plants, and later a small one on the Isthmus. He then returned to his native country, but after a year or two his longing for botanical exploration and for a milder climate took him to Trinidad, where for a time he botanized with his old zeal and assiduity.

Fendler was a close and accurate observer, a capital collector and specimen-maker, very pains-taking and methodical, and his excellent distributed collections are classical, especially the first one, a large part of which was early named and published in the *Plantæ Fendlerianæ Novo-Mexicanæ*. It was the first collection made in that part of the country. He is commemorated in a beautiful and quite peculiar Saxifragaceous shrub, indigenous to New Mexico and Texas, *Fendlera rupicola*, and numerous species of his own discovery bear his name. He was very retiring and shy in habits, of refined bearing, and of a scientific turn of mind in other lines than that of his chosen pursuit of Botany. He kept up meteorological observations during most of his life, and he was very much interested in speculative physics. In the year 1874 he published at Wilmington, Delaware, where he then resided, at his own expense and, we suppose, with small returns, a well-written treatise (of 154 pages, 8vo.) on "The Mechanism of the Universe and its primary effort-exerting Powers; the Nature of Forces and the Constitution of Matter, with remarks on the Essence and Attributes of the All-Intelligent." He was one of the ingenious race of paradoxers, and it may be left to the future De Morgan to characterize his work. He will certainly be lastingly and well remembered in botany.

Alphonse Lavallée, as we are grieved to learn, died at Segrez, his country seat, a few leagues from Paris, on the third of May last, at the age of only about forty-nine. This is a most unexpected and a heavy loss to botany, and especially to dendrology. A gentleman of abundant means and of great public spirit, he had taken ornamental trees and shrubs for his specialty, had formed nearly the largest and best collection of these in Europe, and had devoted himself to their study with utmost assiduity, endeavoring to determine them correctly, to ascertain their history, and to settle their synonymy. His first publication upon the *Arboretum Segrezianum* was his Enumération des Arbres et Arbriseaux cultives à Segrez, an 8vo. vol. published in 1877, in which much attention is paid to the synonymy. In 1880 he began his fine illustrated work, the *Icones Selectæ Arborum et Fruticum in Hortis Segrezianis collectorum*, in imperial quarto, of which he had brought out five parts, the last in December, 1882, with thirty plates; and early in the present year he published, in the same sumptuous form and with great beauty of illustration, *Les Clematites à Grand Fleurs*, with twenty-two plates. He had in preparation a general monograph of *Cratægus*, to be illustrated by eighty plates. Very recent letters spoke of some failure of health, and of a visit made to Cannes for its benefit, also mentioning that he had been pressed to take the chair of culture at the Paris Museum, which carries with it the superintendence of the *Jardin des Plantes*, vacated by the death of Decaisne, but was obliged to decline it. A serious loss, indeed, is sustained in the death, at middle age, of this zealous collector of our science, this most liberal-minded, amiable, and accomplished man. A. G.

Helonias bullata in Northern New Jersey.—While botanizing in low grounds bordering on Budd's Lake, Morris county, last year, I discovered several clusters of *Helonias bullata* bearing scapes of faded flowers; owing to lack of time I was unable to see to what extent it was established. I again visited the same locality this year, and after further search I found growing in a piece of woodland several acres in extent, a great abundance of these plants, many of them in fine flowering condition. There can be no possible doubt that *Helonias bullata* has been well established for years in this locality. It has been collected in various portions of Southern New Jersey, its range extending as far north as Freehold, Monmouth county; the only other habitat north of this being at Succasunna, Morris county. I am therefore pleased to be able to make an important addition to the habitats of what appears to be the most northern limit of this plant in New Jersey.—EUGENE A. RAU, *Bethlehem, Pa.*

Abnormal Trillium.—An abnormal specimen of *Trillium erectum* was collected near here a few days ago. It had the regular whorl of three leaves, and at the peduncle, about half way between the leaves and the flower, was a fourth and a smaller leaf. The flower itself was four-parted throughout. There were four sepals, four petals, eight stamens, four pistils, and a four-celled ovary. Two of the sepals were half green and had the other halves colored like the petals.—JOS. F. JAMES.

Note on Viola cucullata.—The flowers of *Viola cucullata* have been remarkable this spring for their numbers and size. Banks are literally blue with them, and many are an inch in diameter. But what is stranger is that they are being largely visited by bees, and are setting fruit freely. Heretofore the fruit has been difficult to find, but it is not so this year. Probably the size of the flowers is the cause of the visits of the bees, and the visits the reason for the setting of the fruit. A curious variation of color was also noticed. The flowers were of a light lavender, not a deeper color faded out, because there were too many of them, and others close by and under the same condition were of the deepest blue. —JOS. F. JAMES.

Arisæma polymorphum, Chapman.—When in North Carolina a few summers ago, I kept a lookout for *Arisæma polymorphum*, but found only a single very small plant of something I thought might be it, and brought it home to my garden. This season it has become strong enough to flower. I have little doubt it is the plant intended under the above name. But while Chapman describes the species as with "leaf solitary," mine has two leaves, as Gray describes *A. triphyllum* "mostly" to have. One of these, the weaker, is simply trifoliate, the other is nearly but not quite quinate, the two lateral lobes being very deeply divided, forming two large auricles towards the base. The spathe is of a very pale green, and with the spadix smaller than the form common in our woods. It is in bloom to-day, June 1st. Our wild plant was in bloom full a month ago. Believing the two to be distinct I have been to the woods for a quantity for comparison, and find all the flowers apparently a couple of weeks over bloom, and all faded, so that I can not find a single one on the road to fertility. Now these leaves are all cinereous on the under surface, while the North Carolina one is pale green on both sides. So far there seemed to be some ground for distinction, but on looking about in the woods I found several in which one of the three leaflets was partly divided. In one case the division extended two-thirds of the distance towards the midrib. Still the gray under surface seemed uniform through all these wild plants. I was surprised to find all of them barren, and went to a locality where I knew I had collected ripe fruit, and found these plants quite different from the early ones. They were larger and stouter, purple stemmed, with two leaves on a stalk as in he North Carolina one, the leaves pale green on both sides, as in the North Carolina one, and just opening its flowers, also as in the one from North Carolina. I did not know before that there were early and late flowering ones with us; that the early ones had gray under surfaces, and that the early ones were barren. It will be interesting to know whether this holds good in other localities. But I suppose we shall have to consider *A. polymorphum* as merely *A. triphyllum*, without even honoring it with a varietal name.

By the way, Engler, in De Candole's monograph, adopts Schott's name, *Arisæma quinatum* for this *A. polymorphum*, and Blume's name, *Arisæma atrorubens*, for our *A. triphyllum* and varieties.—THOMAS MEEHAN.

EDITORIAL NOTES.

THE PHILADELPHIA MEETING promises to be an unusually important gathering for botanists.

ABOUT TWENTY BOTANICAL NOTES are found in the first part of the *Proc. Philad. Acad.* for 1884, principally by Mr. Thos. Meehan.

IN THE GAZETTE for April, p. 53, 54, *Antirrhinum Nevinianum* was by a clercal mistake given as *A. Niveniamum*. It should be corrected accordingly.

THE SUMMER COURSE IN BOTANY at Cambridge this year will be under the charge of Prof Wm. Trelease. It begins July 7th and lasts six weeks, and among advanced students special attention will be given to the study of Cryptogams.

THE WHOLE EDITION of the translation of Nägeli and Schwendener's work on the microscope, about to be published by a London firm, was recently destroyed by fire. It will again be put through the press, however, with as little delay as possible. This is the most important work for botanists on microscopic manipulation yet issued in our language.

A SOCIETY for the protection of alpine plants has been formed at Geneva. "L'association pour la protection des plantes" is its title, and already it numbers about two hundred members. The means used are to spread a knowledge of the danger by means of correspondence and publications; to post placards in Swiss hotels; to cultivate for sale such alpine plants as can be grown in the valleys, and thus furnish them already potted for transportation.

As an instance of polymorphic species *Euphrasia officinalis*, L., might be mentioned. Mr. Frederick Townsend, in a recent number of the *Journal of Botany*, has grouped the many forms, naming fourteen groups, and preparing an analytical key which looks formidable enough for a large genus.

Mr. Meehan has published quite a sizeable catalogue, with notes, of the plants he collected in July, 1883, during an excursion along the Pacific coast in S. E. Alaska. He enumerates about two hundred and sixty species and the local notes with regard to occurrence, native names and uses are very interesting.

The method of sectioning diatoms practiced by Prof. W. J. Sollas, of England, and communicated by him to the Royal Microscopical Society, is to harden in a mixture of chromic acid, osmic acid, and absolute alcohol, stain with hæmatoxylin or eosin, and then cut by freezing in gelatine jelly, from which the sections are directly mounted in glycerine without passing through water. He hopes by this means to obtain a clear insight into the protoplasmic structure.

It is pleasant to note the interest taken in fungi in England. We have now to announce a manual covering the British Discomycetes, with illustrations of the genera, by William Phillips, F. L. S. The author's special knowledge and excellent facilities warrant us in anticipating a thoroughly good work. The price will not exceed $2.50, and a liberal subscription will reduce it. Address the author at Canonbury, Shrewsbury, England.

The fossil flora of Greenland now numbers 617 species, according to Prof. Heer's recent studies, distributed through the Cretaceous and Tertiary epochs. Only one dicotyledonous plant is known from the lowest beds, and the character of the vegetation shows the climate at that time to have been subtropical. A slow change took place until in the Lower Miocene no tropical forms remained, and the mean yearly temperature fell to about 53° F.

Switzerland has a society to prevent the extermination of wild plants, and England has introduced a bill in the House of Commons looking to the same end. In this country we have only a few local laws for this purpose, but we agree with *Science* that at present the danger of valuable kinds becoming extinct is very slight. Some are likely to become rare in certain localities, however, so that protective laws applicable to restricted districts would be desirable in special cases.

During the first two days of the Association at Philadelphia, botanists will find the registry book of the American Botanical Club at the Academy of Natural Sciences, and upon entering their names will become members of the club, and entitled to its privileges. A reception will be given the club on Monday evening, September 8, by the Botanical Section of the Philadelphia Academy of Sciences at the rooms of the Academy, it being the date of their regular monthly meeting.

At a February meeting of the Linnean Society of London, Mr. R. Miller Christy read a paper entitled "The power of penetrating the skins of animals possessed by the seed of *Stipa spartea*." The fact is well known that the seeds of *Spartea* are driven into the soil by means of a very sharp point and the power of hydroscopic movement possessed by the long bent and twisted awn. It also appears that animals, especially woolly animals, sometimes have their skins penetrated by these same seeds, but there is no evidence that they are directly a cause of death. Mr. Christy was of the opinion that this was a device to secure the dispersion of this seed (one of the "buffalo grasses") by means of the buffalo. But the opinion seemed to prevail in the Society that it was simply a contrivance for penetrating the ground, which is the common view in regard to it in this country.

THERE HAS NEVER been greater activity in the study of bacteria than at the present time. Among notable works lately issued are *Les organismes vivants de l'atmosphère*, by Miquel, *Bacteria*, by Magnin and Sternberg, both by authoritive bacteriologists, and the life of Pasteur, giving the methods of the great leader, of which an English translation will soon be issued by the Appletons. Among the recent announcements are the detection of the bacteria of yellow fever, by Dr. Domingos Freire, of Rio de Janeiro; the communication to the French Academy by M. Pasteur, that he is able to inoculate dogs and render them proof against madness; the accomplishment of what the German commission under Koch has yet failed to do, the transmission of cholera to the lower animals by Dr. Vincent Richards, of Calcutta, who experimented with pigs; and the discovery that flowing water retards bacterial development, by Dr. Pehl, of St. Petersburg.

A NEW WORK on British *Hymenomycetes* (mushrooms, toadstools, etc.) is to be published as soon as the subscription list will warrant the expense. Whoever has attempted the collection and naming of these plants has met with the great need of fuller and more exact descriptions, a need the present work is intended to supply. It is to embody translations from Fries' *Monographia*, a work so rare as to be practically inaccessible, as well as from the *Hymenomycetes Europæi*, the *Epicricis*, and the *Icones* of the same author. The rare classical scholarship of the eminent mycologist who has undertaken the work, the Rev. John Stevenson, assures us of the faithful rendering of the Latin text; while the assistance of several well known botanists who are elsewise to co-operate with the author, and the numerous illustrations by Worthington G. Smith, will together place the work among those indispensable to every amateur or professional botanist who gives attention to this group of plants. The fungologists of this country should not be tardy in encouraging so promising a work. It will be published in two octavo volumes at 10s. 6d. each. Subscriptions are to be sent to Rev. John Stevenson, Glamis, Forfarshire, N. B., Scotland.

′

BOTANICAL GAZETTE.

VOL. IX. AUGUST, 1884. NO. 8.

Notes on Carex.—I.

BY L. H. BAILEY, JR.

NEW SPECIES AND VARIETIES.

CAREX HALLIANA, n. sp. Culm a foot high, smooth or nearly so, very leafy; bracts leaf-like, with thin white auricles, the lower exceeding the culm; pistillate spikes about three, an inch long, often staminate at the top, erect, approximate, shortly peduncled; perigynium ovate, tapering at both ends, prominently many-nerved, thickly covered with short, stiff hairs, gradually produced into a white, smooth, toothed beak, longer than the ovate, acute, membranaceous, often dull-margined scale; achenium large, triangular-obovoid or rarely lenticular-obovoid.—Oregon, E. Hall, 1871. Differs from *C. hirtissima*, W. Boott, its nearest ally, in its leafy culm, larger spikes, larger and strongly-nerved perigynium with a stout, white, toothless beak. It is near *C. filiformis*, L. The specimen in the Gray Herbarium is numbered 606, and, evidently by some mistake, labelled *C. amplifolia*, Boott, in Olney's handwriting.

C. RIGENS, n. sp. Stoloniferous; rough throughout; culms 6′–12′ high, stiff, mostly longer than the stiff, rough, long-pointed leaves, their bases surrounded by the fibrous remains of leaves; lower bract green, nearly as long as the culm, the upper awl-pointed, little longer or shorter than the spikes; staminate spike an inch long, shortly peduncled; pistillate spikes about three, pale, sessile, not aggregated, one-fourth inch or less long or sometimes prolonged and staminate at the top; perigynium obovoid, large, angled, many-nerved, very gradually contracted into a stout base, gradually narrowed into a short entire or slightly toothed beak, mostly shorter than the very acute thin scale; achenium obovoid. *C. varia*, Muhl., var. *Arizonica*, Bailey, Carex Cat.—Tanner's Cañon, S. Arizona (*Lemmon, 2904*), San Luis

Potosi, Mexico (*Schaffner, 547, Parry and Palmer, 917*) Described without name by W. Boott in Proc. Am. Acad. XVIII, 172. The species resembles *C. varia* in aspect, but it differs widely in its stoloniferous habit, its scabro-puberulence, its shredded lower sheaths, stiff culms, large staminate spike, and especially in the greater size, more numerous and stronger nerves, and very different shape of the perigynium.

C. MULTICAULIS, n. sp. Culms very numerous, 1–3 ft. high, stiff and wiry, terete or in weaker specimens obtusely angled, smooth (or minutely scabrous beneath the flowers), their sheaths leafless, or produced into stiff, appressed tips an inch or so long, or on the barren culms 3–6 inches long and spreading; radical leaves few or none; scales, at least the lower ones, leaf-like and prolonged into a slender tip often exceeding the culm, their bases dilated and hyaline-margined; pistillate flowers 2–6, loosely disposed at the base of an androgynous spike, the lower one often remote; perigynium very large (3–4 lines long), strongly triquetrous, the sides at maturity cross wrinkled and often concave, much contracted into a stipitate base, very finely many-nerved (rarely the nerves obsolete below), tightly enclosing the minutely punctate achenium, the very short orifice entire. *C. Geyeri*, Boott, Ill. I. 42, in part. W. Boott, Bot. Calif. II. 229, in part. —California; Yosemite Valley (544 Torrey), Ukiah (39 Bolander), Big Trees (1635 and 2306 Brewer), Plumas Co. (Mrs. Ames), Duffield's Ranch (J. M. Bigelow); Alamanden, S. W. Oregon (Thos. Howell, 1884). This species, on account of the close resemblance of its inflorescence and perigynium to *C. Geyeri*, has always been confounded with that species. *C. Geyeri* occurs in the mountains of Utah, Colorado and Montana, and W. C. Cusick finds it in Union Co , Oregon. From the above species *C. Geyeri* is at once distinguished by its much smaller size, stoloniferous habit, few and very slender, rough, angular culms, flat and rough-edged leaves which equal the culm, the absence of foliaceous bracts, its one or two pistillate flowers, and the much shorter, obtusely angled perigynium, which is only one-nerved on the center of two sides. The stiff, prolonged and numerous culms of *C. multicaulis* are wholly unlike those of *C. Geyeri*. Dr. Boott, Illust. I. 42, speaks of Geyer's specimens as having rough culms, only one or two female flowers, and the bracts not foliaceous. In the specimens of Parry and Thurber he found the culm smooth, the female flowers three or five, and the bracts foliaceous. The Table 105 represents the culms of *C. multicaulis* with the enlarged fruit of *C. Geyeri.*

√ CAREX APERTA, Boott, var. DIVARICATA, n. var. Differs from the typical eastern *C. aperta* in its greater size, wider leaves and looser habit, and especially in its large perigynium and very conspicuously divaricate dark scales. *C. aperta, var. B.* Boott, Illustr. IV, 132 in part.—Colorado, Oregon. Var. *minor*, Olney exsicc. is typical *C. aperta.*

CAREX CANESCENS, L , var. DUBIA, n. var. Culm stiff, 1° high, longer than the long pointed leaves; spikes 3-6, all approximate, oblong, 10 20 flowered, light tawny; perigynium gradually narrowed into a beak half or more as long as the body, minutely rough on the angles above, nerved, about the length or a little longer than the scale. *C. helvola*, Blytt? Carex Cat. Bear River Cañon, Utah (No. 1231[a] King's Survey); perhaps also the No. 1018 of Wheeler's Survey from Twin Lakes, Colorado. The variety differs from *C. canescens* in its stiffer culm, mostly shorter leaves, oblong and tawny approximate spikes, and in the characters of the perigynium. Much resembling the European *C. helvola*, itself a doubtful species, but differing in its narrower scales, and its nerved and rough-angled perigynium. In Wheeler's Report, p. 277, after No. 1018 "possibly *C. canescens*, Blytt," should read "possibly *C. helvola* Blytt."

CAREX VESICARIA AND ITS ALLIES.

The limits of this species do not become more apparent as the amount of material accumulates. The distinction between it and *C. monile*, Tuckm., is small and in some cases is well nigh impossible to make out. Forms of *C. monile* frequently occur with a narrow and gradually beaked perigynium scarcely different from the European *C. vesicaria.* The perigynium appears always to differ from that species in texture and color, characters which can not be communicated in print. The following characters are given as aids to the present determination of five of the most perplexing species of the *Vesicariæ*:

*Staminate spike one, rarely two; pistillate spikes short, erect; stigmas usually two; plants small.

C. SAXATILIS, Linn., Fl. Lapp. 259. Sp. Plant. 976 in part. Stoloniferous; culm 4′-12′ high, sharply angled, about the length of or a little longer than the narrow and sharp-pointed leaves; pistillate spikes one to three, the upper sessile or nearly so, the lower mostly more or less peduncled, all dark purple, or at maturity becoming brown; bracts narrow, long-pointed, shorter or a very little longer than the culm; perigynium ovate-oblong or elliptic, nerveless or very inconspicuously nerved at the apex, rather abruptly contracted into a very short nearly entire beak, mostly longer than the more or less obtuse membranaceous scale. *C. pulla*, Gooden. *C. vesicaria* var. *alpigena*, Fries.—Rocky Mountains of British America to the Arctic Regions.

Var. GRAHAMI, Hook and Arn., Brit. Fl., Ed. 8, p. 510. Stouter, 12′-20′ high; perigynium lighter colored, often nearly straw-colored, prominently few-nerved, the beak longer and more conspicuously toothed. *C. Grahami*, Boott. *C. vesicaria, var. dichroa*, Anderss. *C. saxatilis*, var. *major*, Olney, King's Rep. 370.—High mountains of Colorado, Utah and northward.

Var. MILIARIS. Very slender, 6–16 inches high; leaves and bracts very narrow, almost filiform; spikes one to three, small (2–6 lines long, 2–3 lines broad), sessile or the lowest very short-stalked, brown-and-green, the upper usually ovoid or globular, sometimes very much reduced in size; perigynium ovoid, small, nerveless or nearly so, little inflated, the beak minutely toothed, about the length and broader than the acute, purple-margined scale. *C. miliaris*, Michx., Fl. Bor. Am. II. 174. *C. pulla, var. miliaris*, Carey in Gray's Man., 5th ed., 602. Moosehead Lake, Maine, and northward to Lower Canada and New Brunswick. The typical var. *miliaris* is at once distinguished from all other forms of C. *saxatilis* by its very slender habit, small, never purple spikes, and scarcely inflated perigynium. It is the least like the true representatives of the Vesicariæ. Unfortunately, most of the specimens from Maine and Canada which have been referred here are immature, but there is evidently a series of intermediate forms between this and the true *C. saxatilis*. The leaves, at least, do not appear constant. I suspect that many of the forms from that region are to be referred to *C. saxatilis*, var. *Grahami*. *C. rotundata*, Wahl., with which some of the specimens have been confounded, is more like depauperate states of *C. ampullacea*, with which Andersson unites it.—Cyp. Scand. 20.

Carex saxatilis was first described in the Flora Lapponica in 1737, before the advent of binomial nomenclature. In the Flora Suecica, 1745, the descriptive phrase from the Flora Lapponica was made a synonym of a new phrase. In the Species Plantarum, 1753, both descriptions were combined under the name *saxatilis*. The Swedish plant, with the earlier Scandinavian botanists, bore the name *saxatilis*. That plant is *C. vulgaris*, var. *alpina*, Boott (*C. rigida*, Gooden.). Dr. Boott, however, found specimens in the Linnæan Herbarium to prove that the Lapland plant, from which Linnæus' character was first drawn, is the *C. pulla* of Goodenough, to which he restored the name *saxatilis.* Finally, however, he regarded the species as too near *C. vesicaria.*

* *Staminate spikes two or more; pistillate spikes normally long, spreading or drooping; stigmas three; plants large.

† Perigynium conspicuously turgid, ascending at maturity.

C. VESICARIA, Linn., Sp. Pl. 979. Stoloniferous; culms stout, 1°–2½° high, scabrous, shorter than the upper leaves; leaves flat, 2–3 lines broad; pistillate spikes two to four, thick (4–8 lines in diameter), the upper sessile, the lower on weak or nodding peduncles; perigynium ovate-lanceolate, one-third or less as broad as long, gradually tapering into a slender beak, 12- or more nerved, longer than the inconspicuous scale.—California and Oregon, probably in Utah. (No. 1270, King's Survey, from the Uintas, is immature, but is probably to be referred here.)

Var. MAJOR, Boott. Hook. Fl. Bor. Am. II. 221. Mostly larger; perigynium long lanceolate, greenish or rusty, many-nerved, much longer than the small scale. Var. *lanceolata,* Olney. —Tomales Bay, California, and northward to British Columbia near the coast.

Var.? OBTUSISQUAMIS, Bailey, Carex Cat. Spikes short, sessile or nearly so; perigynium broadly ovate or ovoid, mostly purplish, rather abruptly contracted into a short, nearly entire beak, longer than the broad, purple, white-margined, obtuse scale. Var. *V.* W. Boott, Bot. Calif. II. 252.—Soda Springs, Head of Tuolumne River, California. (*Brewer, 1781.*)

The typical *C. vesicaria* with light straw-colored, about 12-nerved perigynium and closely-flowered spikes, is apparently rare in this country. Var. *major* differs widely from the species in aspect, but is connected with it by intermediate forms. Var. *obtusisquamis* strongly resembles *C. monile,* to which it may belong, and in the occasional occurrence of two stigmas, and the short, sessile, often colored spikes, it approaches *C. saxatilis.*

C. MONILE, Tuckm., Enum. Method. 20. Culms usually more slender, leaves a little narrower; spikes more slender; perigynium subglobose, much inflated towards the base, one-half or more as broad as long, abruptly short-beaked, 10- or less nerved. *C. Vaseyi,* Dewey, Sill. Journ., Sec. Ser. 29, 347.—Ostrander's Meadow, California (*Bolander, 6211*), Colorado (*Vasey, 584c.*), and throughout the Northern United States east of the Mississippi to Subarctic British America. Dr. Boott, in his Illustr. I. 28, speaks of a form of *C. monile* with a rough beak. Upon this form Dr. Dewey founded his *C. Vaseyi.* It is not a hybrid. *C. monile* is referred to *C. vesicaria* by Otto von Bœckeler in Linnæa, 41, p. 320.

††Perigynium not conspicuously turgid, squarrose at maturity and the spikes comose in appearance.

C. UTRICULATA, Boott, Hook. Fl. Bor. Am. II, 221. Somewhat stoloniferous; culm stout, acutely angled above, very thick and spongy at the base; leaves broad (2 6 lines), carinate at the base, much exceeding the culm, conspicuously nodulose-reticulated; pistillate spikes two to six, more or less remote, the upper sessile, the lower often on weak peduncles an inch or two long, long-cylindrical or terete (1-7 in. long), thick and compactly flowered (sometimes loosely flowered at the base), often male at the top; perigynium ellipsoid or globose-ovoid, usually gradually tapering into a short beak, broader and commonly longer than the very acute or rough-awned scale. Var. MINOR, Sartwell, is smaller in all its parts, with spikes an inch or so long.—Generally distributed in swampy places throughout the Northern United States, entirely across the continent, and in British America.

C. AMPULLACEA, Gooden., Obs. 207. Strongly stoloniferous?; culm rather slender, obtusely angled, not conspicuously thickened at the base; leaves narrow (¾–2 lines broad), canaliculate, finely and inconspicuously nodulose below; spikes fewer, narrower and shorter, more approximate, the lower seldom conspicuously exserted; perigynium subglobose or globose-elliptic, in typical forms more shortly and abruptly beaked, longer than the normally muticous scale.—Colorado and northward, evidently throughout Western British America. The typical form is not common, and perhaps it does not occur within the limits of the United States. Specimens from our Rocky Mountain region appear to have nearly flat leaves. Von Bœckeler uses *C. rostrata*, Withering, for this species and proposes *C. Michauxiana* for the *C. rostrata* of Michaux.

John Williamson.—Obituary.

BY GEO. E. DAVENPORT.

In the BOTANICAL GAZETTE for June, 1878, the writer called attention to a hand-book on the "Ferns of Kentucky," then in the course of preparation, and asked for it a favorable reception.

Now it has become his painful duty to tell the readers of the GAZETTE that the author of that book is dead. John Williamson is dead!

Only a few years ago his name was unknown beyond the circle of a few friends and business associates; to-day it has a world-wide reputation, and is honored by the city of his adoption as among the proudest in its history.

What John Williamson, the artist-botanist, has done for art in Louisville can never be forgotten. His name will ever stand as a monumental example of what an earnest, sincere soul, animated by high aims and purposes, can accomplish under the most trying adverse surroundings, and encourage others who may be groping upward toward the light, and struggling as he struggled and groped for years, until the dawn of a triumphant career flooded all his future with promises of rich reward. How inexpressibly sad to think that just as that success for which he had worked and waited so patiently seemed within his grasp, he should have been cut off before reaping the harvest for which he had sown so well. But though denied this, and his personal presence is no longer among men, his influence will live and the impetus given to art in his adopted city by his example will go on, reaching out into broadening circles from year to year.

Williamson was a native of Scotland, and came to this country about 1866, settling soon after in Louisville, where he established himself in the business of wood-carving. Later on he became interested in a brass foundry, in the carrying on of which he acquired that knowledge of working metals which enabled him to combine so successfully, and with such exquisite results, his love for the beautiful in nature with the practical in art.

In his mind there existed to an unusual degree the happiest blending of the ideal with the real, and the vast store-house of nature which he had explored so thoroughly was made to contribute as never before to the service of decorative art.

Ferns and wild flowers, wild flowers and ferns, grace and beauty, beauty and grace, without end, worked over and over without repetition into charming variations on metal and bronze and paper, until his artistic tastes culminated in the establishment of the Williamson Art Metal Works for the purpose of carrying into practical operation his rare designs for household art decoration.

To this business he was devoting himself with wonderful energy when cut off in the very prime and strength of his manhood, and while on the threshold of prosperity, with the future big with splendid possibilities.

Full of indomitable energy, and possessed with the sterling Scotch integrity of character, Mr. Williamson enjoyed the fullest confidence and respect of his business associates, by whom he will be greatly missed; but it is to his many warm personal, social friends that his death and loss come home with the keenest poignancy. The charming and unaffected simplicity of his manners, brusque frankness and transparent sincerity, enabled him to make and hold fast friends who loved him for the purity and nobility of his soul, even more than for his unquestionable genius.

An ardent naturalist, he had not been in Louisville long before he sought out the Natural History Society at New Albany, across the river, and soon became known as an enthusiastic botanist. All the leisure moments he could snatch from a busy life were given up to his favorite study, with what result his fern books and etchings testify.

His was another one of those instances in which one possessed with a strong love for natural pursuits finds, or makes time, even in the midst of a busy working life, without neglecting necessary duties, and under adverse circumstances, without the advantage of means, or special training, to do some good work that leaves a mark on the page of history, of which he nor posterity need ever after be ashamed.

High on the scroll, beside the revered names of Frost and Parker, the name of Williamson, the "Louisville Mechanic," claims an honored place.

The writer's correspondence with Williamson grew out of his fern book, and soon ripened into feelings of mutual friendship, and it became a pleasant duty to aid one who, worshiping at the same shrine, brought such rich gifts and tributes to the plants which the writer had chosen for his own special study.

When the Ferns of Kentucky was published, the expense of printing etchings made it necessary to transfer them to the lithographer's stone, and in the reproduction by this process the illustrations lost much of their original beauty. No one was more sensible of this than the author, and it was this that, in a measure, led to the publication of "Fern Etchings," in the second edition of which the etchings were printed by the gifted author. Some of these etchings are marvels of beauty.

The late M. P. Whipple, of Boston, an art critic of good judgment, was warm in his praises of them, and told the writer that in all that constituted the true test of etching—fidelity to texture and life-like expression—they were the finest work of the kind he had ever seen. Hamerton complimented them highly in a personal letter to the author, and journals abroad spoke in high terms of this work of the "Louisville Mechanic," as they called him

Williamson did not study the ferns in vain. He entered into the secrets of their innermost life, and when his dextrous needle traced their outlines in lifeless metal, they sprang into existence as vividly and life-like as when growing in their native haunts.

He was at the writer's home in June, 1881, and the magnetism of his presence drew toward him all our household, of which he quickly became a part. We walked with him over and through the adjacent portion of the "Middlesex Fells," he chatting with the children, with whom he became a great favorite, like one of themselves, yet all the while his keen glance searching for, to him, new plants and flowers. And so we led him on to where the fringed polygala still lingered in bloom, without mentioning it, that he might have the pleasure of finding it himself, when a cheery "Hallo! here is something new; what is this?" made us turn to see him bending in admiration over this charming little plant.

He was at the writer's home again during the winter of the present year, and although he appeared outwardly to be in his usual ruddy health, a tired expression in his eyes gave cause for anxiety and led us to caution him against too much overwork.

Soon after his return home he wrote that he had been confined to his room for a week by what his physician called a severe attack of neuralgia in his side, but, he added, "I think it was more serious."

On the 10th of June he wrote, "Since my last severe sickness I have never felt real well. I have a great deal of hard work to do, and now I find myself unable to do anything. I am just completely broken down, and to morrow I go to the country and take a rest."

And so he went to the mountains of West Virginia with the hope that the mountain air and a brief rest would bring him about again all right. But the season there, as elsewhere, was cold and damp, and while on the river toward evening he was taken with a congestive chill, which resulted in his death. Dr. Barksdale wrote that when he was called to attend him he found him lying on a pallet by the bank of the river, and that he only lived a half-hour after being removed to his hotel.

And so died John Williamson, on the 17th of June, 1884, and in the 46th year of his age, "his last conscious hours passed in the woods he had loved so well," writes a near and dear friend, adding that the banks of the stream and hillsides were covered with ferns, and that "I know that if he could have had his choice he would have preferred to die so, if only his dear old mother could have been by his side."

Williamson's devotion to his mother was chivalrous. He always spoke of her in terms of the deepest reverence and endearment, and if his last conscious thought could have been interpreted, it must have been for her who by his death would be left alone in her old age without a single relative in this country, though he would have known, too, that loving friends would care for and protect her.

His remains were taken to Louisville, and amid graceful tributes of flowers and ferns the artist-botanist, surrounded by sorrowing friends, was borne tenderly to his last earthly resting-place in Cave Hill Cemetery.

> Farewell, dear friend! yet not to thee farewell.
> I know that thou art living, breathing still
> In every flower and fern by rock or rill;
> And thy freed spirit evermore will haunt
> The woods and streams where all thy loved ferns dwell.
> I loved thee for thy virtues and thine art,
> And here in reverence pay this tribute of my heart.

MEDFORD, MASS., July, 1884.

Notes on the Flora of W. Dakota and E. Montana, Adjacent to the Northern Pacific Railroad*—II.

BY JOHN B. LEIBERG.

The *Compositæ*, as might be expected, were numerously represented. Species of *Liatris, Solidago* and *Bigelovia* were abundant. Asters were rather rare. *Helianthus lenticularis*, Dougl., (more correctly known as *H. annuus*, L., since it has been shown to be the original of the common cultivated sunflower), was the only species of this extensive genus occuring at all plentifully west of the Missouri. *Lepachys pinnata*, Torr. & Gr., was wholly replaced by *L. columnaris*, Torr. & Gr., and its variety *Tagetes*, Gray. It is curious to notice the

*Read before the Minnesota Academy of Natural Sciences, March 4, 1884.

gradual transition to *L. pinnata*, as the Red river valley is approached. A number of species of *Artemisia* were noticed; among others *A. tridentata*, Nutt. (sage-brush), but not extending eastward much beyond Pyramid Park. *Senecio lugens*, Rich., var. *Hookeri*, Eaton, was common everywhere. Species of *Hieracium* peculiar to the far west were found; also *Grindelia squarrosa*, Dunal., which extends east into the edge of Minnesota. *Troximon cuspidatum*, Pursh, common in Minnesota, was replaced by *T. glaucum*, Nutt.; and *Iva xanthiifolia*, Nutt., by *I. axillaris*, Pursh. Two species of *Gaillardia*, *G. aristata*, Pursh, and an undetermined one, were collected. *Antennaria* was represented by *A. dioica*, Gærtn., a rather pretty little plant.

Aphyllon fasciculatum, Gray, of the order *Orobanchaceæ*, was very common on the dry hill-sides, parasitic on the roots of various species of *Artemisia*.

Numerous species of *Pentstemon* and *Castilleia* made up the bulk of the *Scrophulariaceæ*.

Only one of the order *Labiatæ* was collected west of the Missouri; this was a species of *Hedeoma*.

Three species of *Echinospermum*, one *Mertensia*, and three species of *Eritrichium*, were noted as representing the *Borraginaceæ*.

Phlox cæspitosa, Nutt., is first found in going westward near the Missouri river, but only on the summit of the highest and stoniest hills; farther west it covers the ground nearly everywhere.

Asclepias Cornuti, Decaisne, was supplanted by *A. speciosa*, Torr., a closely allied species, rather more handsome though not so tall and robust.

Among the rarer *Chenopodiaceæ*, I collected *Monolepis chenopodioides*, Moq., *Eurotia lanata*, Moq., *Sarcobatus vermiculatus*, Torr. (this only in Pyramid Park), *Salicornia herbacea*, L., and three or four species of *Obione*.

Among the *Polygonaceæ*, *Rumex venosus*, Pursh, and several species of *Eriogonum* were of frequent occurence.

Shepherdia argentea, Nutt., and *S. Canadensis*, Nutt., commonly called "buffalo berries," and *Elæagnus argentea*, Pursh, the silver-berry, abounded along the streams.

A low trailing *Juniperus* was exceedingly common west of the Missouri, growing everywhere upon the sides of the dry rocky buttes.

Allium reticulatum, Fraser, two species of *Zygadenus*, *Smilacina stellata*, Desf., and *Calochortus Gunnisoni*, Watson, this last not extending east of Pyramid Park, and *Yucca angustifolia*, Pursh, make up the list of *Liliaceæ* noted in western Dakota.

Scirpus maritimus, L., was common around alkaline ponds, together with several undetermined species of *Eleocharis*. Numerous *Carices* were observed, mostly differing from Minnesota species.

The *Gramineæ* were much more sparingly represented than one would suppose to be the case. West of the Missouri fully half of the grass consisted of a single species, *Kœleria cristata*, Pers. The remaining half was divided between a dozen other species, such as *Aristida purpurea*, Nutt., an undetermined *Calamagrostis* near *C. stricta*, Trin., *Stipa Mongolica*, Turcz., and *S. viridula*, Trin., *Spartina gracilis*, Trin., *Brizopyrum spicatum*, Hook., *Bouteloua hirsuta*, Lagasca, and *B. oligostachya*, Torr., which two last commonly pass by the name of "buffalo grass," *Munroa squarrosa*, Torr., and *Buchloe dactyloides*, Engelm., the true buffalo grass, the last only occurring in scattered patches here and there. Several species of *Poa*, *Beckmannia erucæformis*, Host., *Schedonnardus Texanus*, Steud., *Eriocoma cuspidata*, Nutt., and several species of *Triticum*, complete the list of grasses collected.

Only two species of ferns were observed, a *Woodsia* and *Pellæa atropurpurea*., Link., the latter growing in the crevices of the rocky ledges on the summit of the buttes. A few mosses were seen, and two species of lichens.

The arboreal vegetation was, as might be supposed, very scanty. Aside from the timber on the Missouri river bottoms, only a few stunted willows, cottonwood, box-elder and June berry were found scattered at intervals along the streams.

A curious feature of the country west of the Missouri, beyond the limit of the drift, was the great number of fossil tree stumps protruding through the sod. Hundreds could be counted in many places, and in some localities, especially in Pyramid Park, the fossil trunks were found where they had fallen, almost whole and but little the worse for the ravages of time. There is no doubt that during the Cretaceous and Tertiary periods extensive forests flourished in this region; and to judge from the size of the stumps remaining, some of the trees must have been of immense size. Many stumps were seen ten feet or more in diameter, and I heard of others still larger.

This region will yet prove a mine of wealth to the botanist studying our fossil flora. Fossil leaves in great abundance occur everywhere in the Tertiary sandstones and soft Cretaceous clays. In some places the clay beds were originally underlaid by seams of lignite, which have been burned, baking the clay above into a kind of brown, red, or yellow brick, which shows perfectly the forms and venation of these fossil leaves. The region is well worth the time and attention of working botanists, both in recent and fossil botany; and will doubtless ere long receive its due share of exploration and study, since it has become so easy of access.

GENERAL NOTES.

Botany and the American Association.—The Minneapolis meeting of the American Association for the Advancement of Science last year gave an impetus to the botanical interests in the Association, which promises to yield good results in bringing botanists more into each other's society. A Botanical Club was formed, and a committee appointed to arrange for the meeting in Philadelphia. This committee began its labors in April, and has since steadily endeavored to do what it could for the interests of the botanical members.

The following announcements can now be made for the Philadelphia meeting: The Association opens on Thursday morning, September 4th. During Thursday and Friday the botanical headquarters will be at the Academy of Natural Sciences, corner of 19th and Race Streets, where a committee will be in attendance to receive and introduce all members as they report themselves, to welcome them to the privileges of the Library and Herbarium of the Academy, and as far as possible to promote acquaintance and good fellowship. This committee will also be in charge of the registry book of the Club, in which it is hoped every member of the Association interested in botany will register as soon as possible after arrival. This is the only requisite to becoming a member of the Club, entitled to all the privileges of the same.

The Association will devote Saturday, September 6th, to excursions. The special botanical excursion for this day will be to the pine barrens of New Jersey, the richness of whose flora has become quite proverbial. Those interested in cryptogamic plants will doubtless have the pleasure of Mr. J. B. Ellis' leadership, whose extensive knowledge of fungi in particular, and thorough acquaintance with the region, will be of great service. Those more inclined to phanerogamic botany will find no lack of leaders. After devoting sufficient time to botanizing the general excursion of the Association to the seaside will be overtaken, and the remainder of the day passed in connection with it. There will also be excursions by the Association at the same time to the Delaware Water Gap, and to the anthracite regions, which those preferring can accompany.

Monday evening, September 8th, is the regular monthly meeting of the Botanical Section of the Philadelphia Academy of Sciences. The Section extends an invitation to the Botanical Club of the Association, the Torrey Botanical Club, of New York City, and to other visiting botanists to be present. The usual exercises will be abbreviated and supplemented by short addresses from eminent botanists. It is anticipated that Mr. John Ball, of England, who is now traveling in the western part of the United States, will be willing to give some of his impressions of our country as compared with Europe. Dr. Asa Gray, whom we all revere as the Nestor of American botanical science, will also be present. Altogether the occasion will be one of unusual interest. The exercises will be concluded by a reception, giving an excellent opportunity for social enjoyment and the acquisition of stray bits of information.

At some time during the week there will be an excursion of botanists to the Bartram house and garden at Kingsessing, a place of much historic interest from its associations with the early botanist, whom Linnæus called "the greatest natural botanist in the world." He died in 1777. The place is yet much as he left it. The house he built with his own hands, and many of the trees he planted are still there. The old cypress tree, some thirty feet round, will show that it does not take numerous centuries to make a large tree. Some fine specimens of *Rhododendron punctatum* were there recently, and may be still, a shrub we do not find often, even in its native North Carolina. A very good specimen of the rare *Quercus lyrata* is standing, together with a number of rare southern trees not often seen elsewhere.

Other excursions will be announced during the week. The meetings of the Club will be held at such times as are found most convenient, at which the reading of papers, discussions, and reports of committees will be in order.

All announcements of time and place of meeting, excursions, or other matters pertaining to the Club will be given on the daily programme of the Association.

Probably the point of most interest to botanists will be the botanical treasures of the Academy of Sciences. Here is to be found Barton's herbarium, a professor in the University of Pennsylvania and author of a work on botany, who died in 1815. The great herbarium of Schweinitz, one of the most widely known of early American general botanists, was supposed to contain 20,000 species when deposited in the Academy, but would not number so many now, owing to the degradation of many forms to mere synonyms. He was one of the earliest students of our fungi and fresh-water algæ, and his herbarium contains a large number of type specimens. Here is also the fine herbarium of Dr. Short, which is kept separate from the general collection of the Academy in accordance with an agreement with the heirs. There are also numbers of specimens of Pursh, Rafinesque, Baldwin, Darlington, Le Conte, and other famous botanists of the past, as well as of most of those who give honor to the science to-day. All these collections are arranged in a single universal series, with the exception of Dr. Short's, as before noted. As fast as accessions are received, they are poisoned and labeled, and at once put in place. Afterwards they are permanently mounted, as time for the work can be secured. By means of a reference index a stranger is able to find what is wanted in a few moments. The Academy also possesses a duplicate North American herbarium for convenience of ready reference. The total herbarium probably reaches nearly 50,-000 species; but this is only a guess, for no count has been made. Mr. John H. Redfield is the conservator of the collection, and by his special study of ferns has added much to its completeness in this particular.

The director of the Botanical Section of the Academy is Dr. Ruschenberger, who has done excellent service to science; the vice-director is the widely-known botanist Thomas Meehan, who is also one of the two vice-presidents of the Academy. F. Lamson Scribner, now becoming well known as an able agrostologist, is the secretary, and the corresponding secretary is Isaac C. Martindale, whose private herbarium and botanical library many of us would envy. All these are business men without any professional vacation, and they have a right to feel proud of their voluntary tasks on this good work. Mr. Isaac Burk should also be mentioned for the large amount of labor he has bestowed on the collection; and the whole Section, indeed, of which there are some twenty members, do all they can. It will be one of the profitable experiences of a visit to Philadelphia to note what earnest volunteers can do for the science when persistent, and determined to do good work.

The herbarium of Muhlenberg, an early botanist of much fame, is deposited with the Philosophical Society.

The very rich flora of Philadelphia and vicinity will attract collectors, and many rare plants are also to be found here. The great Fairmount Park, especially the valley of the Wissahickon and the horticultural conservatory are deserving of the attention of botanists.

The features of the meeting so far mentioned are entirely in addition to those provided by the general Association, for it is intended that the botanical meetings and excursions shall in no wise conflict with those of the Association. That this object, and the best welfare of the botanists may be secured, the Botanical Section of the Academy has appointed a committee of five to co-operate during the meeting with the committee of the Club; this committee consists cf Isaac C. Martindale, Prof. J. T. Rothrock, Dr. J. Bernard Brinton, Wm. C. Stevenson, Jr., and Jos. O. Schimmel.

The announcements for the general Association are too long to be given here, and all who are not yet members should write the local secretary, Prof. H. Carvill Lewis, Academy of Sciences, Philadelphia, for the Local Committee's circular. We may, however, mention the lectures on Thursday, Friday and Tuesday evenings, September 4, 5 and 9, the reception at the Academy of Fine Arts, and the lawn party at Haverford College. The International Electrical Exhibition will be open at this time, and must prove very attractive. After the final adjournment, some long excursions of special interest will be given.

The British botanists who have already notified the Local Committee of their intention of attending the meeting are John Ball, F. R. S., F. L. S., M. R. I. A.; A. W. Bennett, F. L. S., representing the Royal Microscopical Society; Wm. Carruthers, F. R. S., F. L. S., F. G. S., from the British Museum; and Wm. Caldwell Crawford, delegate of the Royal Botanical Society of Edinburg. Sir Joseph Hooker, Prof. W. R. McNab, and Sir John Lubbock are expected at the British Association in Montreal, and may attend at Philadelphia, but of this no definite information has been received.

It still remains to say a word in reference to the Botanical Club itself, in order that no misapprehension may arise in regard to its scope and aim, and relation to the general Association. An Entomological Club has existed in connection with the Association for a number of years, and it was in emulation of the advantages secured to its members that the botanists in attendance last year at Minneapolis proposed the Botanical Club. It was organized with the slightest formality possible, and set before itself the task of promoting acquaintance and fraternal interest among the botanical members of the Association. It is not a part of the general Association, but receives its hearty sanction and encouragement; only those who are already members of the Association are eligible to membership in the Club; instead of diverting interest from the biological section of the Association, it hopes to indirectly aid in building up a larger interest in it, so far as botany is concerned. The Club will listen to short papers, and minor notes and observations, while the weightier articles will undoubtedly be presented before the section of biology.

J. C. Arthur,
J. H. Redfield,
Thomas Meehan,
Committee.

Æcidium Ranunculacearum DC.—Under this name several fungi having distinct life histories have been confounded. Schröter first pointed out that the æcidium on *Ranunculus ficaria* was a heterœcismal species connected with *Uromyces Poæ*, and distinct from the *Uromyces ficariæ* with which Fuckel, Cooke and other writers had associated it. At the present time the generally accepted view of the relationship of the Ranunculi æcidia is as follows: the æcidium on

Ranunculus	ficaria belongs to	Uromyces	Poæ;
"	repens belongs to	"	dactylidis;
"	acris belongs to	"	dactylidis;
"	bulbosus belongs to	"	dactylidis.

Cornu has recently shown, however, that *Puccinia arundinacea* has its æcidium upon *R. repens*, while Rostrup and myself hold the view that this æcidium is connected with *U. Poæ*, as the æcidium on *R. ficaria* is. Such being the state of the case, I have during the past two years conducted a series of experimental cultures with the Ranunculi æcidia. These experiments are not yet complete, but I have evidence that there are two æcidia upon *R. repens*, (1) that of *Uromyces Poæ*, and (2) that of *Puccinia Magnusiana*. Both these æcidia resemble each other closely, the one connected with *P. Magnusiana* being, however, rather later in the time of its appearance than that of *U. Poæ*. The æcidia of *U. dactylidis*, I have reason to believe, does not occur on *R. repens*, but is confined to *R. bulbosus*. The æcidium on *R. acris* has a distinct life history, which I am at present endeavoring to work out.—CHARLES B. PLOWRIGHT, *King's Lynn, England.*

Variation and Human Interference.—MR. EDITOR—In reply to the communication on p. 98, signed A. G., I will remark that I do not consider the double flowers or Thalictrum anemonides, etc., as *particularly* favorable to man's wishes, but as an instance of teratological variation. Quoting from my previous communications, on p. 79, BOT. GAZETTE, "It seems to me that where variation *of a nature favorable to man's wishes* is found in plants, and not especially beneficial to the plant, that such variation *suggests human interference* and points towards *a prehistoric cultivation.*" In the January number, p. 8, I say, "We can even go further and say that if the agency of man induces numerous variations favorable to man's wants in a species, then that this presence of numerous variations in a species, of a kind favorable to man, indicates a previous agency of man."

I might perhaps have ended my communications somewhat more plainly; yet I much believe that I have given prominence to an idea which may, perhaps, upon investigation, prove useful. It will be admitted that we have feral plants or escapes, and wild plants or indigenes. Some years since M. Villemain attempted the ennobling of the wild carrot and parsnip; it is said he succeeded with the carrot. Professor Buckman, in trying like experiments, succeeded with the parsnip, but could make no impression upon the carrot. (Gard. Chron., 1862, p. 721.) It seems a plausible explanation of the difference that the one commenced with a feral, the other with a wild plant, and hence the divergence in the results. Should extended trials prove the correctness of such an explanation, it certainly will answer to reason from the opposite direction, viz: that a quick response of a wild plant to cultivation, in changes that are *favorable to man's desires*, but not *especially beneficial to the plant*, is indicative that the supposed wild plant is really feral—especially if such changes are of a nature beneficial to man, yet unfavorable to the plant. Illustrations of this latter proposition seem quite numerous, as, for a general rule in vegetable plants, improvement in form and quality is usually coincident with a lessened ability of the plant to take care of itself, and the highly improved forms seem incapable of becoming feral.

I will say no more, however, as these and allied matters are yet under investigation, but there is indeed a need of an agricultural botany, to be studied under the domination of the evolutionary idea of man as a factor in variation. —E. Lewis Sturtevant.

Keenness of Observation.—After studying botany for three weeks, it was three days more before a single one of the Freshman class of Michigan Agricultural College discovered that the central odd leaflet at the tip of the midrib of a leaf of the mountain ash was usually symmetrical, although they soon discovered that the side leaflets were fullest on the lower edge.

Last year, while studying leaves, it was two days before any member of the Freshman class discovered that the leaf of the common barberry had two joints in following down to the main stem.

Of the members of such a class, very few will see that the geranium has a long torus between the five pistils. Without telling, one in five young students may see that the anthers of Lupine are not all alike; one in three will discover that the anthers of the Mallow are one-celled and kidney-shaped; one in ten, that the anthers are much in advance of the styles; about one in fifteen discovered that although the leaves were opposite, a bud usually appears only in the axil of one of each pair of those of the Sweet William (*Lychnis*). Above this bud is a slight canal, somewhat like that on the cornstalk near and above an ear of corn.—W. J. Beal, *Agricultural College, Lansing, Mich.*

EDITORIAL NOTES

A laboratory for researches on bacteria has been established at Munich.

J. C. Grönewegen, of the Botanic Garden of Amsterdam, died in June at the age of 73 years.

Prof. J. H. R. Goeppert, the phytopaleontologist, lately died at Breslau in his eighty-fourth year.

Oberlin College has secured the herbarium of Dr. Beardslee, of Painesville, Ohio, containing about 3000 species.

A second edition of Prof. W. J. Beal's lecture on the new botany has been issued by Chas. H. Marot, Philadelphia.

PROF. D. P. PENHALLOW has a long article in the *Popular Science Monthly* for July on the nature of the diseases of plants.

DIERVILLA CANADENSIS, Willd. has become wild in several parts of Germany, according to the *Botanische Monatsschrift.*

F. SOÁCHA, of Deutschbrod, Bohemia, is preparing a flora of Austro-Hungary, to contain specimens of the plants described.

GENUINE TRUFFLES have been found in California, according to Dr. H. W. Harkness. They are, however, small and of no commercial value.

THE EXPERIMENTS of Mr. George Murray, of the British Museum, show that perfectly healthy and uninjured live salmon may be attacked by fungus.

THE INTERNATIONAL HORTICULTURAL EXHIBITION at St. Petersburg has awarded a medal to Dr. Gobi, the Russian algologist, for his remarkable herbarium.

DR. S. SCHWENDENER, of Berlin, has heen elected foreign associate of the Linnean Society of London, to fill the vacancy made by the death of Dr. Engelmann.

MACMILLAN & Co. have in press an illustrated work, by Worthington G. Smith, on diseases of field and garden crops. This is the first work of the kind in the English language, and one much needed.

PROF. TRELEASE figures and describes the rose rot, *Peronospora sparsa*, in the *Gardener's Monthly* for July. It has become troublesome in the greenhouses of Philadelphia, and threatens to spread and cause much loss to florists.

MR. JOHN C. BRANNER has contributed a valuable study on the "Course and Growth of the Fibro-vascular Bundles in Palms" to the Proceedings of the American Philosophical Society, which we shall take occasion to refer to again.

WE LEARN FROM the Providence papers that a Mrs. Metcalf has given to Brown University thirteen acres of valuable land in that city for the establishment of a Botanic Garden. We sincerely hope that the information is authentic.

MR. WALTER DEANE, of Cambridge, Mass., reports having found *Festuca Myurus*, L. growing very abundantly at Nantucket, Mass., a locality much farther north than that given in Gray's Manual. Specimens have been deposited in the Gray Herbarium.

THE GAZETTE has been delayed this month that we might be able to present as full an account as possible of the attractions for botanists at the coming meeting of the A. A. A. S. Let all who can possibly do so attend this meeting. None will be disappointed.

THE THIRD MEMOIRE on rhizotaxy, by M. D. Clos, is devoted to *Des Racines Caulinaires*, or the arrangement of roots arising from stems. He divides them into those (*a*) of the nodes, (*b*) of the internodes, and (*c*) of the two combined. The first division is the largest, and is divided into those (1) variously placed, (2) beneath the nodes, (3) encircling the nodes, and (4) strictly axillary. The same mode of growth generally pervades a genus or order.

We learn from the *Am. Microscopical Journal* that Prof. Baird will cause the *Utriculariæ* to be thoroughly eradicated from the ponds of the U. S. Fish Commission, especially *U. vulgaris*, as it is found that the bladders of the plants entrap and kill large numbers of young fish.

Prof. Dr. Leimbach, of Sondershausen, Germany, has as yet received no response to his offer to exchange for or purchase good herbarium specimens of American *Orchidaceæ*. Collectors will confer a favor by communicating with him, although they may have but a few kinds to offer.

The second number of *Drugs and Medicines of N. A.* is fully equal to the first, if not even better. It is devoted to the several species of *Hepatica* and *Ranunculus*, and is profusely illustrated with original cuts and plates, and a map showing the distribution of *Anemone Hepatica* and *A. acutiloba*.

We clip the following from the *Salem* (Mass.) *Gazette* of July 15th:

Within a few weeks the arrangement of the botanical collections belonging to the Peabody Academy, which has proceeded quietly for the past nine years, has been completed, and the cabinet of dried plants may now be examined by students in a pleasant room with reference books and microscopes at hand.

A review of Lesquereux and James' Manual of the Mosses of N. A. by Eugene A. Rau will be published in the September number of the Gazette, in which Mr. Rau supplements the habitats of many species as given in the Manual. It will be especially valuable to those who have purchased the book.

Prof. E. Ray Lankester says, in the April *Quart. Jour. of Micros. Science*, that "there is no more reason for regarding the chlorophyll corpuscles of Spongilla or of Hydra as parasites, than there is for so regarding the chlorophyll corpuscles in the leaf of a buttercup"; that is, they are not imprisoned algæ, but a legitimate part of the animal.

W. G. Smith, who professes to be among the most conservative of botanists, promulgates a theory in a late number of the *Gardener's Chronicle* which is more heterodox than the one he flings derision at. He considers that the æcidia spores of *Æcidium Convallariæ*, Schum. are fertilized by direct contact of the spermatia, and then fall to the ground for a period of rest. He believes the species autonomous.

In a communication to the Linnean Society in March, and later in the *Torrey Bulletin*, Mr. Chas. B. Plowright has shown the genetic connection between æcidium on the European daisy and *Puccinia obscura*, one of the two *Pucciniæ* on *Luzula campestris*. The absence of the æcidial form in this country is the text of an interesting article by the same author in the *Torrey Bulletin* for June on the æcidia-bearing *Uredineæ* as to their deportment when the æcidum is present or absent.

Mrs. A. Lincoln Phelps, of Baltimore, Md., died on the 14th of July in her 91st year. She will be best remembered as the author of Mrs. Lincoln's Botany, a work that was received with much favor in its day. She was the daughter of Samuel Hart, of Connecticut, was educated by her sister, Mrs. Willard, and in her youth was known as Miss Willard of Troy, N. Y. Her first husband, Simeon Lincoln, an editor, died in 1823, and her second husband, Judge Phelps, of Vermont, in 1848. The larger part of her life has been devoted to teaching, and writing upon scientific and educational subjects. She was for some time editor of the *Patapsco Magazine.*

WE ARE PROMISED a handbook for self instruction in the practical details of microscopic botany adapted to both beginners and advanced students, by the renowned Dr. Edward Strasburger, professor of botany in the University of Bonn. It is entitled "Das Botanische Practicum," and is to deal with all sides of modern microscopical technique, even to the culture of bacteria, and at the same time to impart a general knowledge of botany. It is finely illustrated with 182 cuts, which, together with the material of the text, are almost entirely new, and specially prepared for the work. The author's knowledge in the most abstruse kinds of botanical research, such as the structure of protoplasm, etc., assures us a work of the highest value. It should be translated into English.

CURRENT LITERATURE.

Desmids of the United States and List of American Pediastrums, with Eleven Hundred Illustrations. By the Rev. Francis Wolle. Bethlehem, 1884. 8vo. 168 pp. 53 col. pl.

The author has done a lasting service to microscopic botany by the publication of this excellent work. Such manuals in all classes of the lower plants are much needed, and it is gratifying to note the growing interest in this country in the study of microscopic plants, rendering publications of this kind possible by creating a sufficient demand to pay the cost of production, which is all the authors usually ask or expect. The work before us is a large octavo, well printed, substantially bound, and with fine illustrations. The preface is devoted to a notice of the collectors and systematists who have given attention to this class of American fresh-water algæ. Then follow some remarks on algæ in general, the collection and preservation of desmids, and the structure and reproduction of the same. Most of the remainder of the work is given to the descriptions and illustrations of the nearly five hundred species of desmids and ten of pediastrums. The two largest genera are *Cosmarium* and *Staurastrum*, embracing respectively 108 and 111 species. The only fault one is inclined to find with this part is the omission of full references to the sources of original publication of the species. To be sure the author has indirectly provided for this by giving a list of works consulted, but the direct references are still needed. One half the volume is occupied by the plates. These are well executed, and the sight of them is alone enough to awaken interest in the simple yet diversified and attractive plants. The drawing and engraving are both good, and the hand coloring, by permitting fine gradations in shading and unlimited variety in tints, gives a pleasing and natural effect. A good index completes the volume.

It would not do to close this review without calling attention to the remarkably low price ($5.00) at which the work is offered. This has been made possible by the author assuming the responsibility of its sale. We hope his philanthropy may meet with fitting reward.

BOTANICAL GAZETTE.

VOL. IX. SEPTEMBER, 1884. No. 9.

Notes on Carex.—II.

BY L. H. BAILEY, JR.

CAREX STRICTA, *Lamarck.*

One of the most remarkable instances of the general acceptance of an early error occurs in the case of *Carex stricta.* Among all caricographers, so far as I know (unless it be Carey in Gray's Manual), *C. stricta* of Goodenough (Obs. on Brit. Carices, p. 196) has held the preference over *C. stricta* of Lamarck (Dict. de Bot. 3, 387) on account of its supposed priority. Dr. Boott did not confidently adopt Lamarck's name as a synonym of his *C. angustata;* nor was it necessary that he should pay much attention to the name, as he evidently regarded it as more recent than *C. stricta,* Gooden. Sir J. E. Smith, in Rees' Cyclopedia, taking Goodenough's name to be the older, proposed *C. Virginiana* for the plant of Lamarck. Otto von Boeckeler, in Linnæa, 40, 430, adopts Smith's name. Goodenough's name was made in 1792; Lamarck's in 1789. *C. stricta,* Lam., therefore becomes the proper name of the American plant, and the *C. stricta* of Gooden., a European species, must bear some other name. There can be no doubt that Lamarck meant to describe the same plant intended in Dr. Boott's *C. angustata.* His characters can apply to no other Virginian species, unless it be *C. aperta,* Boott, which was separated from the original species at a later day. Sir J. E. Smith reproduces Lamarck's characters and description and, evidently having seen more specimens, adds somewhat to the description. His account of the species, from the American edition of Rees' Cyclopedia, vii, species 100, is as follows:

"*C. Virginiana* (*C. stricta,* Lam.). 'Female spikes two, sessile, erect, with male flowers at the top; male terminal, remote; stem naked.' Stem about a foot high, slender, compressed above, triangular below, rough. Leaves as long as the stem, near two lines broad, striated. Male spike terminal, an inch long; glumes obtuse, brown, with a white edge. Female spikes distant from the male, sessile, upright, linear, pressed close, reddish brown, with some male flowers at the top; lower one with a bracteal leaf as long as the spike. A native of Virginia, Pennsylvania, etc., described by Lamarck from a dried specimen."

C. xerocarpa, S. H. Wright, Sill. Journ. Sec. Ser. xlii, 334, *C. angustata* var. *xerocarpa*, Bailey, Carex Cat., is simply an attenuated form of *C. stricta*, and it has no characters to separate it from the species. I find it growing from the same tussocks with the ordinary form. Occasionally the inflorescence is reduced to one androgynous spike. *C. Virginiana* var. *elongata*, Bklr., Linnæa, 40, 432, appears from the description to be a very large form of the same.

The synonymy of the species may be arranged as follows:

C. stricta, Lam., Dict. de. Bot. iii, 387 (1789).
C. Virginiana, Smith, Rees' Cycl. vii, sp. 100.
C. acuta, Muhl., Descript. Gram. 263; Torr., etc.
C. stricta, Dewey, Sill. Journ. x, 269; Torr., etc.
C. angustata, Boott, Hook. Fl. Bor. Am. ii, 218.
C. strictior, Dewey, Wood's Cl. Bk. 755.
C. xerocarpa, S. H. Wright, Sill. Journ. Sec. Ser. xlii, 334.

C. aperta, Boott, is perhaps too near *C. stricta*. The reticulated fibres of the lower sheaths of the latter species is the readiest distinction between the two. Careless collectors often fail to secure the lower sheaths, or the fibres are destroyed in pulling up the specimens. Occasional plants will be found in which this character is normally obscure, however. *C. aperta* commonly has shorter spikes than *C. stricta*, and sharper and more spreading scales.

CAREX LIDDONI AND C. ADUSTA.

Carex Liddoni has never been well understood. The species was founded upon a plant collected on the Columbia river by Scouler. Its author regarded it as a near ally of *C. arida*, Schw. and Torr., and expressed a doubt of its distinctness from that species. A subsequent knowledge of the species has definitely separated it from *C. arida*, and has allied it to the apparently far different *C. adusta*. The form of the perigynium is widely different in typical specimens of each species, but it varies much in the intermediate forms. Except in the var. *minor* of *C. adusta*, the ovate or orbicular form of the perigynium readily distinguishes *C. adusta* from the lanceolate-fruited *C. Liddoni*. The most distinctive difference between the two, however, lies in the colors of their spikes: *C. Liddoni* is always fuscous or fulvous; *C. adusta* is pale or silvery tawny. The following characters will, I think, distinguish the two species:

C. LIDDONI, Boott in Hook. Fl. Bor. Am. ii, 214. Culm erect or nearly so; spikes 3–6, obovoid or oblong, erect, chaffy at the base, fulvous, contiguous or loosely aggregated into an oblong head (about 1′ long); perigynium greenish or tawny, firm in texture, lanceolate (4″–6″ long), thrice as long as the elliptic, brown achenium, few nerved when mature, rough on the narrowly winged margins, very gradually beaked, about the length of the acute, thin-margined scale. *C. adusta, var. congesta*, W. Boott, Bot. Calif. ii, 238.—Mostly at high altitudes, California and northward, eastward to South Park, Colorado, (*John Wolfe*) and Montana, (*F. L. Scribner, 1883*); said to occur on Mt. Graham, Arizona.

C. ADUSTA, Boott, l. c. Top of the culm often inclined or somewhat nodding; spikes 6–12, globose, pale or silvery-tawny, mostly not contiguous, the lower often somewhat compound; perigynium pale or silvery, fragile in texture, ovate or almost orbicular, about twice the length of the oval, mostly dark and shining achenium, strongly many-nerved, minutely serrate above on the broadly winged margins, rather abruptly beaked, about the length and usually rather broader than the scale. *C. argyrantha*, Tuckm. *C. albolutescens*, Schw., *var. argyrantha*, Olney Exsicc. *C. adusta var. argyrantha*, Bailey, Carex Cat. *C albolutescens var. sparsiflora*, Olney, l. c. (not 591 Hall's Oregon Coll.) *C. adusta var.*, Bailey l. c.—Northeastern States, British America, California.

VAR. GLOMERATA, Bailey l. c. Spikes few flowered, aggregated into a loose, mostly tawny head; perigynium large, almost wingless, nearly filled by the large, dark achenium. *C. albolutescens var. glomerata*, Olney l. c.—Mt. Desert Id., Me., (*R. W. Greenleaf*), New Brunswick (*Rev. J. Fowler*), and from the Saskatchewan region (*Herb. Gray*).

VAR. MINOR, Boott, l. c. Culm 6′–16′ high, very slender towards the top, weak and nodding at maturity, erect when young; leaves narrow, very long pointed; spikes all silvery-brown, the lower rather remote, long-attenuated at the base; perigynium ovate-lanceolate, nearly nerveless. *C. pratensis*, Drejer, Rev. Crit. Car. Bor. 24. *C. adusta*, W. Boott, Wheeler's Rep. 277.—South Park, Colorado (*John Wolfe*), British America, northward to Greenland, eastward to Labrador. Probably a good species.

C. albolutescens var. brunnea, Olney, Hall's Oregon Coll. No. 590, *C. adusta var. brunnea*, Bailey l. c., is *C. leporina L.*

CAREX PYRENAICA AND C. NIGRICANS.

These species have fewer distinguishing characters than were given them by Meyer and Boott. In the Rocky Mountains the species run very close together. Although Dr. Boott regarded "perigyniis ventricosis, majoribus, ore conspicue albo-hyalino aperto" as good characters to distinguish *C. nigricans* from *C. Pyrenaica*, the forms of the perigynium in our specimens furnish no constant differences. They differ as follows:

C. PYRENAICA, Wahl., Act. 139. Two to eight inches high, slender; leaves narrow, mostly involute-filiform, shorter than the culms; staminate flowers few, occupying a third or less the length of the spike; perigynium few-nerved or nerveless, usually shining, little longer than the dark brown or purple scale; spike brown or purple, the fertile flowers erect until full maturity. —High mountains of Colorado to California and northward.

C. NIGRICANS, C. A. Meyer, Cyp. Nov. 211. Stouter; leaves a line or more broad, nearly flat; staminate flowers usually conspicuous, occupying about half the spike; perigynium somewhat ventricose, dull; otherwise as in the last, with which it grows. Evidently the more common species.

SYNONYMY.

Carex Parryana, Dewey, includes *C. Hallii*, Olney, Hayden's Rep., 1871, 496. In the Preliminary Catalogue of Lieut. Wheeler's Survey, Mr. Olney noticed the identity of the two species.

C. Douglasii, Boott, includes *C. Fendleriana*, Bcklr., Linnæa, 39, 1ǎ5 (878 Fendler).

C. rupestris, All., includes var. *Drummondiana*, Bailey Carex Cat., (*C. Drummondiana*, Dewey). The British American plant has been thought to differ from the species in its greater size, longer spikes more attenuated at the base, and more obtuse scales. Specimens from the Pyrenees and from Greenland are exactly like the large forms from British America.

HABITATS.

C. Careyana is credited to Oregon in the Carex Catalogue on the authority of specimens so named in Hall's collection. The specimens are *C. laxiflora* var. *plantaginea*.

C. acutiformis, Ehrh., (*C. paludosa*, Gooden.) was credited to Colorado by Olney, on a plant of King's Survey, too young to be determined. This species is well established at Savin Hill, near Boston, where I have this year collected it.

Mr. Thomas Howell has this year found *Carex cinnamomea*, Olney, at Grave Creek, Southwestern Oregon. This is the second known locality for the species. It was first found by Bolander (No. 6477) on the Red Mountains, Mendocino county, Cal. In some of the specimens the perigynium is minutely pubescent above the middle. The pubescence is evidently deciduous with age.

CARICES UNKNOWN TO AMERICA.

In the Preliminary Catalogue of the Plants of Lieut. Wheeler's Expedition (1874), Mr. Olney introduced the following exotic species upon specimens collected by the survey:

C. lævirostris, Blytt and Fries, upon a specimen of *C. utriculata*, Boott. (No. 1068.)

C. turfosa, Fries, upon *C. vulgaris*, Fries. (No. 1039.)

"*C. personata*, Fries," upon *C. aquatilis*, Wahl., var. *sphagnophila*, Fries. (Nos. 1037 and 1038) Mr. Olney probably referred to *C. acuta*, L., var. *personata*, Fries.

C. alpina, Swartz, var. *nigrescens*, Anderss., upon *C. alpina*, (No. 1044.) The form referred to Andersson's variety will not fall under the character "spicis omnibus sessilibus, atrofuscis; pumila, rigidula,"—*Anderss. Cyp. Scand.*

C. sempervirens, Vill.? Carex Cat., is *C. frigida*, All.

C. obesa, All., is represented in this country only by its var. *minor*, Boott.

On a New Mimulus of a Peculiar Section of the Genus.

BY J. G. LEMMON.

Mimulus Mohavensis is the name under which I sent specimens of this interesting little plant to Prof. Gray. It is so peculiar that he was at first disposed to regard it as a new genus. But as a related species afterwards received from another source appeared to invalidate the characters relied on, he accepted the view which I had taken of it, and drew up the following character of a new section of the genus, which was needed for its reception:

"§ MIMULASTRUM. Corolla with cylindrical tube and throat included in the turgid 5-angled unequally toothed calyx, gibbous anteriorly near the base; the orifice contracted; limb rotate, refracted, almost regularly 5 cleft; lobes flabelliform-dilated, similar, except that the two posterior are slightly smaller. Character and habit of section *Eunanus*, except in the capsule, the submembranaceous valves of which are placentiferous."

Mimulus Mohavensis. Annual, a span or more high, viscidulous-puberulent; leaves oblong and lanceolate, acute and mostly sessile, ½–1 in. long; flowers alternate in the axils, short-peduncled; corolla with a dark crimson eye and a pale border to the lobes, the latter numerously red-veined and glandular-ciliolate, 3–5 lines in diameter.

On sandy slopes or dry washes along the Mohave river, Cal., between Daggett and Waterman, May 10, and opposite, near Calico, May 11, 1884.

Stems erect, sometimes simple, usually branching and ascending, 2–5 inches in height; the leaves in all the specimens discovered are approximate and tinted a warm Indian red; the curious flowers peering out of the thick foliage display vivid contrasts of dark crimson center bordered with light rose, the whole disk traversed with radiating and branching veins of blood red. Generally associated in groups, these little plants are quite attractive with their odd reddish-green leaves, strict habit and bright-eyed flowers.

The specific name *Mohavensis* I have chosen in order to publish more extensively the peculiar region where this novelty is found. The Mohave valley is noted for many rare forms including the types of four as yet monotypic and local genera—Mohavea, Canbya, Lemmonia and Parishella—while it is the headquarters of several other odd genera of wider latitude, such as Monoptillon, Trichoptilium, Tricardia, Hesperocallis and Nicolletia, the latter, however, having a second species outside.

In this connection it may be well to report the names and localities of a few of the new species discovered during the same trip, and mostly in the same valley.

Astragalus Mohavensis, Watson, is a large, woolly species found near Newberry's station.

Astragalus acutirostris, Watson, is a slender, glabrous form in the splintered rocks above Calico mines.

Senecio Mohavensis, Gray, is a curious annual in clefts of rocks near Fort Mohave.

Phacelia invenusta, Gray, resembles *P. crenulata*, in Nevada basin near Fort Mohave. (First collected in 1880 but now recollected and just named.)

Phacelia saxicola, Gray, a delicate, tufted species, in clefts of moist granite rocks near Kingman, Ariz.

Nama depressum, Gray, forms small circular mats on the plains near Calico village.

Nama pusillum, Gray, a tiny, depressed form on gravel tables, between Waterman and Calico.

Also we find here, in a noted cañon of ancient cliff-dwellings near San Francisco Mountains, a large *Cystopteris*, uniformly bearing bulblets near the apex of the fronds. If this is the species *C. bulbifera* it has not before been reported so far west as Arizona.

Fort Moroni, near Flagstaff, Ariz., July 30, 1884.

On the Sexuality of the Fungi.[1]

BY H. MARSHALL WARD.

I propose to show that it is probable that the sexuality of the higher Fungi has disappeared, because its purpose has been equally well or better attained otherwise than by means of sexual organs.

Preliminary to this it will be necessary to be quite clear as to what sexual organs and the sexual process essentially are.

The two points common to all the cases of sexual reproduction which have been directly observed are the following:

1. A larger or smaller quantity of protoplasmic material passes from one portion (the male organ) of the same or another individual, into the protoplasm contained in another portion (the female organ).

2. The protoplasm contained in the female organ therefore becomes capable of further development; either at once, or, more generally, after undergoing a period of rest.

It is not necessary to quote the numerous cases of observed analogies between the sexual reproduction of animals and plants; but will suffice to note that the essential in the sexual process is always the addition of a portion of protoplasm from the male, to the protoplasm of the female.

But this is not all. It is now well established in embryology that the normal ovum, or female mass of protoplasm, is incapable of further development until it has received the protoplasm of the male; that the latter, in fact, incites the former to further development.

The outcome of all we know of these matters leads to the conviction that we have in the germination or development of an

---

[1] The statement of the important hypothesis hereby presented is somewhat abbreviated from the concluding portion of a long and interesting article by Professor Ward, given under the same title. The review of the historic progress of our knowledge of sexuality in fungi, and the present state of such knowledge, with the numerous illustrative diagrams are necessarily omitted for want of space.—EDS.

oospore—and the same is true for an egg, etc., the terms being different—simply a *renewal* of the growth of the organism; and from this and other convictions follows the result that the formation of an oosphere, although it may take place after an accumulation of large quantities of food, implies a condition of weariness—if the term may be allowed—on the part of the protoplasm for the time being. No doubt the molecular energy of the protoplasm forming the oosphere, is less than that of the rest of the plant for the time being; the access of the antherozoid or male protoplasm, however, reinvigorates the sluggish mass, and renewed life ensues. This may require some time, however, and we may possibly not be far wrong if we imagine that interval to be occupied in molecular rearrangements in the mass.

But, although we can sum up the foregoing by saying that, after a time, protoplasm requires reinvigorating by the addition of fresh protoplasm from another source, it is extremely improbable that the protoplasm of the male and female organs is at all similar.

It now remains to be seen if we can throw any light on the curious disappearance of sexual organs and sexuality in the Fungi —curious, because the sexual process appears to be all but universal in all organisms excepting the very lowest.

A hypothesis which suggests itself, and which Eidam[1] favors, and which is certainly supported by some analogies, is to the effect that the apogamous Fungi, *i. e.*, those in which the sexual organs are totally suppressed, are not always apogamous. We know that many forms only produce their sexual organs at comparatively long and rare intervals. The *Mucors*, for instance, may be propagated through numerous generations by means of the asexual spores; the sexual organs only arising now and again under favorable conditions.

Moreover, the cases of polyembryony—where several embryos arise in an embryo sac, although only one oosphere is fertilized—favor the view that the effect of fertilization may be extensive; and we can not doubt that such is the case where adventitious covering branches arise after the conjugation of certain *Mucorini*, and in the *Orchideæ*, where fertilization or even the mere growth of the pollen tube affects the whole flower.

The sexual act, however, consisting as it does simply or mainly in the reinvigoration of protoplasm by the addition of protoplasm of a different nature (though we do not know the kind or limit of difference), it may be that an explanation of what occurs

[1] Cohn's Beitr. zur Biologie, etc., B. iii, H. iii.

in the Fungi is afforded by their mode of life. The Fungi in which sexual organs seem to be most certainly absent are those which are most highly specialized as parasites. Now, we have every reason to believe, first, that parasitism is a matter of degree, and secondly, that the most highly specialized form of parasitism consists in directly obtaining those contents of the cells of the host which are chemically most complex, and therefore contain most energy.

I need not dwell on the degrees of parasitism exemplified by plants which merely rob their hosts of space or moisture, or which have obtained a hold so intimate that they break it up and feed on the rotting *debris*, but may at once pass on to consider a few consequences which follow from the mode of life of those highly specialised parasites which have become so closely adapted to their host, that they exist for a time as all but an organic part of its tissues and substance.

It can scarcely be doubted that the protoplasm of a higher plant, such as a phanerogam, differs from that of a lower cryptogam in being capable of doing more work, and that the great advantage derived by a parasitic Fungus which has its life so adapted that it can tax the cells of a phanerogamous host plant, is that it contains its food materials in a condition more nearly approaching that of its own substance, than would be the case if it had to work these materials up from inorganic matters.

Now it seems not improbable that the protoplasmic substance of a higher phanerogam may contain so much energy that it can not only supply the vegetative mycelium of a parasitic fungus with all that it requires for its immediate growth, but also suffices to enable that fungus to store up enough energy in its asexual or apogamous spores to last until the next generation of the fungus gains its holdfast on another (and it may be distant) source of life-giving substance.

Let us take the case of a uredinous fungus parasitic in the leaves of a phanerogam. We know that the substances necessary for the whole growth of the phanerogam are formed in the cells of the leaf; not only so, the matters which eventually find their place in the reproductive organs must be formed there also, potentially at least. The leaf of a phanerogam so attacked, moreover, is able to support the parasitic fungus for a long time uninjured, as I have convinced myself by experiment, and there can be no doubt that substances pass into the fungus which would normally have passed into other parts of the host plant itself.

But we may imagine even this to fail after a time—we may suppose that at length the Fungus derives too little benefit to be able to go on; or the season during which the host plant flourishes is drawing to an end.

No doubt we have in heterœcism the salvation of such a Fungus. Not only is it carried through a dangerous period, by seeking relief at the hands of a second host, but—and which I believe to be far more important—it obtains reinvigoration by the new protoplasm with which it comes in contact. We may not inaptly compare the sojourn of the Fungus on its second host, to a trip to the seaside, where the weary and enfeebled organism enjoys fresh diet and associations for a time, which in their turn pall and prepare the recipient to renew old modes of life.

We have seen that the disappearance of the sexual organs, leading to apogamy, commences especially in the lower *Ascomycetes*, and it may be more than a coincidence that epiphytic forms, which show a tendency to produce one kind of spore while on the living leaf and develope their asci on the fallen leaf are common here; such forms suggest how the parasitism and heterœcism of higher forms may have begun, and it is remarkable that the apogamy becomes more and more complete as we ascend through the latter.

It is not pretended that the hypothesis embodied above at once explains all the cases possible, and it will be well to state a few of the difficulties at once. The *Basidiomycetes* I shall not dwell upon, since our knowledge of them is still very imperfect.

The difficulty may suggest itself to many that there are parasitic fungi—such as the *Peronosporeæ*—which nevertheless develop the sexual organs in the condition typical and perfect for the group to which they belong. I have already referred to the fact that many of these forms are really saprophytes, and that others break down and destroy the tissues of their hosts—clumsily killing their prey, and then feeding on the rotten mass—and have pointed out that this is a much less specialized form of parasitism than that of the higher Fungi and *Ustilagineæ*.

Nevertheless, the sexuality shows signs of disappearance in extreme members. De Bary[1] shows that in *Phytophthora* and *Peronospora* there is a less evident passage over of protoplasm from the antheridium to the oosphere than in *Pythium;* and that in some cases, indeed, the quantity passing over is too small to be observed. I will not attempt to lay stress on the coincidence that in *Phytophthora infestans* (the fungus of the potato disease) no sexual act has yet been discovered.

[1] Beitr. zur Morph., etc., der Pilze, iv, p. 72.

Another obvious objection may be raised as follows:—The *Saprolegniæ* are in the main saprophytes, and yet they are said to be advanced towards apogamy—parthenogenetic, at any rate. The answer may be that they are saprophytic chiefly on animal protoplasm, which contains more potential energy than does vegetable protoplasm. At the same time, some *Saprolegniæ* are parasitic on plants, and *S. ferax* now appears to be parasitic on fish[1].

I may say, in conclusion, that it was during the study of the parasitic fungus of the coffee disease (*Hemileia vastatrix*)[2] in Ceylon that I was first led to speculate on the enormous amount of energy displayed by an organism which shows not the remotest satisfactory trace of sexuality, but which reproduces itself through many generations exclusively by means of asexual spores. That this energy of reproduction is derived from the coffee tree there can be no doubt, and that it is at the cost of the reproduction of the host is sadly evident; the clear inference from the fact that the coffee leaf supplies substance for the reproduction, etc., of a fungus at the expense of its own fruit, is that the fungus takes matters which are very rich in energy, so rich, indeed, that the fungus is not necessitated to sort these substances in special reproductive organs, and to secrete sexual elements, one of which would then reinvigorate the other, but may employ them forthwith for the purposes of its own relatively simpler existence and reproduction —*Quart. Jour. Mic. Sc*, April, 1884.

GENERAL NOTES.

Polarity of Lettuce Leaves.—The orientation of the leaves of *Lactuca Scariola*, which has made it one of the two best known "compass" plants, is repeated in a less degree in the leaves of the common garden lettuce. The polarity is scarcely apparent until the lettuce begins to throw up the flowering stem. It is very weak in the curled and wrinkled varieties, but it is well marked in the Cos varieties, which have flat narrow leaves much like the wild *L. Scariola.* The observation was made on over one hundred varieties of lettuce grown the present season in the garden of the New York Agricultural Experiment Station.—J. C. A.

Hibiscus Moscheutos and H. roseus.—Dr. J. Guillaud, of Bordeaux, sends a pamphlet containing his investigations resulting in the identification of

[1] Prof. Huxley, 'Quart. Jour. Mic. Sc'., 1882. [It may be found upon otherwise healthy salmon, according to the investigations of Mr. George Murray. 'Science', IV, p. 27.—Eds.]

[2] ['Quart. Jour. Mic. Sc.', Jan. 1882; noticed and figured in 'Am. Nat.', July, 1882.—Eds.]

Hibiscus roseus of Thore—a species supposed to be indigenous to the southeastern coast of France, also found in Italy—with our Marsh Hibiscus. He is not aware that the same identification has been made by Mr. Daydon Jackson, and published a year or two ago in the nineteenth volume of the *Journal of the Linnean Society*, London. Dr. Guillaud has had the advantage of seeing the two plants growing spontaneously, ours in the neighborhood of New York, the other in the marshes of the Landes. *H. roseus* has also been found in North Italy, in the marshes of the Po and lagunes of the Adriatic, and, according to Dr. Guillaud, specimens have been received from Asia Minor, but no mention is made of it in Boissier's Flora Orientalis.

Is this species indigenous to Europe as well as to the Atlantic coats of North America? Is it a survival from the time when the floras of Europe and Eastern America had more common elements than they now have? Or has it somehow been conveyed across the Atlantic, and if so, whether at some early period, or within historic times? Questions not easily answered. If the first, then this plant, like a few others that might be named, is in Europe what *Convallaria majalis*, *Littorella lacustris*, *Marsilia quadriflora*, *Scolopendrium* and perhaps *Calluna* are in North America. In favor of the second view, and even of a late and casual introduction, it is to be said, as Dr. Guillaud notes, that Thore found the plant on the coast of France only at the beginning of this century; that it was unknown to Tournefort, who botanized around Bayonne in the autumn of 1688; that the plant has disappeared from the particular stations where Thore found it and where it was said to abound, and that it is now more rare than formerly. Its spread from the Atlantic coast to that of the Adriatic may be owing to the carriage of seeds by marsh birds. Indeed, Dr. Guillaud thinks it may have been brought to Europe by sea birds. On the other hand, since it is now found in the district near Mantua, he quotes the lines in Virgil's *Eclogues*, in which the stems of *Hibiscus* are twice mentioned, in a way by no means *mal-a-propos;* but he thinks they might as well apply to Marsh-mallow. It appears that the specific name *Moscheutos* came to Linnæus through Cornuti, from a "Rosa Moscheutos" of Pliny, some kind of Rose-mallow, we may suppose. Since the two Linnæan species are clearly one, it is a pity that the name *H. palustris* was not chosen. Torrey and Gray are responsible for that. The reason of the choice was, that *H. Moscheutos* stands first in the book, and *H. palustris* is merely differentiated from that—reasons which need not have prevailed.
A. GRAY.

Vincetoxicum.—Following some authority, which it is now not worth while to look up, it appears that in the Synoptical Flora of N. America, I had derived this name from "*vincues*, that serves for binding" and *toxicum*. Dr. Hance, in Britten's *Journal of Botany* for May, 1883, notes, (1) that the only authority for this adjective is a line of Plautus in which *vincea* is now known to have been a mistake of some copyist for *juncea*, and (2), that the old herbalists, Fuchs and Matthiolus, clearly indicate that the Latin part of this hybrid name is from *vincere*, to conquer.

Stipules in Saxifragaceæ are of small account, as Prof. Coulter's pupils show me by sending *Mitella diphylla* with good stipules between the cauline leaves. It seems to be regularly so.

"Breweria minima," Gray, in Proc. Am. Acad. xvii, 228, is *Convolvulus pentapetaloides* of Linnæus, and doubtless was introduced into California from the Mediterranean region, probably with grain. It turns up from various parts of California of late. The style and stigmas are truly as in *Convolvulus*.
A. GRAY.

EDITORIAL NOTES.

PROF. W. W. BAILEY reports *Galinsoga parviflora* from Providence, R. I.

DR. J. SIGMUND POETSCH, lichenologist, died at Randegg, in April last.

WE notice by the *Torrey Bulletin* that Prof. W. J. Beal is preparing an illustrated work on grasses.

THE *Deutsche Botanische Monatsschrift* is an excellent journal of local botany published at Sondershausen, Germany, by Dr. Leimbach.

THE geological survey of Minnesota is printing a catalogue of the flowering plants and ferns of that State, giving their distribution, etc.

DR. J. D. Cox has come to the conclusion in his study of diatom shells, as we learn from the *Amer. Mo. Micr. Journal*, that the areolæ are cavities inside the wall of the shell, while the ribs are thickening upon the surface.

MISS M. B. FLINT, writes from Duchess county, N. Y.: "*Galium verum* has recently appeared in the town of Stanford. I can trace its introduction to no cause. As Gray (Manual) restricts it to E. Mass., the mention of this station may be of interest."

THE PRESENT SEASON has been a remarkably good one for botanists in Arizona and Southern California, owing to the unusually heavy and long continued rains. Mr. Pringle, who is at work in Arizona and Sonora, writes that he is making a large and rich collection in that region, an advertisement of which will appear later.

THE NEW PART of the Synoptical Flora of N. America (Vol. I, pt. 2) is published. It comprises Caprifoliaceæ to Compositæ inclusive, 474 pages. It may be ordered of Curator of the Herbarium of Harvard University, Cambridge, Mass. Price, $5. It will be sent on receipt of this sum to any address in the United States or Canada, postpaid and *registered*.

WE HAVE RECEIVED from the author a copy of a "*List of N. B. Plants*" by Prof. James Fowler, showing that *Scirpus* (*Blysmus*) *rufus*, Schrad., was found in N. B. much earlier than the dates given by Mr. Boott in the June number of the GAZETTE, p. 85. Mr. Fowler's specimens were collected at Eel River, Restigouche county, N. B., August 1, 1873.

THE American Society of Microscopists had an interesting meeting at Rochester during August. Botanical subjects were not prominent. Dr. Dallinger and Prof. Bennett were present as delegates from the Royal Microscopical Society of London, and the latter read a paper on "Fungi found in Sewage Effluents." Prof. H. L. Smith, of Geneva, N. Y., was elected president for the coming year.

PROF. J. C. ARTHUR has been investigating the infectious nature of the pear blight, making numerous experiments at the Agricultural Experiment Station, Geneva, N. Y. Inoculations of healthy twigs, leaves and fruit caused the disease to appear quickly. Detailed results of the experiments are not yet published. A preliminary notice of the work done appears in *Bulletin No. xcii* dated August 6.

MR. JOSEPH F. JAMES, in the *Journal* of the Cincinnati Society of Natural History, announces that, "while all the genuine *Campanulas* have bell-shaped-drooping, pediceled flowers, the species of *Specularia* have rotate, erect and ses, sile flowers." From which it would seem that the original Canterbury Bell is no longer a *Campanula!* Mr. James and Mr. Morgan accordingly transfer *Campanula Americana* to *Specularia.* But that species has not erect flowers, while a large number of *Campanulas* have; and botanists know plenty of the latter with flowers as nearly sessile as those of the Venus's Looking-glass, and several with corollas quite as rotate.

BOTANY receives due recognition in the prizes awarded by the French Academy of Sciences. Among the awards for 1883, given in May last, was the Desmazières Prize to MM. Bonnier and Mangin for their memoir on "Respiration and Transpiration of Fungi," and the Bordin Prize to M. Costantin for best treatment of the proposed subject: "Influence of environment on structure of root, stem and leaves; modifications undergone in water by land plants and those by aquatic plants compelled to live in the air; explanation of the special form of some marine plant." The Desmazière Prize for 1884 will be given for "The most useful work on cryptogamous plants," and the De la Fons Melicocq Prize for 1886 for "The best treatise on the flora of North France."

DR. T. L. PHIPSON, of London, gives some results in the *Chemical News* for July 25, of a long series of observations on the assimilation of plants. He finds that when algæ grown in spring water are constantly supplied with fresh carbon dioxide, instead of fresh water, as the experiment is usually performed, they give off less and less oxygen and finally none at all; also, that if spring water is first boiled, then impregnated with carbon dioxide, the algæ will give off little or no oxygen. He therefore concludes that green plants require something else beside carbon dioxide and sunlight in order that they may evolve oxygen, and that something he finds to be binoxide of hydrogen. The reaction is theoretically something like this: $CO_2+HO_2=CHO+O_3$, or CHO_2+O_2, or CHO_3+O, or, again, $2\,CO_2+HO_2=C_2HO_3+O_3$, etc. The conclusion if sustained is very important.

IT IS NOW PRETTY well settled that the cells of plants are not the units, separate and individual, out of which they are built. Since the discovery of the sieve tubes by Hartig in 1837, and more especially since the demonstration of the perforations in their septa and the continuity of the protoplasm through these perforations, botanists have been prepared to have the idea of protoplasmic continuity more extended. Recent investigations seem to leave little doubt that the protoplasm of plants is continuous throughout, and instead of a multitude of cells combined into a tissue we have protoplasm cut up into compartments by partition walls in various planes. These partition walls serve for mechanical support and permit a more perfect physiological division of labor. In some cases the wall plays the more important part; in others, the protoplasm. The continuity is established by means of threads of protoplasm reaching through the cell-wall. These threads are not the size of the pits which exist in almost all walls, but much smaller. In all cases the pits seem to be closed by a membrane, through which there are a few (3—5) perforations. Through these perforations run moniliform threads of protoplasm, usually curved and containing a few granules. Russow believes that these threads are coetaneous with the cell-wall, deriving them from the threads which extend between the daughter-nuclei when the cell is undergoing division, the increase in number being due to the longitudinal splitting and the formation of intervening cellulose. Gardiner holds that ordinarily the function of these threads is to permit the transmission of impulses from one part of the plant to another; while in endosperm cells and sieve tubes they "make possible a transference of solid materials."

CURRENT LITERATURE.

Manual of the Mosses of North America. By Leo Lesquereux and Thomas P. James. Boston: S. E. Cassino & Co., 1884. pp. 447, pl. 6.

The recent publication of this work is an important and valuable addition to our bryological literature, and can not fail to be highly appreciated by those interested in the study of mosses. It is in the form of an octavo of 447 pages, containing descriptions of nearly 900 species of mosses, also a glossary of terms and six plates illustrating the most important genera. All mosses thus far found within the limits of the United States, British America, Alaska and Greenland are fully described; those found in Mexico, although properly within the limit of the work are excluded.

When work on the Manual was commenced, Mr. Lesquereux, owing to failing sight, was obliged to leave the examination of specimens to Mr. James; and after the death of the latter this part of the work was continued and finished by Mr. T. Renauld, an eminent French bryologist. Mr. Sereno Watson also rendered valuable assistance in the work.

The Manual includes the advances made in bryological investigations since the publications of the late Mr. W. S. Sullivant. The classification adopted is mainly according to Schimper. It is to be regretted, however, that the habitats in many instances are deficient and do not represent the well-known ranges of the species. In the following notes I have endeavored to show the omissions. The species referred to from Colorado were collected by Mr. T. S. Brandegee, and are represented in my herbarium; a list of some of these was published in the Botany of the U. S. Geol. and Geog. Survey of the Territories by Hayden, Vol. ii., No. 3.

The varieties Torreyanum and plumosum of Sphagnum cuspidatum, are common in Southern New Jersey. Sphagnum Lindbergii, Labrador (Allen). Sphagnum Austini, Mass. (Austin); Canada, (Macoun); Green Cove Springs, Fla. (Rau). The first specimens from Florida were sent to me by Dr. G. Martin; vide BOT. GAZETTE, vol. ix., p. 26. During the month of March, this year, I also collected it in Florida. Sphagnum imbricatum, Hornsch. 1848, might be mentioned as a synonym. Under Sphagnum Portericense is mentioned "fruit unknown"; Dr. Charles Mohr sent me a specimen in fruit from Mobile, Ala. This is, I believe, the first time it has been found fruiting. This species also occurs in Florida. Sphagnum cyclophyllum and sedoides, Adirondack Mts. (Peck). Sphagnum Pylæsii, Labrador (Allen). Andræa rupestris, Lehigh Valley, Penn. (Wolle, Rau). The generic name Micromitrium, Austin in *Musci Appalach.* 1870, has also been adopted by Schimper for a very different moss from Mexico, vide *Prodromus Bryologiæ Mexicanæ*, par E. Bescherelle, 1871. According to these respective dates, Austin's name would claim priority. Austin, however, proposed to change it to Sympoma and Lindberg to Nanomitrium, in order to prevent confusion. Oreoweisia serrulata is not rare in Pennsylvania, Catskill Mountains, Watkins Glen, N. Y., etc. (Rau). Rhabdoweisia denticulata is not rare in the mountains of Pennsylvania and New Jersey (Rau), Mt. Mansfield, Vt., and Ausable Chasm, N. Y. (Pringle). Cynodontium virens, var. serratum, Colorado (Brandegee). Dicranella debilis, Texas (Rau). Fissidens obtusifolius, Colorado (Brandegee). Octoblepharum albidum, Texas (Rau). Ceratodon purpureus, var. xanthopus, Colorado (Brandegee). Eustichia Norvegica, Lawrence county, Penn. (Lesquereux). Campylosteleum saxicola, New Jersey (Austin). Pottia riparia, Bethlehem, Penn. (Rau). Drummondia clavellata, Canada (Macoun). Orthotrichum diaphanum, Colorado (Brandegee). Discelium nudum: notwithstanding the fact that I sent specimens to both authors, the habitat is meagerly given. In Austin's *Suppl. to Musci Appalach.* No. 505, the habitat of this moss is given as follows: "Clay banks, Bethlehem, Penn. (Rau); Ohio (Beardslee); also Canada and westward to Vancouver Island (Macoun);" to which I now add Bingen and Emaus, Penn. (Wolle). Dissodon splanchnoides and Tayloria serrata, both from Colorado (Brandegee). Bartramia radicalis, Narrowsville, Penn. (T. C. Porter, E. A. Rau). Meesia tristicha, Pennsylvania (Rau); Vermont (Pringle). The New York habitat of Paludella squarrosa should doubtless be credited to C. H. Peck. Bryum Muhlenbeckii, White Mountains (Austin); Catskill Mountains (Rau). Aulacomnion turgidum, Labrador (Allen). Atrichum crispum, Closter, N. J. (Austin). Cryphæa glomerata, New Jersey (Austin); Connecticut (Rau). Neckera oligocarpa, Colorado (Brandegee) fertile; Catskill Mountains (Austin, Rau). Fabronia pusilla, incorrectly labeled F. octoblepharis in *Musci Appalach.* No. 535, Del. Water Gap, N. J. (Austin, Rau). Fabronia Wrightii, Colorado (Brandegee). Thelia Lescurii, New Jersey (Austin, Rau). Myurella Careyana, Canada (Pringle) fruiting. Leskea nervosa, New York (Austin); Colorado (Brandegee). Leskea Austini, Pennsylvania (Rau). Anomodon viticulosus, Pennsylvania (Rau). Pylaisia polyantha, Colorado (Brandegee). To the habitat of Cylindrothecium concinnum add (Brandegee). Climacium dendroides, New Jersey, (Austin); New Brunswick (Fowler). Thuidium pygmæum, New Jersey (Austin); Pennsylvania (Rau). Thuidium paludosum, Colorado (Brandegee); Connecticut, New Jersey and Pennsylvania (Rau). Brachythecium acutum, New York (Peck); New Jersey (Austin); Pennsylvania (Rau). Brachythecium Utahense, velutinum, and Fendleri, Colorado (Brandegee). Brachythecium reflexum, Lake Huron region (Mrs. Roy). Brachythecium Novæ-Angliæ has certainly a wider range than indicated. Eurhynchium diversifolium, Colorado (Brandegee); Pennsylvania (Rau). The Rhynchostegium demissum habitat needs revision. Raphidostegium Novæ-Cesareæ fruit is *not* unknown, as will be seen by referring to Bot. Gazette, vol. i., p. 30; fruiting specimens from Stony Creek, Carbon county, Penn., 1874 (Wolle, Rau). Plagiothecium Mullerianum, Pennsylvania (Rau). From specimens of Plagiothecium subfalcatum, Aust., which I collected at Onoko Glen, the late Mr. Austin was convinced that this species is a form of Pl. elegans. Amblystegium fluviatile, Pennsylvania (Rau). Amblystegium compactum, Colorado (Brandegee). Hypnum Bergenense, Aust. is considered identical with Amblystegium hygrophilum, Jur. by S. O. Lindberg. Hypnum nemorosum, Pennsylvania (Wolle). Limnobium eugyrium, Pennsylvania (Wolle, Rau). Pleurozium Oakesii, New York and throughout British America (Austin). Hylocomium Wrightii, Florida (J. D. Smith). Zieria julacea, Colorado (Brandegee).

The following mosses are omitted from the work, although of sufficient importance to be included:

Hypnum thelistegium, C. M., Florida; Aust. Musci App. Suppl., No. 505. H. homalostegium, C. M., Alabama (Mohr). H. occidentale, S. and L., Oregon (Hall); Sull. Icon. Musc. Suppl., p. 105, t. 81. Trichostomum macrostegium, Sull., Alabama (Mohr); Sull. Icon. Musc. Suppl., p. 35, t. 22. Dicranum Richardsoni, Hook., Greenland fide James in Kane's Arctic Explor., vol. ii. Dicranella Canadensis, Mitt., British America (Drummond, Macoun). According to Sch. Syn. Musc. Europ., the following occur in North America: Dicranum arcticum, Schp., Greenland and Labrador; Tetraplodon mnioides, vars. Adamsianus and cavifolius, Arctic regions.—Eugene A. Rau, *Bethlehem, Pa.*

BOTANICAL GAZETTE.

VOL. IX. OCT. AND NOV., 1884. Nos. 10 & 11.

Botanical Papers before the American Association.

The following is a full list of the papers entered upon the programme of the Association devoted to or touching upon botanical topics:

W. O. ATWATER, On the assimilation of atmospheric nitrogen by plants.

V. BALL, On the identification of the animals and plants of India which are mentioned by ancient Greek authors.

W. J. BEAL, The torsion of leaves; and Polarity of leaves of Erigeron Canadense.

C. E. BESSEY, The adventitious inflorescence of Cuscuta glomerata.

LOUIS ELSBERG, Demonstrations of perforations in the cellulose walls of plant-cells.

R. HITCHCOCK, Remarks on fluid and gelatinous media for cultivating micro-organisms.

JAMES HYATT, A discussion of the principles involved in the general action of vegetation, and of trees especially, to prevent extremes of temperature.

JOS. F. JAMES, Affinities of Dionæa.

WM. R. LAZENBY, The influence of cross fertilization upon the development of the strawberry.

GEO. MACLOSKIE, Stomates on seeds.

LILLIE J. MARTIN, A botanical study of the mite-gall on the petiole of Juglans nigra, known as Erineum anomalum Schw.

THOMAS MEEHAN, On the extinction of species.

C. S. MINOT, Biological problems; and Researches on growth and death.

H. N. MOSELEY, Utricularia vulgaris with young teleostean fishes entrapped in the bladder-traps.

ALFRED SPRINGER, Fermentation without combined nitrogen.

GEO. M. STERNBERG, Methods of cultivating micro-organisms.

E. LEWIS STURTEVANT, Influence of insulation upon vegetation.

L. F. WARD, The fossil flora of the globe; historical view, geological view, botanical view.

We are doubtless justified in saying that from a strictly botanical stand-point, none of these reached a high plane of scientific importance, unless we except the last one. Quite a number of them, however, were not intended as contributions to botanical science, and their value is to be judged by other standards. Some of the papers were not read, owing to the absence of the authors when the papers were called, and others were not heard by the editors. The following items are all our space will permit.

We are enabled to give elsewhere an abstract, prepared by the author, of Prof. Ward's valuable paper on fossil botany. It excited much interesting discussion, in which Mr. Carruthers drew attention to the necessity of caution in using the determinations of many fossil forms, especially of those below the Devonian. Many of the monocotyledons of the earlier periods are now known positively to be fragments of forms of other groups. The cryptogams of the Carboniferous strata, and other archæan types, had often undoubtedly peculiar vegetative structures, but their reproductive organs were not materially different from the forms of the present time, and they will all fall into groups established upon living forms. Prof. Ward in replying said there were at present three great schools of paleobotanists: the English, represented by Mr. Carruthers and Mr. Stevenson, the French, represented by M. Saporta and others, and the Swedish school, each with its special views. Prof. Macloskie mentioned the great gap that undoubtedly exists just before the almost simultaneous appearance of the Apetalæ, Polypetalæ and Gamopetalæ. Mr. John Ball pointed out that very likely the originals of the dicotyledons were largely lost through unfavorable conditions for their preservation.

The papers of Dr. Minot called forth a vigorous discussion between botanists and zoologists and between American and English scientists. He said in the first paper that the Linnæan system of nomenclature in its original significance has really become obsolete, although the majority of naturalists may not be aware of the fact, and based this statement on the gradual approximation of the number of species to the number of genera. Mr. Carruthers dissented from this view, and said that on the other side the Atlantic the Linnæan system was in as full force as it was in the days of its author. Dr. Gray fully concurred in this opinion, and doubted if the proportion of genera to species had much changed since Linnæus' time. He also said that the binary system was made for botanists, was kept by them, modified by them, and even to-day serves them as well as a system can well do. The time may come when zoologists will again adopt the true Linnæan system of genera, preserved in its purity by botanists. Prof. Cope said the Linnæan use of genera in zoology was not so strictly adhered to as in botany.

The second paper by Dr. Minot treated of individuality, as influenced by death, and whether death is coextensive with life. Prof. Huxley has said that the whole group of cells springing from a single cell forms one individual, i. e. one cycle of cell life. But if this is a universal definition, then death does not occur among many of the protophyta and protozoa, for they keep up a continuous life by successive divisions. Death is possibly a development that arises along with the differentiation of the higher forms. Mr. Meehan used the sunflower to show that the cycle of life is only a matter of nutrition, for while it usually dies in one year, cuttings may be taken which will continue the growth for another year, and so on. This is true of many other plants. Mr. Alpheus Hyatt had been unable to accurately apply the term individual, so used the new term zoon in the same manner as phyton is used in botany. Dr. Gray said individuality is a matter which is striven after in the organic world, is arrived at in the animal kingdom, but probably only fully achieved in the conscious animal. Several other equally eminent authorities spoke upon the subject.

Miss Martin comes to the conclusion from her study of the walnut *Erineum* that the gall starts very early in the growth of the petiole, and that the development is inward, as shown by the position of the eggs of the mite, and the absence of any sign that the tissues have been pierced. The paper received the special commendation of Dr. Gray.

Prof. Macloskie said that stomata had been reported on the seeds of *Magnolia* and *Lilium speciosum*, to which he added *Polygala, Viola, Carya, Juglans, Caulophyllum, Fagus*, and *Arisæma triphyllum* on the accessory coat.

Prof. Bessey had found by close examination of young plants of *Cuscuta glomerata* that the inflorescence arose from crowded adventitious buds, and not from the repeated branching of axillary flower-branches, as is commonly stated.

The Botanical Club of the A. A. A. S.

The success which attended the first meetings of the Club at Minneapolis, gave promise of greater success when it became possible to somewhat obviate the inconvenience of being a wholly subordinate appendix of a great body whose movements could not always be foretold with certainty. This was partly accomplished at Philadelphia, and yet the Club found itself considerably hampered for want of a convenient hour for meeting, and means for giving full notice to its members. But so much porgress was made in securing suitable arrangements, that we may anticipate that a year or two more will find the Club with ample facilities for carrying on its work.

The meetings were held in the Hall of the Union League, the room where the biological section of the Association met. The first meeting, at 9 o'clock Friday morning, Sept. 5, was called to order by the President, Prof. Beal, of the Agricultural College of Michigan. The Secretary being absent, Prof. Arthur was chosen to fill his place. About thirty were present. After several announcements were made, a paper was read by Dr. N. L. Britton, of Columbia College, "On the Composition and Distribution of the Flora of New Jersey." He described the topography of the state in its relation to the distribution of the vegetation, and spoke of the rarer forms in the several regions. The present number of plants known in the state is about as follows: exogens, 1168 species and 76 varieties; endogens, 483 species and 50 varieties; gymnosperms, 12 species; ballast plants, 400 species; pteridophytes, 365 species and 75 varieties; charas, 10 species; lichens, 240 species and 62 varieties; fungi, about 1500 species; marine algæ, 110 species and 4 varieties; fresh water algæ, 510 species; diatoms, 450 species; protophytes, about 125 species; making the large total of nearly 5,500 species. The catalogue of the State is being prepared for the Geological Survey; a preliminary one was issued in 1881, and the final one is expected in about a year hence.

At 5 o'clock in the afternoon of the same day, the second meeting was held, about 40 being present. Prof. Barnes, of Purdue University, read a paper on the "Course of the Fibro-vascular Bundles in the Leaf Branches of Pinus sylvestris," in which he attempted to throw some light upon the nature of the peculiar bundles in the leaves of pine and other conifers. Each leaf has what might be taken to be two bundles, separated and surrounded by peculiar tissue, the whole enclosed in a bundle sheath, outside which lies the usual green mesophyll. By examining the early stages in the stem, it was found that they divided first at right angles to the plane of the leaves, and afterwards each half again divides, and sends a branch to each leaf. But this does not yet wholly clear up the matter. The paper excited considerable interest, and was discussed by Profs. Buckhout, Macloskie and others.

A paper by Prof· C. E. Bessey, of the Iowa Agricultural College, gave observations on the "Mode of Opening of the Flowers of Desmodium sessilifolium." They expand to a certain degree, and remain in that position till a particular spot at the base of the standard is touched, when the wings and keel drop down suddenly, the stamens are protruded, and the insect is dusted on the breast with pollen. As the stigma is thrust out in front of the anthers, in the next flower visited, it touches the pollen-covered surface of the insect before the pollen of the same flower is deposited.

Prof. Geo. Macloskie, of Princeton, followed with observations on the "Fertilization of Geranium maculatum." It is protandrous. He found that heavy insects, like bumble bees, pull the flower down, and in the efforts to hold on the pollen is rubbed upon the insect, which in like manner is deposited on the exposed stigmas of the next flower visited.

Prof. W. R. Dudley, of Cornell University spoke of the "Torsion of Stems of Eleocharis rostellata," and also on "The Protogynous Character of some Myriophyllums." Some discussion followed on torsion in this and other instances.

Prof. W. H. Seaman, of Washington, advocated the use of oblique sections in studying the fibro-vascular bundle The protest which Prof. Bessey entered against this method for the purpose of exact study will doubtless meet the approval of most workers. Prof. Seaman also spoke of the peculiar terminations of certain bundles in the leaves of Chenopodium and Drosera.

The third meeting was held at 9 A. M. Monday, with about 25 present. Prof. Beal, the President, read a paper "Concerning the Manner in which Certain Seeds bury themselves beneath the Soil," by means of their long hygroscopic awns. He found they succeeded as well on a free surface as among grass or stubble. The discussion that followed was participated in by Profs. Rothrock, Bessey and others

Prof. W. R. Lazenby, of the Ohio University, presented a paper on the "Prolificacy of Certain Weedy Plants," based upon the number of seeds found by actual count to be produced by an average plant.

Prof. J. T. Rothrock, of the University of Pennsylvania, made some interesting remarks on Photomicrography. He said that one with an ordinary microscope was within twenty dollars of photographing. By the dry plate process an hour's practice would enable one to get a picture of some kind, and such as would lead to something better. Some photographs of wood sections were passed about to illustrate how he used this in class work. He laid much stress upon the necessity of very thin sections in all microscopic work.

The same speaker then made some remarks on the significance of "Loments of Leguminous Plants."

Dr. Gray, holding a sunflower in his hand, said Mr. Meehan had made an interesting discovery in these flowers. Instead of the pistil pushing the pollen out of the anther tube by its gradual lengthening, as had always been supposed, he found that the stamens and pistil grow together till of full length, then the filaments shorten, and the anther tube is drawn down, exposing the pistil covered with pollen, which then displays its stigmatic surfaces in the well known way. This fact is connected with the observation of Kölreuter and other older observers, that in Centaurea and some thistles, if the tips of the anther tubes are touched at the right moment, they will quite suddenly retract, which only differs from this instance of the sunflower in the time occupied by the movement. Mr. Meehan, who is inclined to see things from a somewhat different point of view from most of us, thinks this a provision for self-fertilization. But bees undoubtedly carry the pollen from one head to another. A considerable discussion followed, in which Prof Beal suggested the experiment of covering up the heads to see if any seed would set. Dr. Gray thought they would probably form, for many flowers failing to secure cross-fertilization were yet able to self-fertilize. Mrs. Wolcott, of Boston, confirmed this opinion. She had covered up the heads to keep birds away, and had obtained plenty of seeds.

The club met at the usual hour Tuesday morning. Mr. P. H. Dudley, of the Torrey Club, exhibited some fine photomicrographs of wood.

Dr. Geo. Vasey, of the U. S. Department of Agriculture, gave some interesting "Notes on the Vegetation of the Arid Plains."

Prof. Bessey spoke of the "Curvature of the Stems of Conifers," having seen branches of Austrian pine bend that were one, two, and even three years old.

Mr. Meehan discussed the "Relationship of Helianthus annuus and H. lenticularis," two species which have now been thrown together in the Synoptical Flora, the latter being considered the wild and the former the cultivated state of the common sunflower. He exhibited charts to show that *H. annuus* has a campanulate corolla, while that of *H. lenticularis* is tubular, as Nuttall had recognized in naming it *H. tubæformis*. Other differences are not so constant.

The same speaker then adverted to the retraction of the stamens in the sunflower by means of the elastic filaments. He contended that as the bees distributed pollen from one floret to another of the same head, it only constituted self fertilization, according to Mr. Darwin's definition. Mr. Carruthers, of the British Museum, spoke in commendation of the careful observations which the speaker had made.

The next paper by Prof. L. M. Underwood, of Syracuse University, on "Some Statistics Concerning the North American Hepaticæ" gave the distribution by states and regions, and the number of species in the orders: Ricciaceæ 24, Marchantiaceæ 22, Anthoceroteæ 14, and Jungermanniaceæ 171, making a total of 231 species. Of these 120 are peculiar to America, only 39 of which are commonly found in public herbaria, and 60 are probably not represented in any American collection, public or private.

Miss Grace Anna Lewis, of Philadelphia, showed a chart of the vegetable kingdom to learn if it were constructed on right principles.

The final meeting of the club was held on Wednesday morning at 9 o'clock. The first paper, by Prof. J C. Arthur, was on the "Nature of Gumming or Gummosis in Fruit Trees." He considers it to be a deorganization of the tissues through the influence of a fungus, but not necessarily a specific one. A fungus in this connection was first described last year by Oudemans in Hedwigia under the name Coryneum Beyerinckii. The speaker had been able to produce gumming by Monilia fructigena the fungus of rotting fruit, and the bacteria of pear blight, and showed specimens caused by the latter.

The report of the committee on postal matters was then called for. The committee was appointed last year at Minneapolis, and consisted of Profs. Coulter, Farlow and Bessey. The last was the only member present, who read a long statement from the Postmaster General to the effect that the present law could not be construed to allow botanical specimens to be accompanied by the usual written labels except at letter rates of postage, but expressing a willingness to bring the matter to the attention of the law makers at the proper time. The report was discussed, and upon motion the committee was continued. Prof. Barnes moved that the officers of the club draft resolutions to be presented for the approval of the Biological Section of the Association to still further promote the object in view.

The Club then proceeded to the election by ballot of officers for the ensuing year. The first ballot gave for president, Bessey 10, Beal 6, Hyatt 1; for secretary, Arthur 11, Barnes 2, Miss Knight 1, Dudley 1. The president announced that Prof. Bessey had been elected president and Prof. Arthur secretary.

A paper by Dr. Geo. Vasey on "A Hybrid Grass," in the author's absence, was read by the secretary, and is printed in full on another page. In the remarks that followed Prof. Scribner said Muhlenberg, Sprengel and Michaux placed *Eatonia* in *Aira*, which this discovery of Dr. Vasey showed to be not far wrong. *Graphephorum melicoides* and *G. Wolfii* might also be placed in the group *Avenaceæ*. The genus *Graphephorum* is an anomalous one, and the species should doubtless be distributed.

The Club then adjourned. The following papers were on the programme of the Club, but were not heard for want of time: "Notes on a Peculiar Flora on the Kittatinny Mountains," by Dr. N. L. Britton; "A New Preservation Fluid Especially Valuable for Plant Tissues," by Prof. C. V. Riley; Note on the Germination of Grasses," and "A Point in the Structure of the Sterile Flowers of Silphium," by Prof. C. E. Bessey; "The Fertilization of Wheat," by Prof. W. R. Lazenby.

Excursions and Entertainment of the Botanists at Philadelphia.

The prediction that the meeting of the American Association this year would bring together a large and notable attendance of botanists was fully realized. Indeed, they began to arrive as early as Saturday preceding the opening of the Association. The total attendance reached a little above one hundred, of whom six were from Great Britain. Full half the number have more than a local reputation, including a majority of our most distinguished teachers and investigators.

The arrangements for the benefit of the botanists were as elaborate and complete as could have been wished. The efforts of the committee of arrangements appointed by the Botanical Club were heartily seconded by the botanical section of the Academy of Sciences, who arranged the financial matters, a no small item, and both before and during the meeting were constantly at hand to render assistance. But to one person, Mr. J. H. Redfield, more than to any other individual, we owe the thorough success of the arrangements. Before the meeting he left no avenue untried that promised to afford additional enjoyment for the occasion, and during the meeting gave the same assiduous attention to the consummation of every detail. The heat was one feature of the occasion which produced so much discomfort that it can not be passed by in silence. It was intense and constant, both day and night, causing many to leave before the close of the session, and greatly enervating those who remained.

The Academy of Sciences was the headquarters of the botanists, where they met a hearty welcome, and found the library, collections, and other facilities of the institution placed at their service. It proved somewhat too far for convenience from the rooms of the Association, and the heat made the distance seem doubly long.

The excursion of Saturday to the pine barrens was, barring the heat, thoroughly enjoyable. The crossing of the ferry, the bustle of starting, and the ride gave opportunities for much fragmentary intercourse. When the coach which was devoted to the botanists was left on the side track at Egg Harbor the view that greeted the eye was a level sandy plain with low vegetation, interspersed with shrubs and trees here and there, and a few houses in the foreground. It was determined to make a sally eastward first. In spite of the fact that the thermometer had undoubtedly passed above the nineties, the whole party of 50, including ladies and Britishers, wandered out for a mile or so amid a vegetation remarkably rich in showy and interesting flowers and botanical rarities. But the heat would not permit much loitering, and they soon returned with red faces, but arms full of treasures. After a short rest all but a few summoned up fortitude to start out again, going westward for a full mile along the railroad track. This gave a different flora. But the zeal of the excursionists, which was emulating the temperature, reached its highest point when the cry ran all along the line that the Schizæa was found. There was a succession of disappearing forms down the railroad embankment into the thicket, where all, great and small, went down on hands and knees to gather the precious little ferns of such unfern-like aspect. But it is impossible to tell all that happened, and we must pass by numerous interesting incidents. A bounteous lunch was served upon the return, after which Mr. Martindale called the botanists to order, Prof. Beal presided, and remarks were make by several members of the party. Dr Gray gave some reminiscences of his early visits to this region He thought it was in 1832 that in company with Dr. Torrey he first saw the pine barrens at Tom's River, and had found *Schizæa* The following year he spent a week at Quaker's Bridge, and had not been in the pine barrens since till the present occasion. Mr. Carruthers spoke pleasantly of the enjoyment which the day had afforded him, and his surprise to see a region so apparently barren supporting such a varied vegetation, particularly at this season of the year. He was only able to recognize Pteris and Osmunda regalis as plants he had previously seen in a living state. Prof. Crawford, of Scotland, Prof. Porter, of Pennsylvania, and others spoke, when, the train arriving, we were on our way again, visiting the seashore for a breath of salt air, and then back to Philadelphia. It was a thoroughly successful excursion in many respects. In the matter of collecting, flowering plants were abundant and interesting, but we did not learn how many were secured, lichens were numerous, 83 species being gathered, fungi less abundant, 14 species being gathered, but water and moisture-loving plants largely absent. It was a surprise to most to see the vivacity of the older botanists. Dr. Gray was everywhere, and more active and less affected by the heat and the tramping than many of the young men, and Mr. Carruthers's genial face was also constantly with us.

On Monday morning those of the botanists who expressed a desire to visit the famous "ballast grounds" at Camden were met at the Market street ferry by Dr. J. B. Brinton, who was provided with a liberal supply of ferry tickets, and insisted upon distributing them to all who wished to go over. Arriving at the other side, we were met by Mr. Isaac C. Martindale, who ushered us into a four-horse coach. After the arrival of the last boat load, we were whirled off to the American Dredging Company's wharf, where we had our first opportunity to collect the many foreign plants which have established themselves on the ballast grounds. Starr's wharf and the Narrow Guage R. R. wharf yielded still other species. Among those picked up by the party were *Cnicus acanthoides*, *Verbena officinalis* (a new invoice, just over), *Convolvulus arvensis*, *Atriplex rosea*, *Reseda* *lutea, Diplotaxis tenuifolia, Linaria spuria, Lycopus Europæa* (typical), *Atriplex hastata, Chenopodium vulvaria, Amarantus blitum, Coreopsis bidentoides, Lotus corniculatus*, etc. Some of these named are well established in other parts of the country, but it was interesting to see the exact way in which they were, many of them, introduced. By the time the party had skirmished over the three localities, the sun began to grow hot—a gentle reminder of the pine-barren experience—and our host gave the order for the return. In a few minutes we were landed at the door of his hospitable home on Penn street, where Mrs. Martindale, with several other ladies, were waiting to receive us. After looking over the many rare and valuable books—some of them almost priceless—which Mr. Martindale has gathered into his library, the company were glad to heed an invitation to the dining room, where an elegant lunch was spread, such as never before had tickled the palates of "wharf rats," such as we that morning. After lunch, Mr. M. displayed some of the treasures of his herbarium and explained the plan adopted in its arrangement—a plan which provides for unlimited growth without the necessity of complete overhauling at each considerable addition. His herbarium is one of the largest (if not the largest) private herbaria in the country, and certainly no method of arrangement could surpass his for facility of reference and ease of handling.

After spending a most delightful hour or two, the party were driven to the ferry and returned to the work of section F in the afternoon. Those who participated in the excursion to the ballast grounds will undoubtedly all say that no excursion of the meeting was more enjoyable or enjoyed than this

It is said that the social privileges are highly important features of these gatherings, and, granting this, we are ready to maintain that the reception of Monday evening, given by the Botanical Section of the Academy of Sciences at their rooms, stands among the first of the notable events of the session. As many as 300 sat down to listen to the brief formal exercises of the evening. After the adjournment of an extremely short regular meeting of the Botanical Section of the Academy, Dr. Gray was called to the chair, Mr. Martindale acted as Secretary, and addresses were given by Messrs. Vasey, Canby, Meehan, Macloskie, Rothrock, Bessey, John Ball, Carruthers and Redfield. These were brief and pithy, and interspersed with such felicitous and suitable remarks by the presiding officer as to make the occasion a memorable one. The chatting and feasting that followed is not to be described, but resulted in all the satisfaction such an occasion may bestow.

On Tuesday afternoon the botanists of the Association joined the members of the Botanical Section of the Academy of Natural Sciences in a visit to the first Botanical Garden in the United States, established by one of the earliest botanists of this country, John Bartram, on the bank of the Schuylkill about three miles below Philadelphia. When the train stopped at the 58th Street Station, about 80 red badges disembarked, and under the guidance of several members of the Academy, set out for the historic spot. Changes of road since the last visit somewhat misled the guides and the party, and when the road suddenly ended blindly at a seven-rail fence, there was nothing for it but a climb. The ladies, however, took the fence in a style that indicated that they had had some previous experience on sundry collecting trips. A short cut across pastures and barn-lots soon brought us to the desired haven, though not by the most delightful traveling withal.

Coming from the railroad, one approaches the house from the rear as it faces the Schuylkill. The party first halted before a stone in the gable bearing the inscription, in quaint letters,

ΘΕΟΣ ΕΩΖΩ.
JOHN ANN: BARTRAM: 1731.

A larger one on the front of the house, over the window of his study, recites the simple creed for which he was disciplined by the Society of Friends:

'TIS GOD ALONE, ALMYTY LORD,
THE HOLY ONE BY ME ADORD.
JOHN BARTRAM—1770.

This house is built of stone, a gneissoid granite apparently quarried, hewn and laid by Bartram's own hand. In the center is a large recess porch, the roof of which is supported by columns with carved capitals of the Elizabethan order. The stone casings and sills of the windows are also carved in odd designs, and with evident patience. These ornamentations together with the whole make up of the building show that Bartram was a mason of no mean attainments.

The great interest of the garden to botanists lies as much in the wonderful array of plants from all parts of the U. S. almost, which this indefatigable collector got to growing here. Clambering over the corner of the house is the famous Christ's thorn, whose horrid spines bring to mind the bleeding brows of the Savior. The great Cypress planted in 1749 is said to be 130 feet high. Three feet above the ground it meaaures 21 ft. 5 in. in circumference, and near the base fully 30 feet. Some descendants of Bartram's oak, *Quercus heterophylla*, Michx., are growing in the garden, the original tree which stood outside having been cut down many years ago by mistake. After inspecting the house and the cypress, the party scattered, roaming through the grounds at pleasure, noting the great variety of trees and shrubs which Bartram had colleeted in his travels from Ontario to Florida.[1]

The return to the station was along a better road than the first one traversed, and toward train time the party gathered on the steps of the station to chat over the delightful pilgrimage, soon completed by the homeward ride.

A Hybrid Grass.[2]

BY DR. GEO. VASEY.

In a low meadow on the banks of Hunting creek, near where it empties into the Potomac river, a mile below Alexandria, Va., I found, the present season, *Trisetum palustre*, L. and *Eatonia Pennsylvanica*, Gr. I was surprised, and puzzled also by finding growing with these grasses another, which was evidently intermediate between them. The field covered several acres, and there was an abundacne of specimens of all kinds, although the *Trisetum* was mostly out of flower, and, to a considerable extent, had dropped its seed. A careful survey of the circumstances led me to the conclusion that the intermediate form was a true and spontaneous hybrid between the *Trisetum* and *Eatonia*. At first thought this would seem to be improbable, if not impossible, as the two grasses belong to different genera, which in some of the classifications are rather widely separated. A careful examination, however, led me to the conclusion that these genera are closely related, and that the intermediate specimens were truly hybrids between the two species named. The close relationship between *Kœleria* and *Eatonia* is very evident, the two species of the latter genus having been included in *Kœleria* previous to the construction of the genus *Eatonia* by Rafinesque. Both species had, however, been placed in *Aira* by Muhlenberg. Moreover, Dr Hooker, in the Handbook of the New Zealand Flora, places both *Kœleria* and *Trisetum* in the section *Avenaceæ*, and the

[1]An account of Bartram's life, travels, and garden may be found in Harper's Magazine for February, 1880.

[2]Paper read before the Botanical Club of the A. A. A. S., Philadelphia, 1884.

same relationship is maintained by European agrostologists. Even in Bentham and Hooker's *Genera Plantarum*, where the two genera are placed in different sections, there is one group of *Kœleria* described, in which the flowering glume is short-awned, several species of which group were by Trinius placed in *Trisetum*.

As to the two species named, *Trisetum palustre* and *Eatonia Pennsylvanica*, it may be said that both grow in similar situations, both have the same general habit and appearance, growing to about the same height, with similar foliage, and the same kind of long, narrow and loose panicle. Both have about two flowers in the spikelet, the outer glumes are very similar in form, texture, nervation and relative size, and nearly the same may be said as to the flowers.

When we come to minutia, however, there are differences. The spikelets of *Eatonia* are about $1\frac{1}{2}$ lines long, the obovate upper glume about 1 line long; the lower flower is about $1\frac{1}{4}$ lines long, the upper one about 1 line, both linear and obtusish. The axis connecting the flowers is smooth or nearly so. In *Trisetum* the spikelet is about 3 lines long, the obovate-lanceolate upper glume about 2 lines long, with scarious margins, the lower flower 2 to $2\frac{1}{2}$, and the upper slightly shorter; and the upper flower has a bent awn 2 to 3 lines long, proceeding from the apex between the two acuminate lateral teeth, the lower flower being unawned or barely mucronate. The flowering glumes are linear-lanceolate and 3 nerved, the lateral nerves indistinct below. The axis connecting the flowers is sparingly hairy.

Examining now the intermediate or hybrid form, we find the spikelets about 2 lines long, the outer glumes about $1\frac{1}{2}$ lines, the lower one linear-lanceolate, acute, 3 nerved; the upper glume is obovate-oblong, acute, 3 nerved, with scarious margins. The flowering glumes are linear, $1\frac{1}{4}$ to $1\frac{3}{4}$ lines long, 3 nerved, the lateral nerves obscure; the lower flower is acute or acutish, the upper one with 2 *short* lateral teeth, and an awn about 1 line long. The axis is slightly hairy, less so than in *Trisetum*.

In all these characters there is an intermediate gradation of the two species.

The finding of these hybrid specimens recalled to my memory the fact that 7 or 8 years ago, I found, mixed with specimens of *Eatonia Pennsylvanica* collected by Mr. A. H. Curtiss in South Carolina, almost exactly the same hybrid form, although I did not then realize their relationship.

The conclusion which I draw from these cases is that *Eatonia* and *Trisetum* are very closely related, and should both be in the section *Avenaceæ*, as also should some species of the genus *Graphephorum*.

NOTES[1] BY F. L. SCRIBNER.—The above paper, in which Dr. Vasey details a discovery made by himself, describes an undoubted instance of hybridization between *Trisetum palustre* and *Eatonia Pennsylvanica*.

Fig. 1. Trisetum palustre. Fig. 2. Hybrid between the preceding and the following. Fig. 3. Eatonia Pennsylvanica. Figs. 4 and 5. Graphephorum melicoides.

Figures 1, 2 and 3 are magnified drawings of the spikelets of the three forms in question, all enlarged to the same scale, showing the relative size and proportions of the various parts. Figure 2, the spikelet of the "hybrid," it will be seen, is intermediate in size between the *Trisetum* and *Eatonia*, illustrated by Figures 1 and 3, respectively. In general shape and texture of the outer glumes and florets it resembles the last named, but the flowering glumes are awned as in the *Trisetum*. Whether the

[1]Remarks made at the reading of the paper, prepared by the author and sactioned by Dr. Vasey.

seeds of this "hybrid" are fertile or whether it produces seeds at all was not stated.

This discovery of Dr. Vasey's is an exceedingly interesting one, and apparently fixes the position of the genus *Eatonia* in the Avenaceous group, as indicated by Dr. V., along with *Trisetum*, to which genus it was once, and as now appears very properly, referred by Trinius. If we examine the synonomy of this grass —*Eatonia*—we find that Dr. Vasey's paper confirms the opinion of the older botanists as to its position: Michaux, Pursh, Sprengel, Muhlenberg and Willdenow placing it in *Aira*, Desveau and Roemer and Schultes in *Airopsis*. Beauvois doubtfully referred it to *Poa*, and Kunth founded upon it the genus *Reboulea*, placing it in *Poaceæ* along with *Glyceria*, and this classification has been followed by Dr. Gray and by Mr. Bentham.

Dr. Vasey alludes to the very evident Avenaceous character of certain species of *Graphephorum*, referring to *G. melicoides* and *G. Wolfii* (*Trisetum Wolfii*, Vasey in Wheeler's Report). Figure 4 represents a spikelet of *G. melicoides*. Like *Trisetum palustre* it is two-flowered, with a similar prolongation of the rhachilla above the second floret; there is a like inequality of size in the empty glumes, and the hairiness of the rhachilla differs only in degree, and, although the flowering glume is awnless in the typical form, we occasionally find samples that are short-awned, as represented in Fig. 5.

Graphephorum Wolfii presents some specific differences in habit, and has a narrow and more densely flowered panicle, but the spikelets are very similar to *G. melicoides* in all their parts, differing chiefly in being three, or, in the more robust forms (*Trisetum Brandegei*, Scribn.), four-flowered, with the flowering glume constantly short-awned. Prof. Thurber, in the Botany of California, referred this grass to *Trisetum subspicatum* (*T. subspicatum*, var. *muticum*), while another well-known botanist referred samples of it to *Graphephorum melicoides*. Dr. Vasey himself thought at one time that it might be only a variety of the last-named species. In respect to other species of the genus *Graphephorum*, as it now stands, I would like to quote from a letter from Dr. Vasey dated April, 1881, and I hope the Doctor will pardon me for taking this liberty when I say that I heartily second the views he expresses:

"*Graphephorum fulvum* and *pendulinum* I would restore to *Colpodium*, and place next *Glyceria*. *Graphephorum festucaceum* I would call *Fluminia arundinacea*, Fries., and think it belongs to the group *Festucaceæ*.

"*Graphephorum flexuosum,* only doubtfully referred to *Graphephorum* by Prof. Thurber, is neither one nor the other, but a good genus.

Graphephorum melicoides should be *Trisetum melicoides*, or if a genus (*Graphephorum*) be made for it, it should come next to *Trisetum* or *Avena*, for it is evidently Avenaceous."

The Fossil Flora of the Globe.[1]

BY LESTER F. WARD.

HISTORICAL VIEW.—The writers of antiquity make no mention of any form of vegetable petrification. The earliest allusion to the subject was made by Albertus Magnus in the thirteenth century. Agricola and Gesner treated of petrified wood in the sixteenth century. The first mention of any kind of vegetable impression in the rocks was made by Daniel Major, of Jena, in 1664. In 1699 Edward Lhwyd, of London, wrote an extensive treatise on such impressions. He maintained that they were the remains of plants that had perished in the Noachian deluge. In 1709 Scheuchzer, of Switzerland, defended this view in his "Herbarium Diluvianum," a large work, in which he described and figured many fossil plants, referring them to species living in Europe. In 1718 this author went so far as to classify the fossil plants according to the system of Tournefort. In 1723 he published a new edition of the "Herbarium Diluvianum," into which he introduced this classification, and enumerated 445 species. A powerful reaction against this method followed; comparisons with living plants were carefully made, which failed to establish the identity of the fossils. The idea of their exotic origin was thereupon suggested, and for a time prevailed, but towards the close of the eighteenth century this in turn gave way to the true view of the existence of the former geologic periods with floras of their own differing from that of the present. Baron von Schlotheim headed this new school, and was followed by Count Sternberg and Adolphe Brongniart, who jointly founded the science of vegetable paleontology in the first quarter of the present century.

The first attempt to place it upon the footing of a systematic

[1]Abstract, prepared by the author, of a paper read before the A. A. A. S., Philadelphia, 1884.

science was made by Rev. Henry Steinhauer, of Bethlehem, Pennsylvania, in a paper read before the American Philosophical Society, and published in its "Proceedings" for the year 1818. In this paper he described and figured ten species of Waller's genus *Phytolithus*, which was made to embrace nearly all forms of vegetable fossils. Two years later Schlotheim, in his "Petrefactenkunde" applied specific names to 78 fossil plants. Brongniart, in his "Prodrome," published in 1828, went much farther. He referred many fossil plants to living genera, and created a largen umber of new extinct genera. He enumerated 501 species, many of which were fully characterized and thoroughly illustrated in his "Histoire des Végétaux Fossiles."

A census of fossil plants was taken by Unger in 1845, which showed that the number of known species had increased to 1,648. In 1848 Göppert made a similar enumeration, and found 2,055 species. The extraordinary activity that followed in the developing of new fossil floras rendered it possible for Schimper, in 1874, to describe about 6,000 species in his great work, "Traité de Paléontologie Végétale." The decade which has elapsed since the appearance of that work has witnessed extensive investigations in this field, particularly in the arctic regions and in the United States, and the number of fossil species now known to science is probably between eight and nine thousand.

GEOLOGICAL VIEW.—The most ancient vegetable remains known are two species of *Oldhamia* from the Cambrian of Ireland. From the Lower Silurian 44 species, chiefly marine algæ, have been named. Among these, however, are included the earliest terrestrial forms, viz., *Eopteris Morierei*, Sap., *Sphenophyllum primævum*, Lx., and two other vascular plants from the Cincinnati Group. Of the 13 species of the Upper Silurian, five are vascular plants, and these include *Cordaites Robbii*, Dawson, from Hérault. The Devonian furnish 188 species of fossil plants, in which ferns play the leading rôle, while from Permo Carboniferous strata nearly two thousand species are known. Only 67 species are found in the whole of the Trias. With the Rhetic a new impulse is felt increasing to the Oolite, in which 419 species occur. The Upper Jurassic and Lower Cretaceous are sparingly supplied with the remains of vegetation, but in the Cenomanian, to which the beds of Atane, Greenland, and our own Dakota Group of Kansas and Nebraska are referred, nearly 500 species of fossil plants have already been found. The Turonian, with its probable equivalent in the west, the Fort Benton Group, is nearly destitute of vegetable remains, but the Senonian immediately overlying it, with which the Canadian geologists have correlated certain rich plant beds of British Columbia, and to which Heer's flora of Patoot, Greenland, must be referred, yields more than 350 species. The Laramie Group of the western United States is thought to be extreme Upper Cretaceous. This is very rich in plants, and 333 species have already been described from this horizon.

The Tertiary flora is much more abundant than even that of the Carboniferous. The Eocene furnishes nearly 800 species (including our Green River Group and the Paleocene beds of Sezanne and Gelinden). The Oligocene of Europe yields a somewhat larger number. The maximum is attained in the Miocene, from which more than three thousand fossil plants are known. The Miocene practically closes the geological series so far as vegetable paleontology is concerned. Only about 150 Pleiocene species exist, and a still smaller number from the Quatenary.

BOTANICAL VIEW.— I. First appearance of types.

The Oldhamias of the Cambrian, mentioned in the last paper, are classed as marine algæ of the order *Florideæ*. The ferns, *Equisetineæ*, and *Lycopodineæ* all appeared in the Lower Silurian. One species of *Cordaites*, which is now regarded as the ancestral type of *Coniferæ*, occurs in the Upper Silurian. The *Rhizocarpeæ*, according to Dawson, existed in the Devonian of Canada and Brazil.

The *Cycadaceæ* and the Monocotyledons have their earliest known representatives in the Carboniferous. The order *Gnetaceæ* is represented, according to Heer, in the Oolite of Siberia by his species *Ephedrites antiquus*. The Dicotyledons first appear in the Urgonian of Kome, Greenland, through Heer's single species *Populus primæva*. All three of the divisions of dicotyledonous plants occur in great abundance in the Cenomanian. If the genus *Selaginella* is regarded as belonging to the *Ligulatæ*, this small transitional type also first appears in the Cenomanian, at Atane, Greenland.

All the leading types of vegetation are thus introduced without going later down the geological scale than the middle Cretaceous.

II. Age of maximum relative predominance of each type.

The marine algæ, of course, being the only vegetation, were supreme during the Cambrian and early Silurian. The maximum relative predominance of each of the other principal types was reached as follows: The ferns in the Permian, the *Equiset-*

Number of Species of each of the Principal Types of Vegetation that have been present time, as nearly as it is possible to ascertain, together with the

Geological Formations.			Cryptogams											
			Cellular.		Vascular.									
					Ferns.		Rhizocarpeæ.		Equisetineæ.		Lycopodineæ.		Ligulateæ.	
			No.	p. c.	No.	p. c.	No.	p. c.	No.	p. c.	No.	p. c.	No.	p. c.
Present time			35,000	23.89	3,000	2.05	100	0.07	30	0.02	500	0.34	400	0.27
Cenozoic.		Quaternary.	27	33.3	4	4.9	...	...	2	2.5	...	...	...	...
Cenozoic.	Tertiary.	Amber	37	55.2	...	...	...	...	...	...	...	...	...	...
Cenozoic.	Tertiary.	Pliocene	...	...	3	3.1	...	...	...	...	...	...	...	...
Cenozoic.	Tertiary.	Miocene	138	5.5	87	2.9	6	0.2	18	0.6	...	...	2	0.06
Cenozoic.	Tertiary.	Oligocene	17	2.2	17	2.2	1	.0.1	3	0.4	...	...	...	...
Cenozoic.	Tertiary.	Green River	5	2.2	8	3 5	2	0.9	3	1.3	1	0.4	1	0.4
Cenozoic.	Tertiary.	Eocene	71	10.3	22	3.2	...	...	1	0.2	...	...	...	...
Cenozoic.	Tertiary.	Paleocene	3	2.5	7	5.9	...	...	...	...	...	...	...	...
Mesozoic.	Cretaceous.	Laramie	13	3.9	23	6.9	1	0.3	4	1.3	1	0.3	3	0.9
Mesozoic.	Cretaceous.	Senonian	23	6.5	73	20.6	...	...	1	0.3	...	...	...	...
Mesozoic.	Cretaceous.	Turonian	1	20.0	1	20.0	...	...	...	...	...	...	...	...
Mesozoic.	Cretaceous.	Cenomanian	8	3.3	38	15.5	1	0.4	1	0.4	...	...	1	0.4
Mesozoic.	Cretaceous.	Dakota	1	0.5	7	3.3	...	...	...	...	...	...	...	...
Mesozoic.	Cretaceous.	Gault	...	...	10	27.8	...	...	...	...	...	...	...	...
Mesozoic.	Cretaceous.	Urgonian	...	...	50	46.3	1	0.9	3	2.8	1	0.9	...	...
Mesozoic.	Cretaceous.	Necomian	10	25.6	12	30.8	...	...	...	...	...	...	...	...
Mesozoic.	Jurassic.	Wealden	7	5.8	44	36.4	...	...	...	...	...	...	...	...
Mesozoic.	Jurassic.	Coral	19	29.2	12	18.4	...	...	...	...	...	...	...	...
Mesozoic.	Jurassic.	Oolite	39	9 3	133	31.7	1	0.3	14	3.3	3	0.7	...	...
Mesozoic.	Jurassic.	Lias	13	9.7	44	32.8	...	...	4	3.0	...	...	...	...
Mesozoic.	Jurassic.	Rhetic	8	6.3	69	54.3	...	...	5	3.9	...	...	...	...
Mesozoic.	Trias	Keuper	...	...	15	36.6	...	...	3	7.3	...	...	...	...
Mesozoic.	Trias	Muschelkalk	2	33.3	1	16.7	...	...	...	...	...	...	...	...
Mesozoic.	Trias	Bunter Sandstein	...	...	7	31.9	...	...	1	4 5	...	...	...	...
Paleozoic.		Permian	6	1.8	186	55.4	...	...	26	7.7	9	2.7	...	...
Paleozoic.		Carboniferous	17	1.2	627	42.4	...	...	143	9.7	368	24.9	...	...
Paleozoic.		Sub-carboniferous	5	3.7	64	47.4	1	0.8	20	14.8	29	18.5	...	...
Paleozoic.		Devonian	33	17.6	79	42.0	3	1.6	16	8.5	28	14.9	...	...
Paleozoic.		Upper Silurian	8	61.5	2	15.4	...	...	1	7.7	1	7.7	...	...
Paleozoic.		Lower Silurian	40	90.9	1	2.3	...	...	1	2.3	2	4.5	...	...
Paleozoic.		Cambrian	2	100.0	...	...	...	...	...	...	...	...	...	...

ineæ and the *Lycopodineæ* in the Carboniferous, the *Cycadaceæ* in the Lias or Oolite, the *Coniferæ* in the Wealden or Neocomian, the Monocotyledons in the Eocene, the monochlamydeous Dicotyledons in the Cenomanian, the polypetalous Dicotyledons in the Miocene, and the gamopetalous Dicotyledons in the present living flora of the globe.

III. Probable true period of origin and of maximum absolute development of each type.

found Fossil in each Geological Formation; also, the number existing at the percentage that each type forms of the total flora of each formation.

PHÆNOGAMS.														
GYMNOSPERMS.						ANGIOSPERMS.								Total.
Cycadeæ.		Coniferæ.		Gnetaceæ.		Monocotyledons		Dicotyledons.						
								Apetalæ.		Polypetalæ.		Gamopetalæ.		
No.	p. c.	No.	p. c.	No.	p. c.	No.	p. c.	No.	p. c.	No.	p. c.	No.	p. c.	
75	0.05	300	0.24	40	0.03	20,000	13.65	12,000	8.19	35,000	23.89	40,000	27.31	146,445
2	2.5	4	4.9	......	......	......	......	27	33.3	8	9.9	7	8.7	81
......	......	14	20.9	1	1.5	2	3.0	5	7.5	1	1.5	7	10.4	67
......	......	13	13.3	......	......	9	9.2	32	32.6	31	31.6	10	10.2	98
6	0.2	250	8.2	1	0.04	272	8.9	826	27.1	1,064	35.0	346	11.3	3,046
2	0.3	64	8.3	1	0.1	82	10.6	256	33.1	259	33.6	70	9.1	772
......	......	10	4.4	......	......	21	9.2	85	37.1	73	31.9	20	8.7	229
3	0.4	34	4.9	......	......	116	16.8	162	23.5	221	82.1	59	8.6	689
......	......	1	0.8	......	......	7	5.9	57	47.9	39	32.8	5	4.2	119
1	0.3	15	4.5	......	......	33	9.9	125	37.5	84	25.2	30	9.0	333
5	1.4	34	9.6	......	......	18	5.1	118	33.3	64	18.1	18	5.1	354
......	......	1	20.0	......	......	......	......	......	......	2	40.0	......	......	5
11	4.5	28	11.4	......	......	6	2.5	61	25.0	82	33.7	7	2.9	244
7	3.3	12	5.6	......	......	5	2.4	88	41.3	84	39.4	9	4.2	213
2	5.5	22	61.2	......	......	2	5.5	......	......	......	......	......	......	36
21	19.4	25	23.2	......	......	6	5.6	1	0.9	......	......	......	......	108
6	15.4	9	23.1	......	......	2	5.1	......	......	......	......	......	......	39
43	35.5	26	21.5	......	......	1	0.8	......	......	......	......	......	......	121
17	26.2	17	26.2	......	......	......	......	......	......	......	......	......	......	65
116	27.7	103	24.6	1	0.3	9	2.1	......	......	......	......	......	......	419
58	43.3	10	7.5	......	......	5	3.7	......	......	......	......	......	......	134
26	20.5	18	14.2	......	......	1	0.8	......	......	......	......	......	......	127
15	36.6	7	17.1	......	......	1	2.4	......	......	......	......	......	......	41
......	......	3	50.0	......	......	......	......	......	......	......	......	......	......	6
3	13.6	7	31.8	......	......	4	18.2	......	......	......	......	......	......	22
14	4.1	92	27.4	......	......	3	0.9	......	......	......	......	......	......	336
8	0.5	307	20.8	......	......	8	0.5	......	......	......	......	......	......	1,478
......	......	20	14.8	......	......			......	......	......	......	......	......	135
......	......	29	15.4	......	......	......	......	......	......	......	......	......	......	188
......	......	1	7.7	......	......	......	......	......	......	......	......	......	......	13
......	......	......	......	......	......	......	......	......	......	......	......	......	......	44
......	......	......	......	......	......	......	......	......	......	......	......	......	......	2

Cellular Cryptogams of some kind probably lived in the Laurentian, and account for the graphite beds and dark carbonaceous matter of certain Archæan rocks. Being an heterogeneous group their later representatives belonged to entirely different families. If we include the fungi the number of species is probably greater in the living flora than it was at any geological epoch. The ferns, *Equisetineæ*, and *Lycopodineæ* probably all originated in the Lower Silurian, and reached their absolute maximum in the Carboniferous. The *Cycadaceæ* may have originated as early as the Devonian. They must have attained their absolute as well as their relative maximum development in the middle Jurassic. The *Coniferæ* through their archaic form, the *Cordaiteæ*, began in the Lower Silurian. They attained their full maturity in the Cretaceous, and are now on the decline. The Monocotyledons probably date back to the Lower Carboniferous or Devonian, and reached their highest expression in the palms whose reign occupied the early Tertiary. These also are probably now waning. The Dicotyledons must have had their real origin in the Lower Jura or Upper Trias; their absolute probably coincides with their relative development, the *Apetalæ* being now declining, the *Polypetalæ* about stationary, and the *Gamopetalæ* rapidly advancing.

GENERAL NOTES.

Results of the Philadelphia Meeting.—It is unnecessary to mention hose features which are obvious from the nature of the meeting and the large attendance of botanists. Not among the least results was the awakening to united action, which must be still further augmented in order to forward measures of commanding importance which are quite within the scope of the organization.

The action in reference to postage on botanical specimens seems to have been as vigorous and effective as could have been devised. The committee of the Club did their work well. The resolutions drawn up and presented by the officers of the Club to the Biological Section of the Association were as follows:

Resolved, 1st. That the Biological Section of the American Association for the Advancement of Science earnestly request that the Postmaster General recommend to Congress such changes in the existing postal laws as will permit the transmission through the mails of botanical specimens, accompanied with the customary written labels, giving name, locality, date of collection and collector's name, at fourth-class rates of postage.

Resolved, 2d. That he take such action as may be deemed best to secure similar regulations in the transmission of botanical specimens to and from Canada.

Resolved, 3d. That he cause the same subject to be presented before the Congress of the Universal Postal Union at its meeting in Lisbon in October next, in order, if possible, to secure like liberality with foreign countries.

The secretary of the Section was instructed to transmit the same to the to the Postmaster General. Upon the suggestion of the vice-president, Prof. Cope, a motion was carried to have a committee appointed to wait upon the Postmaster General, and personally urge the importance of the measures. The chair appointed Prof. Ward, of the National Museum, Dr. Vasey, of the Department of Agriculture, and Prof. Chickering, of the Deaf-Mute College.

The desirability of calling attention to the necessity of more extensive investigations on plant diseases, from both an ecomical and scientific view, was the topic of much conversation, but it did not till the last days of the session crystallize into definite shape. The following was finally presented to the Section of Biology: The members of the Botanical Club desire to call the attention of the American Association to the necessity of encouraging researches upon the influences which affect the health of plants, particularly those of fungous origin, and therefore pray that the Biological Section request that a permanent committee be appointed, to be known as a "Committee on the Encouragement of Researches upon the Health and Diseases of Plants," to confer with regard to the best methods by which to advance this object, the first report to be made to the Society at its next meeting. Seven names were suggested for members of this committee. This received the hearty sanction of the Section, and was sent to the Standing Committee, and from them to the General Session of the Association, which established the committee and appointed the following members: J. C. Arthur, C. E. Bessey, W. G. Farlow, T. J. Burrill, J. T. Rothrock, C. H. Peck and W. J. Beal. The marked favor with which the matter was received by members of the Association, both officially and privately, gives much encouragement that important results will be accomplished.

In opposition to these commendatory results, a few failures, or more properly negative results, should be noted. Foremost of these is the low average quality of the botanical papers presented before the Association. Last year the botanists were ten per cent. of the total attendance, and this year eight per cent., or, exclusive of the British, nine per cent., and among them some of the most distinguished names of the science in this country, and yet the botanical communications in no instance exhibit that profund research or comprehensive statement of laws or relationships, or other characteristics that would entitle them to rank with the better papers presented by the zoologists, physicists or chemists. It lies with individual workers to see that this does not remain so. The Botanical Club gives an opportunity for presenting notes and less weighty communications under equally good auspices, and therefore in honor to the science the Biological Section should only be asked to hear what is the most important.

The Club were the recipients of a fine registry book from the local committee of arrangements appointed by the Academy. Nearly 100 names were registered in it, but owing to imperfect methods, due to the newness of the thing, there were conspicuous omissions, and some names entered that ought not to have been. A different system will be devised for the future.

A New Variety of Comandra umbellata, Nutt.—Flowering stem erect, six to ten inches high, several growing from the base of a barren stem, along its upper side; barren stems one to two feet long, decumbent, or from an ascending base, sometimes prostrate; leaves of barren stem rather large, one to two inches long, one-third to five-eighth inch wide, elliptical or lance-elliptical, somewhat deciduous. May be called *C. umbellata* Nutt. var. *decumbens*, from the habit of its stem. Dry, wooded hills, Poysippi, Wanshara Co., Wis., July, 1883. Perhaps only local.—E. J. HILL, *Englewood, Ill., July 28, 1884.*

A Reply.—*To the Editor of the Botanical Gazette:*—Allow me a word in reference to *Specularia* and *Campanula.* My critic, in the notice of my pamphlet in the September number of the GAZETTE, after quoting me to the effect that the genuine Campanulas have bell-shaped flowers and the Specularias have rotate ones, goes on to say that "it would seem that the original Canterbury Bell is no longer a Campanula!" I confess my inability to understand this. Wood's Botanist and Florist is all I have at hand at present to consult, but he distinctly states that in *Campanula medium*, Canterbury Bells, the flowers are bell-shaped. It would therefore come under *Campanula*, as I have stated it.

Again, in reference to *Specularia.* Wood states that the flowers are "sessile, erect." Gray does not state as to this. But my critic says positively that they are *not* erect. My experience is that they are erect, in opposition, at least, to drooping. Lastly, if there are plenty of species of Campanulas with sessile and rotate flowers, there is all the more reason for the union of the two genera into one. On the whole, therefore, I do not see that I am so very far out of the way after all. The word "suggests" would convey a better idea of the manner in which the suggestion was made than the word "announces," which has a disagreeable sound.—JOS. F. JAMES.

Siphoptychium Casparyi, Rostfki.—In August of last year I found on the surface of a decaying log at Lake Placid, Adirondack mountains, an Æthalium or Compound plant of the Myxomycetes, which presents some interesting features.

Its dimensions were large, being one foot by eighteen inches in diameter in the main portion of the plant, which, with various prolongations additional, gave an area of at least two square feet. Subsequent examination led me to refer the plant to the genus *Siphoptychium*, as far as the genera discription, alone given in Dr. Cook's British Myxomycetes, would permit. This genus is one of the two new genera created by Rostafinski in the supplement to his Monograph, and has not yet been recorded as American? Through the kindness of Prof. Farlow, to whom I referred the plant for identification, I am enabled to append a translation of its specific description, as contained in the Polish Monograph. This description so literally applies to my plant that any further detailed account of it is unnecessary.

Siphoptychium Casparyi, Rostfki. On the strongly developed hypothallus stand collected sporangia, having an angular columnar form in consequence of mutual pressure, and slightly convex at the apex. The tubes of the capillitium issuing from the columella are few in number and develop in rows. The hypothallus, the walls of the sporangia, the columella and the mass of the spores are everywhere umber brown. The spores are finely echinulate, size 7.5 mm.—GEO. A. REX, M. D., *Philadelphia.*

Teratology.—I have before me a most curious case of an abnormal daisy, *Chrysanthemum leucanthemum.* In it there are three heads on the same stem, no flattened and malformed as in most cases of fasciation, but all placed back to back and with perfect individual involucres. Indeed, the heads are in no way changed except in their strange position, which was so remarkable as to attract the attention of my correspondent, Miss Luther, of Providence, who kindly sent the plants for my examination. The three heads combined form a sort of pyramid. If the cluster is turned in a certain position the observer sees but one disk at a time. It is impossible to view all three at once except from above. I think the malformation quite unique.

Cases of fasciation are common, but perhaps worth noting. Mr. Leland, an enthusiastic collector of this city, found a large specimen of *Lobelia cardinalis*, in which apparently two buds had united to produce a uniformly flattened or ribbon-like stem. This bore normal flowers.

Miss Eloise Butler, of Minneapolis, sends me a specimen of *Arisæma triphyllum* with a double spathe including a single spadix; also a much fasciated stalk of *Linaria vulgaris*, having numerous normal flowers on alternated and leafy-bracted pedicels.

Within a day or two I have seen a garden rose in which, in the center of the rosette of petals, was a perfect but unopened flower bud.—W. W. BAILEY, *Providence, R. I.*

American Æcidia on Ranunculi.—The great difficulty of properly distributing æcidia to their respective teleutosporic forms is well brought out by trying to arrange our species in accordance with foreign investigations. *Uromyces Poæ* and *U. dactylidis* are not known in this country, but a *Puccinia* on *Ranunculus repens* does occur. We have an æcidium on *R. abortivus* known as *Æ. Ranunculi*, and one on *Anemone nemorosa*, both of which have been referred to *Æ. Ranunculacearum*, but without much doubt incorrectly. In fact, the true *Æ. Ranunculacearum* is rare in this country, but occurs, as I am informed by Dr. Farlow, near Boston on *R. acris*. After such excellent investigations as those of Mr. Plowright, we are yet quite in the dark regarding the affinities of our own *Ranunculi* æcidia.—J. C. A.

The Potétomètre.—In Nature, xxx, 79, H. Marshall Ward gives a description and figures of an instrument, the "potétomètre," recently devised by Moll, for measuring the amount of water transpired by plants. The instrument is designed to furnish water to the shoot under experiment at a constant pressure. It consists essentially of a burette, stoppered at the top and expanded into a bulb just above the lower stopper. This bulb has two orifices near its middle, one on the right and another on the left side, at the same height. Into one a capillary glass tube is fixed by means of a caoutchouc or cork stopper and into the other a slender glass tube is permanently soldered. The latter tube is bent into the form of a very broad U and expanded at the distal end into a thimble, into which the shoot to be experimented on is fixed by rubber tubing, so that its lower end is exactly on a level with the capillary tube in the bulb. This capillary tube has a movable plate of polished copper placed at right angles, and near to the end which is within the bulb, for the purpose of regulating the size of the bubbles of air which the tube is intended to admit.

The copper plate serves also to direct the bubbles upward into the tubular portion of the burette. As the water is evaporated by the shoot, the exact amount can be read off, by means of the graduations of the burette. The entire apparatus may be supported by an ordinary burette stand.—C. R. B.

EDITORIAL NOTES.

LUDOVICO CALDESI died at Faenza, Italy, in May last.

GEO. BENTHAM died Sept. 10, at the age of 84.

G. B. DELPONTE, late Professor of Botany in the Univ. of Turin, Italy, is dead.

D. APPLETON & Co. have announced a new series of scicnce text books, including botany.

DR. LARS MAGNUS LARSSON, author of several valuable floras, died in July at Karlstad, Sweden.

IT IS stated in Müller's *Eucalyptographia* that 1½ parts of Eucalyptus oil in 1000 parts of fluid prevents the development of bacteria.

THE NEW BIOLOGICAL laboratories of the University of Pennsylvania are expected to be ready for occupancy in November.

DR. GRAY, Mr. John Ball and Mr. Wm. Canby took a botanical trip to Roan Mountain after the close of the American Association.

PROF. C. E. BESSEY, of Ames, Iowa, has been tendered the chair of botany in the University of Nebraska, and it is rumored that he will accept.

L. H. BAILEY, JR., is writing a series of "Talks About Weeds" for the *American Cultivator*. The fertility of the Canada thistle is discussed in No. 11.

AN IMPORTANT treatise on fungi by Dr. de Bary has just been issued under the title *Vergleichende Morphologie und Biologie der Pilze, Mycetozoen und Bacterien.*

THE JAPANESE government has made a large and interesting exhibit, both botanically and economically, of the native ligneous flora and its products, at the International Forestry Exhibition now in progress at London.

THE JAPANESE make toothpicks from the wood of the common snowballs, (*Viburnum Opulus*), rope from the stems of the Chinese *Wistaria*, and oil from the seeds of *Camellia Japonica*.

EXPERIMENTS made by A. Adrianowsky of Moscow, given in a late number of the *Botanisches Centralblatt*, showed that diffused daylight had no influence upon the germination of seeds but to retard the process, and the older the seeds the greater the retardation.

A CONSIDERABLE amount of interesting botanical literature annually finds its way into the reports of agricultural and horticultural societies. The following has just come to hand: "A grain of corn," by Prof. C. R. Barnes, in Rep. Ind. Bd. of Agric., 1884. "Two parasitic fungi" and "Functions of the leaf," by Dr. C. E. Bessey, and "Mildew of growing plants," by Prof. J. C. Arthur, in Trans. Iowa Hort. Soc., 1883.

DR. GRAY'S paper before the British Association at Montreal was one of the five papers which only will be printed in full in the Proceedings of the Association.

PROF. LESTER F. WARD has published in the Proceedings of the Biological Society of Washington a list of 41 species, to supplement his Flora of Washington.

PROF. FEDERICO DELPINO, well known for his numerous studies on the fertilization of flowers by insects, has accepted a call to the chair of botany in the Univ. of Bologna.

THE BRITISH ASSOCIATION devotes £1,515 the present year to the aid of scientific research, of which biology receives £515, or rather zoology, for not a penny is given to botany.

DR. ASA GRAY, together with several other British and American visitors to the British Association in Montreal, was the recipient of the honorary degree of LL. D. from McGill University.

THE DELIVERY of certain scientific works to the subscribers to circulating libraries of Russia, among which are the writings of Darwin, Huxley, Agassiz, Lubbock and Spencer, has been interdicted by Imperial decree.

A NEW *Saprolegnia* is figured by W. G. Smith, in the *Gardener's Chronicle* for August 23 of current year. It forms an abundant white felt over the gills of bedding mushrooms, and produces oospores only when placed in water.

THE COMMON YARROW, *Achillea Millefolium*, L., as we learn from Mr. Carruthers, of the British Museum, is so much relished by cattle in England, and kept so closely cropped that it is rarely to be seen in pastures, which is contrary to experience in this country.

THE BULLETIN OF THE TORREY BOTANICAL CLUB for August contains a "List of Cyperaceæ," collected by the late Mr. S. B. Buckley in the valley of the Rio Grande, in Texas and northern Mexico. *Cyperus Buckleyi*, *C. oxycarioides* and *Heliocharis Texana* are described as new species.

UNDER THE NAME of Blue Mountain tea, Mr. Meehan, in the *Gardener's Monthly* for September, states that the leaves of *Solidago odora* are quite extensively used as a beverage. It has upon its own merits come to have a commercial value, being sold in the Chicago markets and elsewhere.

THE BOTANICAL PAPERS read at the British Association at Montreal were as follows: On the identification of animals and plants of India which are mentioned by early Greek authors, by V. Ball; On the Jessup collection to illustrate the forestry of the U. S. in the New York Natural History Museum, by A. S. Bickmore; Notes on the occurrence of bacteria on coins, by L. Elsberg; Remark on the characteristic features of North American vegetation, by Asa Gray; Result of the investigation of insular floras, by W. B. Helmsley; On the diatomaceous remains in the lake deposits of Nova Scotia, by A. H. Mackay; Observations on the trapping of young fish by Utricularia vulgaris, by H. N. Moseley.

FROM *Hedwigia* we learn that Baron von Thümen has been obliged on account of his failing health to remove to Görz, Austria, and to discontinue much of his mycologic work. He has concluded to offer the few remaining complete sets of his Mycotheca Universalis (Centur. I–XXII) at 200 marks, being sixty-four marks less than the regular price.

NUMBER TEN of the Memoirs of the University of Tokio is entitled "Phytochemical Notices of Some Japanese Plants," by Prof. J. F. Eykman, of the medical faculty. The following species have been studied: Andromeda Japonica, Scopolia Japonica, Macleya cordata, Chelidonium majus, Nandina domestica, Orixa Japonica, and Skimmia Japonica. The memoir is in German.

THE "LOCO WEED," or one of them at least, is *Astragalus mollisimus*, Torr., according to Prof. T. C. Porter in the *Gardener's Monthly*. Experiments were performed by Dr. Isaac Ott, of Easton, Pa., during 1882, with infusions of this plant received from Western Kansas, and the same effects produced as the stock men of that region ascribe to it. Its active principle is doubtless a powerful poison.

WHILE ATTENDING the American Association, we had the pleasure of examining a number of both the original drawings and proofs of the plates for for Prof. Beal's new work on grasses, and found them of superior quality. The artist is Prof. F. L. Scribner, the agrostologist, whose excellent work should bespeak for him the patronage of other botanists. The engraving is by the Levytype process.

PROF. DR. ALEXANDER FISCHER VON WALDHEIM, President of the Imperial Society of Naturalists in Moscow, died on July 13, at the age of eighty-one years. He is best known in this country by his studies on the development of the *Ustilagineæ*. A translation of an important contribution on this subject to Pringsheim's Jahrbücher für Botanik appeared sometime ago in the Report of the N. Y. Agric. Society.

A NEW MYCOLOGICAL journal is talked of, we hear. It is to bear the highly appropriate name *Schweinitzia*, and like the Italian journal *Michelia*, to be devoted to the publication of new species, and the collected descriptions of particular groups. We wish the enterprise the heartiest support, and suggest that all, who are interested in it, manifest their appreciation by communicating with Mr. J. B. Ellis, Newfield, N. J.

AN INTERESTING description of Michaux's garden at New Durham, N. J., is given by Mr. H. H. Rusby in the *Torrey Bulletin* for August. The site is now largely occupied by a cemetery, and almost no relic remains, the buildings as well as the trees and shrubs having disappeared. The original boundaries, and position of the principal objects were pointed out by the descendants of Michaux's associate, Saunier, who are now living in the vicinity.

THE AMERICAN MICROSCOPICAL JOURNAL warmly endorses the effort of the American Association to create a greater interest in fungous diseases of plants. It says: "The subject is one well worthy of liberal assistance; the work is of peculiar difficulty, requiring constant attention on the part of the observer, and it is not only necessary to have special laboratories properly furnished for it, but skillful and experienced observers must be engaged, who can give their entire attention to the work." The necessity for Government aid is urged.

THE EDITORS of "Drugs and Medicines of N. A," J. U. and C. G. Lloyd, find it necessary to begin the issue of a four-page supplement to that publication, in which they can make known any new facts, *addenda et corrigenda*, answer questions, collate and present notes, etc. In the first number they ask botanists for information regarding the geographical distribution, local names, abundance, situations, etc., of the following plants: Hydrastis Canadensis, Coptis trifolia, Aconitum uncinatum, A. reclinatum, Xanthorrhiza apiifolia, Actæa spicata, var. rubra, A. alba, Cimicifuga racemosa, C. Americana. Address 180 Elm street, Cincinnati, O.

A BUREAU of scientific information has been formed in Philadelphia, composed of officers and members of the Academy of Science, whose duty shall be the imparting, through correspondence, of precise and definite information upon the different departments of science. The organization is purely voluntary, and should not be imposed upon by trivial questions, or those containing no postage for returning the answer. We notice the following names in various branches of botany: Thomas Meehan, Exotic and Cultivated Plants; J. H. Redfield, Ferns and N. Am. Phænogams; J. T. Rothrock, Vegetable Physiology; F. L. Scribner, Grasses. The Secretary of the Bureau is Prof. Angelo Heilprin, who may be addressed at the Academy of Sciences.

CURRENT LITERATURE.

Synoptical Flora of North America. By Asa Gray, LL. D., etc. Vol. I.—Part II. Caprifoliaceæ-Compositæ. New York: Ivison, Blakeman, Taylor & Co.

Botanists will have a great sense of relief at the appearance of this very important and very difficult volume. The great order of Compositæ, to which it is chiefly devoted, has long needed a thorough revision by a master, and no one could possibly have had the whole subject so completely in hand as our author. This elaboration of some of our very complex genera of Compositæ is the result of time, and travel, and severe study, and is the matured, as well as probably the most valuable of the many contributions to North American Botany that have issued from Cambridge. To say that it will enhance a reputation already the greatest in American botany seems almost superfluous.

A general key to all the gamopetalous orders prefaces the volume, and in the whole matter of typography there is such an evidence of long experience that it leaves little to be desired. If an American botanist can have but one set of books on systematic botany in his library it should undoubtedly be this. An enumeration of a few of the more striking changes adopted or suggested must occupy the remainder of this notice.

Among the Caprifoliaceæ *Sambucus pubens*, Mx., becomes *S. racemosa*, L.; Symphoricarpus must end in "os," *S. montanus* of the west becoming *S. oreo-*

philus, Gr.; the western form of the southern *Loncera flava* is *L. Sullivantii*, Gr., which latter name will replace the former in our northern manuals; while *L. parviflora*, Lam., is now *L. glauca*, Hill.

The Rubiaceæ receive an accession in a monotypic African genus, Pentodon, to which *Oldenlandia Halei* of Chapm. Fl. has been referred; while Borreria disappears, its species appearing under Spermacoce; and the var. *montanum* of *Galium circæzans* is the *G. Kamtschaticum* of Steller.

Among the Valerians Tournefort's genus Valerianella appears, absorbing both Fedia and Plectritis; *F. Fagopyrum* becoming *V. chenopodifolia*, DC.; and *F. umbilicata* and *F. patellaria* varieties of *V. Woodsiana*, Walp.

Our North American Compositæ number 237 genera, containing 1,610 species, of which 1,551 are indigenous. By far the largest and most difficult genus is Aster, numbering 124 species, all natives, and as there is no real line of division between Aster and Erigeron, with its 70 indigenous species, this group of nearly 200 species represents the most successful North American group of the most successful phænogamous order. In fact the tribe Asteroideæ containes nearly one-third of our Compositæ, the three largest genera belonging to it, viz: Aster with 124 species, Solidago 78, and Erigeron 71. The fourth genus in point of size is Senecio, with 57 species, while those containing fewer than 50 species and more than 25 are Aplopappus 43, Artemisia 42, Helianthus 40, Eupatorium 39, Cnicus 37, Bigelovia 31, Brickellia 30, and Coreopsis and Hieracium each 28. The Californian genus Hemizonia has sprung into sudden prominence with 25 species.

The great South American genus Vernonia has but ten species with us, and western botanists will be glad to see additional room given for heretofore puzzling forms in a new variety under *V. Noveboracensis*, called *latifolia*, and a disentanglement from *V. fasciculata* of Nuttall's *V. altissima*, which is not only ranked as a species but given a new variety, *grandiflora*. In the genus Eupatorium, which includes Conoclinium, *E. parviflorum*, Ell., becomes *E. semiserratum*, DC.; *E. pubescens*, Muhl., is Torrey's var. *ovatum* of *E. rotundifolium*; and *E. purpureum* and *E. perfoliatum* each have varieties to dispose of some of their most decided forms. *Liatris pilosa*, Willd., is *L. graminifolia*, var. *dubia*, Gr.; and the genus loses several species belonging to sections raised to generic rank. For instance, *L. odoratissima* and *L. paniculata*, both of Willd., appear as species under the genus Trilisia of Cassini, and *L. fruticosa* is made to commemorate its re-discoverer, Dr. Garber, under the generic name Garberia. The multitudinous western forms of *Chrysopsis villosa* have begun to take shape under nine varieties, which only represent the more marked forms. The rapidly enlarging western genus Aplopappus appears with four new species and eight new varieties, thirty-five of its forty-three species bearing the name of the author. *A. inuloides* has been merged with *A. uniflorus*. In the second genus of the order, Solidago, there was great confusion, and among many changes are the following: *S. virgata*, Mx., is included under *S. stricta*, Ait.; *S. Virgaurea*, var. *humilis* is *S. humilis*, Pursh; *S. thyrsoidea*, E. Meyer, is *S. macrophylla*, Pursh; *S. arguta*, var. *juncea* is *S. juncea*, Ait., with its variety *scabrella*; *S. Muhlenbergii* is included under *S. arguta*; *S. linoides* of the Manual is made a var. of *S. neglecta*; *S. altissima* is *S. rugosa*, Mill.; and *S. gigantea* becomes a var. of *S. serotina*. *Brachychæta cordata* is found in great abundance in S. Indiana, but the old range of E. Kentucky and southward is retained. *Boltonia glastifolia* is merged into *B. asteroides*, L'Her. In the great genus Aster (including Machæranthera and Diplopappus) several Linnæan species subside, among which are *A. linifolius* and *A. miser*, and the old section in which the latter stood has been completely overhauled, so much so that the incautious will become lost in the vexed synonymy, *A. vimineus*, Ell., *A. diffusus*, Ait., each with varieties, *A. Tradescanti*, L., and *A. paniculatus*, Lam., approximately covering the forms heretofore included under *A. Tradescanti* and *A. miser*; *A. paniculatus* also includes *A. simplex*, *A. tenuifo-*

lius of the Manual, and forms of *A. carneus; A. salicifolius*, Ait., also appears, including among others forms of *A. carneus; A. æstivus* becomes *A. junceus*, Ait.; *A. graminifolius*, Pursh, is *Erigeron hyssopifolius*, Mx.; *A. flexuosus*, Nutt, is *A. tenuifolius*, L.; *A. linifolius* of the Manual is *A. subulatus*, Mx.; *A. ericoides*, var. *strictus* of Fl. Colorado, is *A. Porteri;* the genus Machæranthera brings into Aster its old specific names and several new ones; and thirty-five to forty species of recent description show that the west is not without its own forms. Very many other changes under Aster could be noted, but those given will serve to illustrate both the great need and thoroughness of the revision. The first thing noticeable under Erigeron is the change in all specific names from a neuter to a masculine termination; and the eastern botanists will be surprised at the number of western species, many of them of recent description. *Pluchea fœtida* is included under *P. camphorata*. *Antennaria margaritacea* has become an Anaphalis. *Eclipta procumbens* is *E. alba*, Hasskarl. Heliomeris is merged into Gymnolomia, HBK. *Helianthus cinereus*, var. *Sullivantii* is considered a form of *H. doronicoides*, Lam.; *H. microcephalus* is *H. parviflorus*, Bernh. Part of Actinomeris has been included under Verbesina, *A. helianthoides*, Nutt., becoming *V. helianthoides*, Mx. Villanova appears under Bahia. It is already well known that *Maruta Cotula* is an *Anthemis*, and that Leucanthemum is Chrysanthemum. *Artemisia arctica* is *A. Norvegica*, Fries. *Arnica mollis* is *A. Chamissonis*, Less. Senecio is a famous western genus, and its many forms, especially mountain and alpine forms, are very interesting; *S. Elliottii* is included under *S. aureus*, var. *obovatus;* among the forms of *S. aureus*, var. *werneriæfolius* becomes a species of the same name, and var. *alpinus* is *S. petræus*, Klatt; *S. longilobus* and *S. filifolius* are both included under *S. Douglasii*. *Nardosmia palmata* becomes *Petasites palmata*. Under Cnicus (Cirsium), *C. discolor* is made a variety of *C. altissimus*, and *C. Virginianus*, var. *filipendulus* is made a var. of the same species. *Cnicus benedictus* is *Centaurea benedicta*. Krigia includes Cynthia, and *C. Virginica* becomes *K. amplexicaulis*, Nutt. Nabalus is the only American subgenus of Prenanthes; *N. Fraseri* is *P. serpentaria*, Pursh., and *N. nanus* becomes one of its varieties; and a new species from Maine is named *P. Mainensis*. Troximon absorbs Macrorhynchus, and our old friend *Taraxacum Dens-leonis* is *T. officinale*, Weber, with the western *T. palustre* as its var. *lividum*, and a new high alpine form of the Colorado mountains named var. *scopulorum*.

Such are a few of the changes which would especially strike a user of the Manual, many of them already known from previous notices. It will be observed that the author, while accepting in general the decisions of Bentham & Hooker in the *Genera Plantarum*, has thought best to retain some of the original genera, as being a better expression of the facts so far as North America is concerned.

Vacation Cruising in Chesapeake and Delaware Bays. By J. T. Rothrock, M. D. J. B. Lippincott & Co., Philadelphia, 1884. 12mo., 262 pp. Illust.

The author is already well known to the readers of the GAZETTE by his excellent papers on methods of work in the German laboratories. The present volume is the record of a holiday trip taken primarily for recreation. The trained observer, however, can not be abroad without seeing objects of interest, and what is seen is to be commented upon. The comments appropriate to a pleasure trip are bound by no laws of sequence, and we are treated to delightful bits of philosophy, notes on yacht building, topography of the bays, character sketches, historical incidents, and glimpses of scenery; and withal, our author being a pronounced optimist, being becalmed just as a violent storm is approaching, or meeting an obstinate headwind that makes a day's hard labor in vain, does not for a moment lower his good spirits, but, instead, only gives some happy turn to the tenor of his thought. The book is adapted to the reader who wishes to fill up a spare hour, will prove acceptable to thoughtful persons who desire instruction with their pleasure, and is of special value to all who contemplate assuming the managementof a yacht, or cruising on the bays named.

The botanist will naturally expect to find items of professional interest, from an author so eminent in the science. But the book is a record of a season of recreation in a very complete sense of the word, and all odor of the shop was shaken off before starting. Nevertheless, there are a few excellent botanical notes and comments. The special value of the work to the botanist is to show how he may spend a vacation with the most profit. Indeed, but few readers will lay the book down without a longing to try yachting, or, if living inland, canoeing.

The Essentials of Botany. By Charles E. Bessey, M. Sc. Ph. D. Henry Holt & Co., New York, 1884. 12mo., 292 pp. Illust.

This is one of the Briefer Course text-books, and is essentially an abridgement of the author's larger Botany. The changes, however, are so many and so important that it has the interest of a new work.

A change that will go far toward making the work more popular with both teachers and pupils is the simplification of the language by using fewer technical terms, and substituting English equivalents whenever possible. Thus for parenchyma, collenchyma, sclerenchyma we have soft tissue, thick angled tissue, and stony tissue, and so with other terms. This is extended to the plant names also, as water net for Hydrodictyon, green felt for Vaucheria, white rust for Cystopus, pond scums for Zygnemaceæ, green slimes for Cyanophyceæ, water moulds for Saprolegniaceæ, sac-fungi for Ascomycetes, cup-fungi for Helvellaceæ, mossworts for Bryophyta, fernworts for Pteridophyta, etc. We have only mentioned the most prominent. Among the other innovations is the substitution of Zygophyta, Oophyta, Carpophyta for Zygosporeæ, Oosporeæ and Carposporeæ, which makes the terms uniform with Protophyta, Bryophyta, etc., a change to be commended.

It is a pleasure to find that instead of trying to compress all the larger work into this, the author has given a readable statement of those important topics which lie at the basis of the science, in fact the "essentials of botany."

A valuable feature of the larger book was the directions for laboratory work. This has been much extended under the title of practical studies, and is now placed under every subject in the book, including the physiological part.

Among the minor changes are the employment of thicker leads, and sparing use of italics, which make more inviting pages to the eye. Quite a number of the cuts have not appeared in the larger work, and the failure to acknowledge the source of these must have been an oversight.

No text book ever gave better promise of meeting a long felt want than this. It will be welcomed wherever the aim is to learn from nature herself, and to make the book serve only as *a guide.*

SCRIBNER ON A NEW ERIOCHLOA.

BOTANICAL GAZETTE.

VOL. IX. DECEMBER, 1884. No. 12.

A New Eriochloa.

BY VASEY AND SCRIBNER.

ERIOCHLOA LEMMONI. Culms (1½ ft. high) ascending, branching below, and with the sheaths and leaves covered with a fine soft pubescence. Leaves linear-lanceolate, acute, acute spreading, longer than the internodes (¾ in. long, upper one a little shorter), 4–5 lines wide; ligule a short ciliate ring, sheaths somewhat inflated. Panicle about 4 in. long, composed of about 6 simple sessile branches or spikes, which spread horizontally when in flower, becoming nearly erect. Spikes 1–1¼ in. long, rhachis covered with short spreading hairs. Spikelets 2 lines long, nearly at right angles with the rhachis, on short (½ line) pedicels; outer glumes soft-hairy, equal, ovate-lanceolate, rather obtuse, lower one 5-nerved, upper one 3-nerved; flowering glume oblong, ¼ shorter than the outer glumes, finely striate and wrinkled, tipped with a tuft of short hairs.

This is the *Eriochloa grandiflora*, Vasey, in "Grasses of the United States," p. 11, and in BOTANICAL GAZETTE, vol. IX., p. 96 (without description). It is quite distinct from the South American *E. grandiflora*, Benth. (*Helopus grandiflorus*, Trin. Gram. III, 278), differing in its lower habit, shorter and broader leaves, shorter and more approximate spikes, and in the smaller and less pubescent spikelets. Like that species this has the flowering glume tipped with a tuft of hairs, instead of the short awn common to the other species of the genus, and the second glume has (in the spikelets examined) an imperfectly developed palea.

Arizona (n. 2910 *Lemmon*, 1882), and N. Mexico (n. 2087 *C. Wright* in part, as per specimens in Dr. A. Gray's Herbarium at Cambridge.

EXPLANATION OF PLATE II.—Fig. 1. Habit of plant. 2. Spikelet, showing the lowest glume. 3. Spikelet, showing the second glume. 4. Flowering glume, dorsal view. 5. Anterior view of floret. 6. The second glume with an imperfectly developed palea. (This plate is from Prof. Beal's proposed work on the Grasses of North America.)

Arizona Plants.

BY F. LAMSON SCRIBNER.

Botanists will be glad to learn that Mr. C. G. Pringle has returned safely from Southern Arizona, where he has been spending the past summer, to the "pure air and water of Vermont," and that, in spite of a severe illness, which prematurely closed his field labors, he has brought with him a large collection of plants. Owing to an unusual amount of rain in the Territory, all vegetable growth has been remarkably rich and varied, and he has been enabled to secure many novelties that have never before, or that have but rarely appeared in American collections. In the region explored we might reasonably expect that so acute an observer as Mr. Pringle would discover many new species, but we are truly surprised to learn of the recognition of *four new genera* among his collections from Sonora. Respecting the character of the specimens themselves, the name of their collector is a sufficient assurance of their superior excellence. Some of the grasses which will enter into the present distribution are named below. We may add here, that if the new acquisitions in this order afford any index to the discoveries in other families, the collection is valuable indeed, and the labors of Mr. Pringle surely deserve the thanks and hearty support of all botanists interested in acquiring a knowledge of the rich flora of our Western Territories.

Cathestecum erectum, V. & H., recently described and figured in the *Torrey Bulletin*. *Manisurus granularis*, Sw., *Trachypogon Montufari*, Nees., *Andropogon hirtiflorus*, Kth., *Aristida Scheidiana*, Trin. & Rupr., *Aristida*—near *A. fascicularis*, Torr., but not agreeing exactly with any of the forms previously collected, *Stipa fimbriata*, HBK. *Muehlenbergia Texana*, Thurb., *Muehlenbergia arenicola*, Buckl., which may be only a large form of *M. gracillima*, Torr., and, indeed, has been referred to that species, *Muehlenbergia monticola*, Buckl., *Muehlenbergia* *depauperata*, n. sp.,* *Trisetum interruptum*, Buckl., (= (?) *T. elongatum*, HBK.) *Bouteloua prostrata*, Lag. (B. pusilla, Vasey), *Scleropogon Karwinskyanus*, Benth., *Melica Porteri*, Scribn. (M. mutica, var. parviflora, Porter).

New Species of Uredineæ.

BY T. J. BURRILL.

The plants described below are from large collections in Illinois of leaf-fungi, mostly made by A. B. Seymour for the Illinois State Laboratory of Natural History, Normal, Illinois. A paper upon the Uredineæ of Illinois, containing a fresh description of all the species so far observed in the State, is now ready for publication, and will be issued in a bulletin of the State Laboratory. Much care has been taken with the identification. While the writer holds himself responsible for the conclusions reached, he is glad to acknowledge the invaluable assistance of Mr. Seymour in the difficult sifting of names and types. Since the collections were made several species found to be new among them have been described by others.

UROMYCES ŒNOTHERÆ.

I. Infected leaves somewhat involute or revolute; peridia irregularly scattered over both surfaces of the leaf, minute, short, roundish or slightly elon-

---

*MUEHLENBERGIA DEPAUPERATA, n. sp —Annual. Cæspitose. Culms erect, branched below, 1-4 inches high. Sheaths inflated, prominently striate, with membraneous margins. Ligule elongated, variously cleft. Leaves ½–1 inch long, minutely hairy or scabrous on both sides, finely striate, margins a white, cartilagenous, scabrous line, point rigid, involute. Inflorescence simple, racemose, spikelets appressed to the angular rhachis, sessile or raised on short, stout pedicels. Empty glumes minutely scabrous, especially towards the point, 1½–2 lin. long, the upper a little longer than the lower—the lower more or less cleft and terminating in two unequal points, the upper long-pointed, entire. Flowering glume, hardly as long as the empty ones, smooth or sparingly hairy below, terminating in an awn 1–3 lin. long.

Mr. Lemmon also collected this species in the Huachuca Mts.

In the allied *M. Schaffneri*, Fourn., the culms are usually taller, the empty glumes scarcely one-half the length of the flowering one, which is 2 lines long, and terminating in a very slender awn 6 to 7 lin. long.

EXPLANATION OF FIGURES.

Spikelet of *Muehlenbergia depauperata*. 1.
Floret of *Muehlenbergia depauperata*. 2.
Spikelet of *Muehlenbergia Schaffneri*. 3.
Empty glumes of same. All enlarged to the same scale. 4.

gated, with a whitish, spreading or recurved irregularly lacerated border; spores pale, globose-angular, 15 μ in diameter.

II. Spots red, purple, indefinite; sori epigenous, roundish, soon naked, brown; spores subglobose, minutely echinulate, brown, 15–18 by 16–24 μ.

III. Spots same; sori roundish or oblong, epigenous and soon naked, or cauline and long covered by the epidermis, blackish; spores oval, elliptical or oblong, strongly thickened at the apex, broadly rounded or variously pointed, dark brown, 16–18 by 24–30 μ; pedicels about one and a half times the length of the spore, often broad, tinted, especially close to the spore.

On *Œnothera linifolia*, Makanda, Ill., April 27, 1882. *A. B. Seymour.*

The æcidia occur on the cauline leaves, affecting all alike, but sparingly on the radical leaves; the uredo and telento forms are mostly confined to the radical leaves. The pedicels of the Uredospores are somewhat persistent.

UROMYCES SCIRPI.

II. and III. Amphigenous; spots brown, indeterminate; sori long covered by the epidermis, minute and rounded or larger oblong, sometimes confluent end to end, forming clusters up to one-fourth of an inch long, nearly black. II. Uredospores among the teleutospores, few, irregularly elliptical, yellowish brown, sparsely echinulate, 15–20 by 27–36 μ. III. Teleutospores clavate-elliptical, widest at the center, mostly pointed, brown, apex darker and thickened, about 18 by 32–42 μ; pedicels stout, subhyaline, about the length of the spore.

On *Scirpus fluviatilis*, Champaign, Ill., August 13, 1881. *A. B. Seymour.*

The leaves are thickly mottled with conspicuous brown spots, not definitely circumscribed. The appearance is nearest to that of *U. spartinæ*, Farl. of anything found, but is sufficiently distinct in the appearance of the sori and the larger, differently shaped spores.

UROMYCES GRAMINICOLA.

II. and III. Sori amphigenous, but more common on under surface, scattered, small, oblong or linear, soon uncovered, the ruptured epidermis ragged, but usually its remains plainly apparent; uredospores spheroidal or oval, minutely echinulate, 15–18 by 18–23 μ; teleutospores variable, subglobose, oval or oblong, smooth, apex rounded or angular, thickened, 12–18 by 21–30 μ; pedicel somewhat colored, thick, scarcely tapering below, once to twice the length of the spore.

On *Panicum virgatum*, McLean Co., July 20, 1881; *Elymus Virginicus*, Piatt Co., August 10, 1881. *A. B. Seymour.*

PUCCINIA TENUIS.

I. Hypophyllous, rarely also epiphyllous; æcidia clustered in little irregular groups or sparsely scattered, very small, short, the narrow border irregularly lacerated and recurved; spores subglobose, very minutely tuberculate, 14–18 μ. (*Æcidium tenue*, Schw.)

III. Hypophyllous; spots small, often confluent, mostly yellow, with a broad blackish center; sori sometimes scattered, usually confluent, effused, slightly convex, covered by the epidermis, dull grayish black; spores oblong-clavate, slightly constricted, usually angular or variously conspicuously pointed, 15 by 40 μ; pedicels hyaline or slightly colored, half as long as the spore.

On leaves of *Eupatorium ageratoides*, Bloomington, Ill., Sept. 3, 1879. *A. B. Seymour.*

PUCCINIA SEYMERIÆ.

III. Hypophyllous and on stems and calyces; spots definite, dark-colored; sori rather large, mostly crowded in conspicuous circular clusters a fifth of an inch in diameter, these sometimes confluent, dark brown; spores elliptical or oval, little constricted, obtusely rounded at the ends, smooth, wall firm, brown, 15–21 by 30–36 μ; pedicel hyaline, broad, persistent, twice as long as the spore.

On *Seymeria macrophylla*, Bloomington, Ill., Sept. 2, 1879. *A. B. Seymour.*

This is perhaps near *P. veronicæ* (Schum.) (*P. veronicarum* DC.), from which it differs in the size of the sori, the shape of the spores, and especially the stout, persistent pedicels. In the form of *P. veronicæ*, with persistent pedicels, the spores are oblong to spindle form, as well as furnished with a thickened apex.

MELAMPSORA CROTONIS, (Cooke).

II. and III. Amphigenous; uredosori scattered, rather prominent, circular, cinnamon colored; uredospores obovate, sharply echinulate, produced on pedicels, 15–21 by 18–27 μ; teleutosori irregular, scattered or somewhat confluent, slightly elevated, reddish-brown; teleutospores irregular, mostly elliptical or oblong, two or more celled, variously imbricated in an irregular layer, smooth, cell-contents granular, pale to dark brown, 11–15 by 30–42 μ.

Trichobasis crotonis, Cke. Grev. vi. p. 137.

On leaves of *Croton capitatum*, and *C. monanthogynu*, S. Ill., Oct., 1881; *Crotonopsis linearis*, La Salle Co., Sept., 1882. *A. B. Seymour.*

ÆCIDIUM DICENTRÆ.

Hypophyllous; æcidia uniformly and remotely scattered over the entire surface, rather large, prominent, border regularly segmented and quite uniformly and abruptly rolled, firm; spores subglobose or elliptical, epispore thin, minutely tuberculate, 10–13 by 11–16 μ; spermogonia large, disk-like, rather distant in a single row on the margin of the leaf, reddish-brown.

On *Dicentra cucullaria*, Central and Southern Illinois, April and May, 1882. *A. B. Seymour.*

ÆCIDIUM ONOBRYCHIDIS.

Hypophyllous; spots distinct or confluent, somewhat effused, yellowish-brown; æcidia subcircinate, crowded, short, border abruptly recurved, rather coarsely dissected; spores subglobose or elliptical, epispore rather thin, studded with low, obtuse tubercules sometimes united in ridges, 19–24 μ; spermogonia clustered in the center of spots mostly on the upper surface, minute, reddish-brown.

On *Psoralea Onobrychis*, La Salle Co., Ill., June 20, 1882. *A. B. Seymour.*

ÆCIDIUM DIODIÆ.

Hypophyllous, on the cotyledons and rarely lower leaves; spots distinct, small, greenish-brown; æcidia few, in little irregular clusters, small, short, border little or not at all recurved; spores subglobose or elliptical, epispore rather thin, tuberculate, 17–21 by 21–30 μ; spermogonia rather numerous, scattered, above, not found on many of the spots.

On *Diodia teres*, Johnson Co., Ill., May, 1882. *A. B. Seymour.*

ÆCIDIUM MYOSOTIDIS.

Hypogenous; æcidia uniformly distributed over the leaf, mostly somewhat densely crowded, rather large, somewhat prominent, the recurved border wide and rather coarsely divided; spores subglobose or elliptical, epispore thick, conspicuously tuberculate, 15–18 by 18–22 μ; spermogonia numerous, uniformly scattered over both surfaces of the leaf, reddish-yellow.

On *Myogotis verna*, Cobden, Ill., April, 1882. *A. B. Seymour.* The distribution of the æcidia is decidedly different from that of *Æ. asperifolii*, Pers., as described, as well as from the specimens at hand, and similarly different from those named *Æ. lycopsidis*, Desv., *Æ. lithospermi*, Thum., and *Æ. symphyti*, Thum. The three last are made synonyms of the first by Winter, and all are said to be the æcidia of *Puccinia rubigo-vere.*

The latter is common in Illinois in wide areas where Myosotis does not occur, and no other species of Borraginaceæ has been observed infested with *Æcidium.*

ÆCIDIUM PHYSALIDIS.

Hypogenous; æcidia uniformly, usually densely, distributed in patches over the leaf-surface, short, friable, soon becoming pulverulent; spores subglobose or elliptical, often angular, epispore rather thick, obscurely tuberculate, 13–15 by 15–21 μ; spermogonia very abundant, hypophyllous, scattered over extended patches with or without æcidia, comparatively large, honey yellow.

On *Physalis viscosa*, Urbana, Ill., May 30, 1879. *T. J. Burrill.* There is an *Æcidium solani*, Mont. (Flora Chile 8. 38), of which no further information can be had.

ÆCIDIUM CROTONOPSIDIS.

Hypogenous, occurring upon the cotyledons, and less commonly upon the caulicle and lower leaves; spots distinct, dark colored, the affected cotyledons soon yellow, æcidia not numerous, irregularly clustered, short cylindrical, becoming coarsely divided and widely spreading, pseudo-peridium thin but firm; spores irregular, mostly elliptical, epispore rather thick, tuberculate, 12–15 by 15–18 μ; spermogonia very few, scattered above.

On *Crotonopsis linearis*, Johnson Co., Ill., May, 1882. *A. B. Seymour.*

ÆCIDIUM TRILLII.

Hypophyllous; spots distinct or somewhat confluent, circular effused, yellowish; æcidia densely aggregated around a free central circular space, sometimes with a more or less distinct outer circle later in development, short, pseudoperidium thin, fragile, soon after opening becoming pulverulent; spores subglobose, epispore very thin, smooth, 19–24 μ; spermogonia very numerous, rather prominent, scattered, central, on both sides of leaf.

On *Trillium recurvatum*, Pine Hills, Union Co., Ill., April 24, 1882. *A. B. Seymour.*

Differs from *Æ. convallariæ* in the more fragile and fugacious æcidia, and in the smooth, very much thinner epispore.

ADDITIONAL SPECIES BY A. B. SEYMOUR.

PUCCINIA RANUNCULI.

III. Amphigenous but mostly epiphyllous; sori irregularly associated, often crowded but scarcely confluent, occupying large areas or the whole leaf surface, little elevated, circular, powdery, surrounded by the upturned edges of the epidermis, æcidium-like, cinnamon brown; teleutospores broadly elliptical, usually little or not at all constricted at the septum, ends rounded, vortex more rarely furnished with a low pale apiculus, thickly but minutely tuberculate, 18–23 by 22–39 μ; pedicel hyaline, fragile, short, sometimes more or less lateral.

On *Ranunculus repens*, Riverside, Ill., near Chicago, June 2, 1883. *J. C. Arthur.*

The little warts of the epispore are scarcely visible in soaked specimens. The teleutospores sometimes germinate in the sorus in June. One-celled specimens are not uncommon, and some vary widely from the described type.

PUCCINIA CONOCLINII.

II. and III. Mostly hypophyllous; spots small, purple, often confluent over large areas, becoming pale; sori scattered, sparse or very numerously associated, not often confluent, uredosori cinnamon-brown, teleutosori dark reddish-brown; uredospores subglobose to oval, sharply echinulate, 18–25 μ; teleutospores broadly oval, little constricted, ends rounded, wall thick, warty, 27 by 32–42 μ; pedicel nearly hyaline, firm, crooked, very long, about three times the length of the spore.

On leaves of *Conoclinium cœlestinum*, Pine Hills, Union Co., Ill., Sept. 11, 1882. *F. S. Earle.*

This is *P. centaureœ*, DC. of Berkeley's Notices of North American Fungi, Grev. III., p. 53, as ascertained by examination of the original specimen in Herb. Curtis, but differs from authentic specimens bearing this name in various exsiccati.

ÆCIDIUM CEPHALANTHI.

Hypogenous; spots distinct, brown, scarcely thickened; æcidia numerous, irregularly crowded, short, the strongly recurved narrow border abrupt, finely divided; spores large, subglobose or elliptical, epispore very thick, very conspicuously reticulately roughened, 28–36 by 33–43 μ; spermogonia scattered over the upper side of the infected area, minute, reddish-brown.

On *Cephalanthus occidentalis*, Ravenswood, near Chicago, June, 1883, *J. C. Arthur*; Quincy, Ill., July, 1883, *C. A. Hart*

To the above the following may be appended:

UREDO HYDRANGEÆ, B and C. Hypogenous; spots small, yellowish, more or less confluent, sori minute, scattered, few; spores obovate, produced on pedicels, minutely tuberculate, 12–18 by 16–24 μ.

On *Hydrangea arborescens*. This name is attached to specimens in the Curtis Herbarium, and published in Curtis's Cat. Plts. N. Car., p. 122, without description. The specimens from which the description is taken were collected by Mr. F. L. Earle, Cobden, Oct. 13, 1879, and determined by comparison with the original.

GENERAL NOTES.

A New Silphium from Tennessee.—SILPHIUM BRACHIATUM. n. sp.—Stem 3 to 5 feet high, square, smooth and glaucous: leaves all opposite; lower short petioled, gradually attenuate from a dilated, truncate or subhastate base, slightly decurrent on the short ciliate petiole, roughened on the upper side, smooth on the lower, except the principal veins, which are slightly hirsute, irregularly and repandly dentate, 4 to 6 inches long, thin and glaucous green; uppermost sessile, ovate-lanceolate, ciliate on the margin: heads solitary on slender peduncles: involucre of about 15 or 16 foliaceous subsquarrose ovate scales: rays about eight, ¾ inch long: receptacle 1 inch high: akenes nearly orbicular, narrowly winged and slightly notched at the apex.

Collected July 14th, 1867, on the western slope of the Cumberland Mountains, one mile from the railroad tunnel at Cowan, Tennessee.

The species is very distinct and apparently plentiful in the locality, but has never been observed by me in any other part of the State. The only specimens now in collections are in the herbaria of Prof. J. W. Chickering and Prof. Lester F. Ward, of Washington, and Mr. Wm. M. Canby, at Wilmington, to which gentlemen I gave specimens at the meeting of the A. A. A. S. at Nashville in 1877, under the spurious name *S. perfoliatum*, var. One specimen I have recently sent to Dr. Gray, not finding it described in his recent volume on the Compositæ, and he expressed his regret that I had not sooner called his attention to the existence of this species.—A. GATTINGER, M. D., *Nashville, Tenn.*

Cynoglossum grande, Dougl.—This species has a long-peduncled inflorescence, terminating a leafy stem. The bracts of the panicle are seemingly all wanting; but they are really present in the shape of large leaves. By the coalescence of the branches to the stem and to each other, the false racemes are carried far away from the leaves to which they belong. That this is the case is seen best early in spring, when the leaves and flower-buds are closely together. At that time the lower leaves have buds or undeveloped branches in their axils, while four to six of the upper ones are perfectly empty. Directly above each empty axil, and not far away from it, there is a cluster of flower-buds; the lowest above the first empty leaf, the next cluster above the second of these leaves, and so on to the last leaf or bract. The first of the false racemes is often few-flowered or rudimentary, and then it remains low down on the peduncle, or among the leaves, sometimes nearly in the axil of its leaf. Two, or occasionally more, of the upper racemes are without bracts.—W. N. SUKSDORF, *White Salmon, Wash. Ter.*

Campanula and Specularia.—Referring to p. 149 and p. 176 of the GAZETTE, we offer a brief rejoinder to Mr. James's reply to a curt criticism, in which we deprecated the making of a needless synonym upon a misunderstanding of the facts. Mr. James called our *Campanula Americana* by the name of *Specularia Americana*, on the ground of its having "rotate, erect and sessile flowers," "while all the genuine Campanulas have bell-shaped, drooping and pedicelled flowers." Upon which we remarked, in passsing ,that it would seem from this that the original Canterbury Bell is no longer a *Campanula*. Mr. James is unable to understand this, and the reader of his reply may say the same if he fails to notice that in repeating the criticised statement above quoted he has left out the word "drooping." Our point was that the flowers of *Campanula Medium* are erect in anthesis, and in that respect out of his character for *Campanula*. But, as we said before, a large number of Campanulas have erect flowers, some of which, as in *C. Medium*, are inclined or recurved on their peduncle or pedicel after anthesis, and some not. As "Wood's Botanist and Florist ..... distinctly states that in Canterbury Bells the flowers are bell-shaped, it would therefore come under *Campanula* as I have stated it"—i. e. under the altered statement. So it would if it had the rotate corolla of *C. planiflora* or the subrotate corolla of some other species, or the quite erect peduncle or the sessile flowers of certain others.

But the gist of our criticism was that the flowers are not erect in *C. Americana*. Mr. James replies that in his experience "they are erect, at least in opsition to drooping." Next summer, when he looks up the plant in blossom, he will probably find that, while the capsule is erect, the flowers in anthesis are so placed that the flat face of the corolla is parallel with the vertical axis of inflorescence.

"Lastly, if there are plenty of species of Campanula with sessile and rotate flowers, there is all the more reason for the union of the two genera into one," Mr. James thinks. A third course might be taken, namely, to let them alone upon the characters which botanists have recognized.

Maine Notes.—A forty-mile stage ride through the more thinly settled portion of northwestern Maine, during the past summer, exhibited one botanical phenomenon of great interest and beauty.

As we were riding along the banks of the Canabassett river, a noisy, little tributary of the Kennebec, our driver hearing us speak of different flowers, said, "Just wait, and in a few miles I will show you the biggest flower garden that ever you saw."

Before long we came to a tract of some 4,000 acres, over which lumbering operations had been carried on some years ago, leaving a tangled mass of limbs and underbrush.

On June 8th, of the present year, a fire broke out and swept over this entire tract, lasting for two weeks, and burning with such fury that it was almost impossible for the stage to travel along the road.

The driver said that the new vegetation began to start in three weeks after the fire, and as we drove along, August 14th, our road passing through this tract for four miles, the whole region as far as the eye could reach, over hill and valley, ridge and interval was one mass of color from the "fireweed," *Epilobium angustifolium*. It looked. as one of the party said, as if the earth were covered four or five feet deep with a fall of pink snow. The sight was one never to be forgotten.

Now comes the query, "Where did the plants come from?" The region had been thoroughly burned over two months before, so that but little other vegetation had survived; the seeds are very light and feathery, and the driver had noticed none in the previous years.

Several albino clumps were noticed, where a dozen stalks would have a pure white inflorescence, but with no other peculiarity to be detected.

When at Linn Pond, twenty miles farther in the woods, were seen a number of spruces, *Abies nigra*, from which, at twenty feet or more from the ground, one branch had gotten the better of all the others, and making a symmetrical curve upwards, with a diameter of several inches, was running up parallel with the main stem, although the terminal bud did not seem to have been injured.

J. W. CHICKERING, JR., *Washington, D. C.*

Wild Fruits in Boston Markets.—The fruit of *Prunus serotina* is sold in the Boston markets to a considerable extent in seasons when it is plenty. Germans and Italians make excursions from the city, and pick the fruit from trees in copses and pastures. Wild cherries were not abundant this year, and the amount sold probably fell considerably short of one hundred bushels. They sold for $3.00 per bushel. The cherries are used for flavoring rum and brandy, being added to the liquor whole.

The grapes of *Vitis Labrusca* are largely used for jellies. This year they were scarce, and they sold for two and three cents per pound. At one time they brought more in the market than Concords. Probably about two hundred bushels were handled this year.

The sweet little berries of *Physalis pubescens*, L., with their calyxes intact, are selling at present (Oct. 22), for $1.00 per peck. They are known in market as "strawberry tomatoes." They are grown in small gardens in this vicinity. The berries are made into preserves. "Strawberry tomato" is a name which properly belongs to the ornamental *Physalis Alkekengi*. I believe, as a boy, I knew the Physalis fruit as "ground cherry."

The fruit of *Berberis vulgaris* is one of the commonest of small fruits in Faneuil Hall market. On nearly all the hills of Eastern Massachusetts the barberry has run wild, and the berries are in most places harvested regularly. The pretty berries make attractive garnishes, and they are highly prized for pickles. They bring about fifteen cents per quart.—L. H. BAILEY, Jr.

Oospores of Cystopus in Capsella.—Mr. Horace Stafford first, and afterward several other members of the same class in Purdue University, while studying *Cystopus candidus* lately, found abundant oogonia and antheridia in the upper parts of the stem and floral organs of *Capsella*. The oogonia were in all stages of development, many of them containing mature oospores. Dr. Farlow says (BOT. GAZ., VIII., 335): "I have not seen oospores in these plants [*Capsella* and *Lepidium*] in this country," and I am not aware that any one else has seen them before.—C. R. B.

The same results were obtained at nearly the same time in the botanical laboratory of Wabash College.—J. M. C.

Carya myristicæ formis, Nutt., occurs in the Red River Valley as far as the Arkansas boundary, and probably considerably farther up the river. North of the Red river it extends into the foot hills of the Palæozoic region, and is found in abundance on eminences four or five hundred feet above the valleys. It is known among the people of that region as *Blasted Pecan.* The nuts in drying split open at one end (usually), and are easily opened by means of the blade of a pocket knife placed in the cleft. The kernel, though small, is of excellent flavor.

Manual of the Mosses of N. Am.[1]—In the Sept. number of the BOTANICAL GAZETTE, Mr. Eug. A. Rau has published for species of mosses an enumeration of localities which have not been mentioned in the Manual of the Mosses of North America. A detailed enumeration of the localities cited by collectors would have greatly increased the bulk of the book, without adequate advantage for the student. The same may be said of the numerous varieties which have forcibly been omitted.

The same bryologist adds a list of species which, he says, are omitted from the work, although of sufficient importance. The list is as follows: *Hypnum thelistegum,* C. M., Florida. Aust. Musci. App. Suppl. N. 505, *H. homalostegium* C. M., Alabama, Mohr. *H. occidentale,* S. & L., Oregon, Hall., *Trichostomum macrostegium,* Sull., Alabama, Mohr., *Dicranum Richardsoni,* Hook. Greenland, *Dicranella Canadensis,* Mitt. British America, Macoun., *Dicranum arcticum,* Schp, Greenland, Labrador, *Tetraplodon mnioides* vars. *Adamsianus* and *carifolius,* Arctic regions. Of the above species *Hypnum homalostegium* and *Trichostomum macrostegium* have not been found within the limits of North America. According to Dr. Mohr's information the specimens communicated formerly as found in Alabama are Mexican specimens collected by himself in Mexico, and casually mixed with those found around Mobile. *Dicranum Richardsoni,* iHook, is a synonym of *Cynodontium virens,* Schp. *Dicranella Canadensis,* meaning *Cynodontium Canadense,* Mitt. is *Dichodontium Canadense,* of the Manual. *Tetraplodon mnioides* var. *carifolius* is of no account as a variety. It is included in the cited synonym *Splachnum urceolatum. Dicranum arcticum,* considered by Bruch and Wilson as a variety of *D. Starkii,* might have been mentioned though not described in the first edition of the Synopsis of Schimper, and *Hypnum thelistegum,* C. M. (not *thelistegium*) is of Austro-American type, and no specimen of it could be obtained. Its determination is still to be ascertained. I owe to Mr. J. Donnell Smith, to whom the discovery of the moss is credited, a set of his specimens found in Florida; but the species is not represented in the lot. The only species, therefore, really forgotten in the manual, and that by an unaccountable oversight, is *Hypnum occidentale,* Sull. & Lesq, and this, under about nine hundred species described, do not indicate carelessness in the preparation of the work, the species being one originally determined by myself.—LEO LESQUEREUX, *Columbus, O., Oct. 7th, 1884.*

[1]This note was crowded out of the last No., for which it was prepared.

Dioclea Boykinii, Gray, was found in full bloom two years ago, in Drew county, Arkansas, the last of July. The legumes were quite immature, and we concluded this was its usual time of flowering. From observations the last season we conclude that it sometimes begins flowering as early as the middle of June. We would say from June to August is the period of this species. We were unable to visit the Drew county locality this season, but the plant was found in abundance as far north in Arkansas as the line of the Memphis & Little Rock R. R., on the border of Grand Prairie near Devall's Bluff. The flowers had nearly all fallen by the middle of July (only a few at the ends of the racemes being left), and many of the pods mature. The plant often climbs twenty feet high, and the leaves sometimes are eight inches in diameter, and broader than long. The racemes are occasionally seven feet long, and bear numerous blossoms, but few of which produce legumes.

Entirely sterile racemes are abundant, and but few pods are developed on the fertile ones. We did not notice a single raceme where all the flowers were fertile. The pods usually contain but few peas, which are separated from each other by a membranous partition, and are about two-thirds as long as field peas. The taste is somewhat like that of a garden pea. Occasionally pods contain as many as six peas, and are three inches long, and five-eighths broad.

Cows are exceedingly fond of the foliage and pods, and the vines are stripped wherever in reach, requiring the botanist to pull his specimens from the tree tops in exposed places. The pods when they drop are devoured greedily by swine. This species was seen about Little Rock, north of the Arkansas river, and probably occurs throughout the east and south part of the State.

F. L. Harvey, Fayetteville, Ark.

EDITORIAL NOTES.

Foote's Leisure Hour for October opens with a poetical extract dedicated to the Botanical Club.

Dr. E. P. N. Fournier, best known for his work on the Mexican flora, died in Paris lately, at the age of fifty.

Dr. W. G. Farlow has been granted a year's vacation, and will soon go to the Southwest to recuperate his health.

Bulletin No. 4, of the same Division, is devoted to a continuation of an investigation of the composition of American wheat and corn.

Science Record has suspended publication with the completion of its second volume. It was an excellent journal, and we regret its loss.

The title of Dr. Sturtevant's paper before the American Association was the "Influence of Insolation upon Vegetation," and not *insulation*, as given in our last issue. It dealt with the relation of certain solar influences to rapidity of growth.

DR. CHRISTIAN LUERSSEN has been called to the professorship of botany at the Forstakademie in Eberswald, to succeed Prof. Dr. Brefeld, who goes to Münster.

PROF. DR. ENGLER, of Kiel, has been appointed professor of botany and director of the botanic garden at Breslau, as successor of Dr. Göppert, recently deceased.

DR. C. E. BESSEY has accepted the position of professor of botany in the University of Nebraska, situated at Lincoln, Neb., and has already entered upon his duties.

"THE BOTANICAL CLUB was a noticeable feature of the American Association, and the perfection and compactness of its organization called forth much favorable comment," says the *American Naturalist.*

DR. CHARLES TULASNE, of Paris, died on August 21, in the 68th year of his age. He illustrated many of the botanical works of L. R. Tulasne, chief among them being the sumptuous work on fungi, *Selecta fungorum carpologia.*

INDIA INK, owing to the readiness with which it stays in suspension and the absence of all deleterious qualities, is specially adapted to use in studying the movements of the lower thallophytes. Attention has recently been called to it by M. Léo Ewera.

MR. C. B. PLOWRIGHT has published a list of the fungi of Norfolk, England, which reaches over 1,500 species, a very large number for one county. 636 of these are *Hymenomycetes*, 376 *Pyrenomycetes*, and 85 *Uredineæ*. Specific names are used without capitals.

BULLETIN No. 3, of the Chemical Division of the department of Agriculture on the "Northern Sugar Industry," contains three very poor figures, which, it is alleged, show the cell-structure of the stalk, leaf and seed of the sorghum plant. The figures are better for what they are than for what they claim to be.

PROFESSOR W. TRELEASE has given a statement in *Psyche*, for September, of the present knowledge regarding the black spots on the leaves of solidagos and asters, usually considered by botanists to be some species of *Rhytisma*, and by entomologists to be galls of some cecidomyid larva, generally *Cecidomyia carbonifera* O. S., and has come to the conclusion that they are due to the joint influence of the fungus and insect.

THE AMERICAN MICROSCOPE is not an instrument for research, that is, not for convenient every-day use. The American manufacturers make instruments for the so-called microscopists, those who are willing to pay a fancy price for a fancy article. One of the prominent makers of the country told the writer, not long since, that he was working to establish a reputation, and could not afford to produce the "cheap" instruments desired by some workers. Until the makers assume a different attitude the showing made in the last *Science Record*, which gives a list of thirty-one prominent investigators, twenty-three of whom use foreign microscopes, mostly Zeiss and Hartnack, is not likely to be materially changed.

THE FACILITIES FOR BOTANICAL INSTRUCTION at Harvard have recently been increased by the appropriation of the first floor of Harvard Hall together with rooms for constant temperature and studies in light to the use of the department of vegetable physiology and histology. The former rooms at the Botanic Garden are reserved for the economic and systematic work which comes in the spring term. The cryptogamic department has excellent quarters at the Museum of Comparative Anatomy.

PROF. M. STALKER, state veterinarian of Iowa, and professor in the Iowa Agricultural College, has been studying a new disease among horses of the Missouri valley. In mild cases of the disease the animals lose vigor, and after some weeks die, but in more violent cases they become wild and unmanageable or pass into a stupor and live but a short time. The cause was traced to the eating of *Crotalaria sagittalis*, L., a not distant relative of the famous "loco weed," *Astragalus mollissimus*, Torr. The disease is named crotalism.

THE CONTROVERSY on the relation of cluster-cups or æcidia to rusts, especially those on grasses, which has been caried on with much fervor in England between Mr. W. G. Smith and Dr. M. C. Cooke on the one hand, and Mr. Plowright and others on the other hand, has little concern for botanists on this side of the waters. No botanist of note in this country advocates the autonomy of *Æcidium* and *Ræstelia*, although most of them believe it best to keep them separate in our catalogues until their exact relationships have been determined by cultures. Dr. Farlow is cited on both sides of the question, but no one who knows how thoroughly progressive although cautious he is, could for a moment believe he would endorse the wild or antiquated opinions of Mr. Smith. Mr. Smith's views are stated at length in his work on the diseases of crops, and have been answered by Mr. Plowright in the British Journal *Agriculture* for September 10.

IT IS HARDLY NECESSARY to make any announcement concerning the GAZETTE for 1885. It is sufficient to say that it will be continued under the same management, and upon the same plan as during the past year. Some new features will be added, but they will recommend themselves as they appear. During the coming year the GAZETTE will finish its first decade, and its steady growth in the favor of botanists is taken as a sufficient indication that it was a necessity. Even more attention will hereafter be given to editorial notes and book reviews, that subscribers may be kept well informed of the world's work in botany. At the same time, the editors will constantly exercise the right of criticism, as they are not willing to take the responsibility of even indirectly recommending worthless books. The rapidly developing departments of physiological and cryptogamic botany will receive their full share of attention, while systematic work in the higher groups will probably yet hold the attention of the greater number of our readers. We would ask that our subscribers act as our agents, not that money may be made, but that the GAZETTE may make still farther advances in usefulness.

CURRENT LITERATURE.

Orchids of New England: a popular Monograph. By Henry Baldwin. 8 vo. pp. 159, figs. 40. New York. John Wiley & Sons, 1884.

Mr. Baldwin tells us in his preface that he had for some years "a bowing acquaintance" with the Orchidaceæ of his neighborhood, but was brought to closer observation of them by making sketches of the various species. His acquaintance now has certainly become more than a bowing one, and he details in this book many choice bits of information which only a close observer would have gathered. The various species are figured and discussed in the order in which they come into flower. In a pleasant way he chats about the habits and habitats of one and another, quoting freely from several previous writers on Orchids both popular and scientific, as to the structure, homology and physiology of the floral and other organs. It would have been better had Mr. Baldwin given more of his own observations and experiments as to these points. It would not have made the book less popular, and would have rendered it still more interesting to the botanists who are above (?) reading a popular book. New England certainly contains more species of Orchidaceæ than any equal area in the United States, forty seven being enumerated in the table of geographical distribution at the close of the book. In addition to this table a full though not complete bibliography and good indexes make the book very useful to botanists—more especially New England botanists. The figures, photo-engravings of the author's drawings, are all good, and many of them excellent.

Descriptive Catalog of the North American Hepaticæ North of Mexico. By Lucien M. Underwood, Ph. D. pp. 133. Bulletin of the Illinois State Laboratory of Natural History.

To those who are acquainted with Dr. Underwood's previous volume, "Our Native Ferns and their Allies," which has brought the author much deserved credit for its careful and able preparation, it will be no surprise to find the present work equally well done. Dr. Underwood has, in this pamphlet, made a very praiseworthy and successful effort to set in order the species of Hepaticæ heretofore published from the region named. He has made no attempt to describe new species, "believing that too many have already been described from insufficient data." How many difficulties he met in getting out descriptions of the already published species, no one knows so fully as Dr. Underwood, because no one else has undertaken the task. We get a mere hint of them in the prefatory note. Neglect by collectors, rarity and inaccessibility of the literature, absence of American species from American collections, and inherent complexity, are enough to have deterred a less energetic worker than Dr. Underwood. Let botanists show their appreciation of his labor by communicating to him specimens of all forms found in their localities. In addition to the descriptions of species and genera, there is a brief account of structure, habits, geographical distribution, remarks on collecting and a complete bibliography of systematic works. Finally, let botanists rejoice that there is *one* State, at least, enlightened enough to support a State Laboratory of Natural History.

Vergleichende Morphologie und Biologie der Pilze, Mycetozoen und Bacterien. Von A. de Bary. Wilhelm Engelmann. Leipzig, 1884. 8vo. 558 pp. 196 Illust.

The original work, written in 1865, was entitled "Morphologie und physiologie der pilze, flechten und myxomyceten," and contained but 316 pages. The remarkable progress since made in the study of these plants is indicated in the change of title, in which the lichens are absorbed in the fungi, and the new class of bacteria added, but yet more by the table of contents, showing a wonderful revolution and expansion in all that pertains to sexuality and classification.

The comprehensive statement of a subject by a master is invaluable to those who have passed the threshold of the study; and such we have in the work before us. It is a concise presentation of the principal facts, and a clear and critical discussion of their bearing. Such topics as the first recognition of form-species and genera in 1851, the homology and relationship of the fungi with algæ, mosses, ferns and flowering plants, interrupted homologies, the doctrine of apogamy, the meaning of pleomorphism, the discussion of proper terminology, copulation in the *Ustilagineæ*, the relation of the parasite to the host, form-genera in bacteria, and pathological bacteria, are replete with interest and instruction; limited space does not permit the mention of a longer list.

The author has placed all the best known groups in an ascending Ascomycetous series, beginning with *Peronosporeæ* and passing through the *Saprolegniaceæ*, *Mucorini*, *Entomophthoreæ* and *Ascomycetes* to the *Uredineæ*. The imperfectly known *Chytridineæ*, *Ustilagineæ*, *Saccharomycetes* and *Basidiomycetes* are treated as out-lying groups related to the higher forms.

The work is so fundamental and authoritative that no investigator can afford to remain ignorant of its contents.

Das Botanische Practicum. Von Dr. Edward Strasburger. Gustav Fisher. Jena, 1884. 8vo. 664 pp. 182 Illust.

Some idea of the importance of this work has already been presented in the August number of the GAZETTE. It aims to give a very full course in the essential features of the minute and gross anatomy of plants, adapted to both the beginner and the advanced student. The work is divided into thirty-four tasks, most of them too long for a single sitting, as laboratory work is conducted in this country. The first chapter treats of the parts of the microscope, the preparation of an object, and the study of various kinds of starch grains, introducing such simple reagents as iodine, potash and sulphuric acid, and the use of the polarizer. The second chapter takes up the study of the grains of peas and corn, illustrating the methods of making and mounting temporary and permanent sections, both free hand and with apparatus. The seeds of several other plants are then studied. The third chapter deals with protoplasm and its movements as seen in *Vaucheria*, the hairs of *Tradescantia*, *Cucurbita*, *Lamium*, etc., and in the cells of *Vallisneria* and *Nitella*, with the action of reagents, and method of using the camera lucida. The fourth chapter treats of chlorophyll grains, color bodies and leucoplasts in a variety of plants, and so on. It is impossible to more than barely indicate the completeness and suggestiveness of the work, the table of contents alone covering twenty-three pages. The student is led by easy stages to an understanding of the methods of investigation, and a knowledge of the mysteries of structure that have justly placed German botany so far in advance of the rest of the world. No topic of importance is left untouched, and abundant references indicate the source of additional information. Until translated it can not be used very much, of course, as a handbook, but is admirably adapted to individual study wherever the language is not too great an impediment, for which the remarkably copious index, such a rarity in German works, is of much assistance.

Diseases of Field and Garden Crops, chiefly such as are caused by fungi. By Worthington G. Smith, F. L. S. Macmillan & Co. London, 1884. 12mo. 353 pp. 143 Illust.

This work is timely, and deserving of attention. We have had numerous works of all grades on the cultivator's insect foes, but this is the first book in our language on fungous foes. The damage which fungi do annually to cultivated crops is something enormous, and far beyond the popular apprehension. This comes from the fact that the true nature of the diseases which owe their origin to this cause is not usually well understood, or it may be not suspected; and the fungi themselves are minute and obscure, are insidious in their attacks, and difficult of control. Although the annual loss to the country from the depredations of fungi is undoubtedly as great as that from insects, we yet have no government or state reports on the subject, and but limited investigations. It is therefore very apparent that if Mr. Smith's work is accurate and readable, it meets a genuine need; and such, we hasten to assure the reader, is in the main the case.

The topics treated are the diseases of potatoes and onions, rust and smut of grain, mildew and other diseases of grass, ergot, club-root in turnips and cabbage, mildew of peas, lettuce and turnips, and various less known diseases. A few, like the clover sickness, clover dodder and ear-cockle (the last two, by the way, not of fungous nature), and some others, are unknown or not troublesome in America, but for the most part the book is as applicable here as in England. The few remedies only which are suggested show how little has yet been done in this line.

The illustrations are clear and suggestive, although we must demur to giving the impression that such highly diagrammatic drawings are produced by the camera lucida.

The author has a good deal of that quality known in America as Johnny Bull, and it has led him into giving undue prominence to a topic on which he holds antiquated notions, and which he tries to pass current by propping up with bad philosophy. We refer to the forty pages on the connection of corn mildew and barberry blight, which had better been left unsaid. We speak of the subject elsewhere in this journal. The chapter on the passive state of the potato disease also needs critical sifting.

The Agricultural Grasses of the United States. By Dr. George Vasey. Also, *The Chemical Composition of American Grasses.* By Clifford Richardson. Department of Agriculture, 1884.

Dr. Vasey has done a good thing for agriculturists in publishing this bulky pamphlet. There are nearly 150 pages of text, and 120 plates intended to represent all of our agricultural grasses. It does seem as though even the most obtuse observer could get from this pamphlet at least a general notion of the ordinary grasses about him. The plates will help him more than the text, for that, simplified as it has been, is unavoidably technical, although a good glossary may enable some to spell their way through. Some special reports from Montana, and the Rocky Mountain region; also in a more condensed way from other sections of our country, give additional interest. Mr. Richardson's work is given in a tabulated form, and has a very direct bearing upon the successful cultivation of grasses. There can be no doubt that by such means our farmers will be led into some scientific knowledge of the plants they chiefly cultivate, a knowledge which must have its influence in improved methods, and may act somewhat as a safeguard against much of the unutterable "scientific" bosh published by certain agricultural papers.

American Medicinal Plants: An illustrated and descriptive guide, etc. By Charles F. Millspaugh, M. D. Bœricke & Tafel, New York; Philadelphia. Nos. 1 to 5.

This is a very elaborate work, being issued in loose sheets with colored plates, and is meant to represent the American plants used as homœopathic remedies. The plants are all drawn by the author *in situ*, and are mostly very well done. Each number contains six species and plates, and one hundred and eighty are promised. The principal object seems to be to enable practitioners not only to collect fresh material within their reach, but also to understand its preparation and application, a desire which is very well met in these handsomely printed sheets.

Characteristics of the N. Am. Flora: An address to the Botanists of the B. A. A. S., at Montreal; read August 29. From the *Am. Jour. of Sci.* 38. 323-340.

Dr. Gray's masterly address at Montreal has probably been read by all botanists, at least it ought to be, and no notice here can make good any such failure. A subject of greatest interest to us all, treated by one of all the most competent, is a combination that no American botanist can afford to neglect. Bristling as it does with interesting facts, nothing but a reprint could do it justice.

The N. Am. Geasters: By A. P. Morgan. From the *Am. Nat.* 18. 963-970.

This paper is illustrated and well describes the beautiful "Earth-Star Puff Balls." Sixteen species are described, twelve of them being figured.

Catalogue of the Flora of Minnesota, by Warren Upham, and *Preliminary List of the Parasitic Fungi of Wisconsin*, by William Trelease, come too late for review in this number, but will be more worthily noticed in the next.

BAILEY ON CAREX.

BOTANICAL GAZETTE.

Vol. X. JANUARY 1885. No. 1.

Notes on Carex.—III.

(WITH PLATE.)

BY L. H. BAILEY, JR.

1. CAREX NERVINA, n. sp., connecting the groups *Fœtidæ* and *Vulpinæ*: Culm flat and weak, smooth, striate, about 18 inches high from a woody root; leaves ample, broad, striate above, minutely nodulose below, the upper equalling the culm, the lower short (½ to 3 inches long) from loose truncate sheaths; spikes densely aggregated into a fulvous head (½ to ¾ inch long) which is subtended by one or two setaceous bracts of half its length; perigynium lanceolate, spongy and compressed at the base, firm in texture, very strongly many-nerved, marginless and smooth throughout, about the length of the very thin acute scale; achenium oval (Figs. 6 and 7).—Summit Camp, California, July 10, 1870.—*Dr. A. Kellogg.* In aspect much like *C. Hoodii*, Boott, but at once distinguished by its smooth, firm and strongly nerved perigynium. The perigynium is somewhat like that of *C. stipata*. In the specimens I have examined the spikes, of which the head is composed, are compound at the base, and the basal branches are all staminate. Most of the top of the spike is staminate, and the two or three pistillate flowers appear as if borne in the center of a continuous staminate spike.

2. CAREX MURICATA, L., var. CONFIXA, n. var. Differs from the usual forms of the species in its very slender and mostly prolonged culms (which are 1 to 2½ feet high), and its oval or oblong continuous head of spikes, and in an habitually narrower perigynium.—*C. Hoodii* of authors, not Boott. N. W. Wyoming (*C. C. Parry, 281*); Wahsatch Mts., Utah (*Watson 1228*); California, Toulumne River (*Brewer, 1702* and *1772*, and *1069 Kellogg & Harford*); Union Co., Oregon (*Cusick, 1182*); British Columbia (*Macoun*). Very like *C. Hoodii*, Boott, and heretofore confounded with that species, into which the stouter

forms may pass. It also approaches forms of *C. cephaloidea.* *C. Hoodii*, as I understand the species, is characterized by its much stouter culms, its much heavier, browner and more compact heads which are made up of many-flowered, chaffy, linear or ovate more or less pointed spikes, and more upright perigynia which are covered by the large scales. The brown-and-green and truncate characters of the spikes, and the spreading, greenish perigynia of the var. *confixa* are not found in *C. Hoodii* in the few specimens I have seen of that species. *C. Hoodii* occurs in California, Oregon and Kamtschatka.

3. CAREX DECIDUA, Boott, is one of the least known of our Carices. The species was founded upon specimens from Terra del Fuego and the Falkland Islands, and was first published in the Linnæan Transactions, XX, 119 (1846). Shortly after, *C. Andersoni* was published by the same author in Hooker's Flora Antarctica, II. 364. This species differed from *C. decidua* in its larger size and compound spikes. In Boott's Illustrations, I, 163 (1858), the two species were united. Collectors upon our own Pacific coast had then found the species, so that its habitat was extended to "California, *Trubner* [*Thurber?*]. Oregon, *Douglas, Nuttall, Hinds*." The Carices collected by Dr. J. M. Bigelow in Lieut. Whipple's Exploration were submitted to Dr. Boott, and his determinations, with the other determinations of that collection, were published in vol. IV of the Pacific R. R. Reports. *C. decidua* is there given as occurring in "Mountains near Oakland, Los Angeles, Duffield's Ranch, Sierra Nevada, and other parts of California." One specimen of Bigelow's collection named *C. decidua* is in Herb. Gray, but it is *C. aquatilis*. Mr. N L. Britton has loaned me all the specimens of *C. decidua* in the Torrey Herbarium. They are all of Bigelow's collection, and all on two sheets. One sheet is labelled "Oakland and Los Angeles." A part of the specimens are unripe; the remainder are *C. nudata*, W. Boott. The specimens on the other sheet, from "Sierra Nevada (Duffield's Ranch)," are entirely too young to be determined. Evidently Bigelow's specimens have been mixed. If the collection contained *C. decidua* it must be at Kew. In Herb. Gray are three specimens from "N. W. Coast, Mr. Hinds, Herb. Bentham," and labelled *C. Goodenovii*, Gay, in Dr. Boott's handwriting (Figs. 1–5). These specimens answer almost perfectly the figures and final description of *C. decidua* given by Dr. Boott, and they are no doubt a part of the specimens referred to that species in the Illustrations. These specimens are the only ones I know from North America. I have an imma-

ture and depauperate specimen from Terra del Fuego, named by Dr. Boott, but it affords little aid in the determination of the species. Its perigynium is almost identical with that of *C. nudata.* There are no mature South American specimens of *C. decidua* in Herb. Gray, although a specimen from "Extra-tropical South America," collected by Dr. Cunningham, is probably to be referred to *C. nudata.* It appears probable that the original *C. decidua* was confounded with William Boott's *C. nudata.* The figures in the Illustrations are mostly those of the former *C. Andersoni.* Hinds' Oregon specimens agree with the figures of the original *C. decidua.* These Oregon specimens and the plants figured by Dr. Boott are distinguished from *C. vulgaris*, their nearest ally, as follows: *Spikes heavier; scales and perigynia deciduous; perigynium conspicuously stipitate and strongly nerved.*

No. 598 of Hall's Oregon Collection referred to *C. decidua* by Olney, and No. 594 referred to "*C. elata*, All. (*C. stricta*, Good.)," are probably the same, and evidently an undescribed species.

C. nudata, W. Boott, Bot. Cal. II, 241, is distinguished from *C. vulgaris* by its fibrillose sheaths and deciduous perigynia, and from both that species and *C. decidua* by its long, thin, finely punctate and lightly nerved perigynium, which is empty in the upper half. Its spikes are much more slender than in *C. decidua*, and with the present material it appears distinct enough from that ambiguous species.

4. Carex microglochin, Wahl., a North European and Greenland species, occurs in Colorado. It is 607 Hall and Harbour, the *C. pauciflora* of Porter and Coulter's Flora of Colorado. The specimens in the Gray Herbarium are labelled *C. oligantha*, Boott, in Francis Boott's handwriting. *C. oligantha* grows in Terra del Fuego. It differs essentially from *C. microglochin* in the fewer flowers, curved and conspicuously stipitate perigynium, and in the much deeper cavities in the rachis of the spike. These characters are strongly marked in specimens which I have from Terra del Fuego, but they do not appear in Hall and Harbour's specimens. Olney, in his notes which accompanied the fourth fasciculus of his *Exsiccatæ*, correctly referred Hall and Harbour's specimens to *C. microglochin.* The species is very much like *C. pauciflora*, and likely to be confounded with it, although the principal distinguishing character is decisive and infallible. The orifice of the mature perigynium of *C. pauciflora* is tightly closed by the *stiff and persistent style*; that of *C. microglochin* by a *stiff racheola which springs from the in-*

side of the perigynium beneath the achenium. A careful dissection of the perigynium at once reveals this distinction. *C. microglochin* is also smaller than *C. pauciflora*, the perigynium is less spindle-shaped and more strongly reflexed. Hall and Harbour's specimens are larger than the European and Greenland specimens, and it was probably due to this fact that Dr. Boott referred them to the very similar *C. oligantha*. I do not know that *C. pauciflora* occurs in the United States west of the Mississippi, but Drummond collected it in the Rocky Mountains of British America.

5. CAREX GLOBOSA, C. UMBELLATA and C. ROSSII have been endlessly confounded at the West. After a careful study of many specimens from all parts of the West, the following characters appear to be general and decisive:

C. GLOBOSA, Boott, Trans. Lin. Soc. XX, 125. *Rootstock* woody, mostly *perpendicular*, or nearly so; *culm one, slender*, angled and scabrous, 6 to 12 *inches high; leaves* many, *broad* (2 lines wide), *upright, mostly flat or flattish*, usually exceeding the culms; *staminate spike* ½ to 1 *inch long, conspicuous; pistillate spikes* usually several, 2 to 8 flowered, *the upper one borne at or near the base of the staminate spike, the remainder on very slender radical or sub-radical peduncles; perigynium pear shaped* (rarely nearly elliptic), *very gradually tapering from a rounded summit into a stipitate very strongly-nerved base*, sparsely hirsute, the *short, straight beak slightly toothed.*—California; *Nuttall; Bolander*, Nos. 20, 2298 and 6196; *Brewer*, No. 303.

C. UMBELLATA, Schk. Riedgr. II, 75. *Rootstock* mostly *horizontal; culms many, mostly very short and crowded and concealed among the leaves*, sometimes 3 to 4 inches long; *leaves* many, *mostly narrow, generally short, stiff and curved*, sometimes weak and straggling and 6 inches long; *staminate spike* ½ *inch or less long, not usually distinct and conspicuous; pistillate spikes usually crowded among the bases of the leaves, sometimes one or more of them exserted and clustered with the staminate spike, perigynium globose elliptic, more or less flattened, nerveless or nearly so, tightly enclosing the achenium*, clothed with sparse, short hairs (rarely smooth), *margined by two prominent ridges which terminate in a flattened, sharply cut beak as long as the body.*—Frequent on dry, sandy soil throughout the Northern States east of the Mississippi and northwestward to the Rocky Mountains of British America; also in Indian Territory.

Var. BREVIROSTRIS, Boott, Illustr. II, 99. *Beak much shorter and minutely toothed, the perigynium rounder or somewhat 3-*

sided.—Rocky Mountains of British America; near Golden City, Col., and Mogollon Mountains, New Mexico (*Rev E. L. Greene*); Cisco, Cal. (*Dr. A. Kellogg*); Plumas Co., Cal. (*Mrs. R. M. Austin*).

C. NOVÆ-ANGLIÆ, Schw. An. Tab. More or less cespitose; *culms few, very slender, often reclining; leaves narrow, weak*, commonly as long or longer than the culms; staminate spike ½ inch or less long, often inconspicuous; *pistillate spikes small* (3 to 8-flowered), *more or less globular, some of the lower on radical peduncles, the upper one, or two, close to the staminate spike and subtended by a narrow green bract as long or longer than itself; perigynium purple or very dark green, triangular or round obovoid, densely clothed with short hairs, the beak half or less the length of the body*, stout and slightly toothed.—Dry hills from Northern New England to Greenland and Alaska; also, in Washington Territory (1145 *Brandegee*, 1883), and in Eastern Oregon (*W C. Cusick*), and probably *Hall's* No. 603 from Oregon.

C. deflexa, Hornem., is the Greenland form of the species, differing from the Southern form in its much smaller size, greater relative length of culm, and in the pistillate spikes being more aggregated. I have this form from Alaska and Washington Territory (1145 *Brandegee*), and Oregon (*Cusick*). *C. brevipes*, W. Boott, *C. globosa*, var. *brevipes*, W. Boott, appears to be a large and triangular-fruited form of this type of *C. Novæ-Angliæ*. Drejer unites *C. Novæ-Angliæ* with *C. pilulifera*, L., as var. *deflexa*. It appears to me at present that the stiff and long culms, the globular and mostly many-flowered spikes and the much rounder perigynium of *C. pilulifera* separately it specifically from *C. Novæ Angliæ*.

Var. ROSSII. *Culms and leaves firm and upright; the leaves often very strict and nearly always longer than the culms; pistillate spikes 1 to 4-flowered, linear, upright, light colored; perigynia loosely alternate on a zigzag rachis*, the flattened beak longer or shorter than the body, *less hairy than in the species.*—*C. Rossii*, Boott in Hook. Fl. Bor. Am. II, 222.—Colorado (*Vasey*, 592 A, perhaps 592; *Hall and Harbour*, 620; Twin Lakes, 1058 *Wolfe*); Oregon (*Cusick*); New Mexico (889 *Fendler*); Utah, Cottonwood Cañon (1260 *Watson*), and in the Rocky Mountains and Great Plains of British America (*Drummond, Macoun*).

C. Novæ-Angliæ, as outlined above, includes a wide variety of forms, but between which I can detect no distinguishing characters.

6. SECTION PHYLLOSTACHYS, Carey, Gray's Manual, may be defined as follows: Spikes androgynous, staminate above. Pistillate flowers few, often remote, usually on a more or less zigzag rachis. Scales mostly prolonged and leaf-like. Perigynium smooth or slightly hispid above, mostly tightly enclosing the perigynium, the beak, if any, straight.

Under this definition should be included six species, all but the type species exclusively American. These are *CC. phyllostachys*, Meyer, *multicaulis*, Bailey, *Geyeri*, Boott, *Steudelii*, Kunth, *Backii*, Boott, *Willdenovii*, Schkuhr. These species naturally arrange themselves into two subordinate groups, which may be characterized as follows:

Phyllostachyæ. Culms all as long or nearly as long as the leaves; staminate flowers conspicuous; pistillate flowers very few and large; beak very short. Including *CC. phyllostachys, multicaulis, Geyeri.*

Bractoideæ. Culms mostly much shorter than the leaves; staminate flowers inconspicuous; perigynium small, the beak produced to half or more its length; scales very green and much dilated, often concealing the perigynia and readily mistaken for bracts. Including *CC. Steudelii, Backii, Willdenovii.*

In the Monograph of N. Am. Cyperaceæ, 404, Dr. Torrey thought that *C. Willdenovii* and its allies might properly be separated under the generic name Phyllostachys. Carey made the name a sectional one.

EXPLANATION OF PLATE III.—Fig. 1, *Carex decidua*, Boott, from Northwest Coast (*Hinds*), about ⅘ natural size. Fig. 2, a perigynium. Fig. 3, an achenium. Fig. 4, same, side view. Fig. 5, scale. The details are enlarged about eight diameters.

Fig. 6, Head of *Carex nervina*, Bailey. Fig. 7, perigynium. Fig. 8, achenium.

The Menominee Iron Region and Its Flora.—I.

BY E. J. HILL.

Wishing to compare the flora of that part of the northern peninsula of Michigan which lies within the basin of Lake Michigan with that farther south, or near the head of the lake, the Menominee Iron Region was selected for a fortnight's work. It is in the valley of the Menominee River, a stream that for a part of its course forms the boundary between Michigan and Wisconsin. In general, it takes a southeasterly direction, and enters Green Bay on its western side about half way between its head and the lake. This river is about 120 miles long, being the longest in the upper peninsula. The Machigamig, its principal tributary from the east, rising in the Huron Mountains, has its head waters within fifteen miles of Lake Superior, distant from Green Bay about two hundred miles, by the course of the two rivers. As was expected, there was a decidedly Lake Superior aspect in its flora. The soil is either sandy, forming pine plains covered with an almost exclusive growth of *Pinus resinosa*, the so-called "Norway Pine" of the lumbermen, or a light clay loam, devoted to the hard woods. Where the ground is less sandy, and richer, the White-pine occurs. Interspersed with these are swamps of Cedar, Tamarack and Birch. It is a rocky region, ledges frequently rising above the surrounding land, and being exposed in all the streams. These streams are full of rapids and waterfalls, owing to the frequent change of level, and many choice bits of scenery can be found hidden away in the woods.

Parallel with the Menominee Iron Range is a series of depressions occupied by small lakes, the most important of which in Michigan, commencing with the westernmost, near Iron Mountain, are lakes Antoine, Fumée and Hanbury. As the region is mainly given up to mining and lumbering, it is nearly in its primitive state, aside from the work of the ax and fire that have made sad havoc in some places. But little of the land is used for agriculture in the part visited, though some of it may, and doubtless soon will be, taken for that purpose. Prospectors for iron ore are the men busiest in turning up the soil, and the woods of the Iron Range are full of pits, sunk with the expectation of making a discovery of the useful metal and laying the foundation of a fortune. It is possible to go all day without meeting with a fence, save, perhaps, by the railroads, or near some village, as a protection against the village cows. It is such a state of things as would have delighted Rafinesque, who "liked the free range of the woods and glens," and hated the sight of fences like the Indians.[1] Out of the beaten track of the tourist, it is an inviting spot to one botanically or geologically inclined, for the writer ordinarily took wallet and hammer, as well as the customary tin box of the botanist, in nearly all trips, and often returned to his lodgings well loaded with rock specimens, since some great upheaving force had wrought with tremendous power on the rocks, setting some of the strata nearly on end, and the

[1]New Flora of North America, Part First, p. 14.

rock studies and geological problems were many and deeply interesting.

To one tired of work in the school-room and city, and wishing for mental rest and change, yet not freedom from all occupation, but employment in some new direction, often the best of recreation, such spots can be highly recommended. Physically, the work can be made as hard as is wanted for the strengthening of muscle and gaining a devouring appetite, by clambering over rocks and fallen timber, or making headway through cedar swamps and thickets, with only a path traced by deer and bear, an occasional sight of which may be gained. There being so much iron in the rocks and soil, the springs are chalybeate, and the thirsty explorer of the woods can drink in health from the running brooks.

To reach this region, a steamboat was taken at Chicago which, three days afterward, landed me at Escanaba, the principal shipping port for iron on Lake Michigan. It was long enough before sunset on a July day to get quarters in a hotel and take a stroll in the adjoining woods. The flora, as far as it went, was so much like that at the head of the lake, long a familiar working ground, that one blindfolded and carried to the midst of it would have been puzzled to tell the difference of location, when permitted to see it. There was less variety, something to be expected the farther north we go, especially in comparison with the sandy, pine barren section from Chicago eastward to Michigan City, remarkable for the variety and number of species. The main point of difference was the presence of *Pinus resinosa*, and *Potentilla tridentata*, and the profusion of *Cornus Canadensis* and *Linnæa borealis*, carpeting the ground in places. The last two are also found at the south end of the lake, in a few limited areas, and seem somewhat astray. It was the 9th of July, but in some places in the damp woods and cedar swamps, the Bunch-berry still whitened the ground and rotting logs with its large blossoms. And Linnæa was equally prolific with its modest flowers of pink; I gathered it in just the same state the present year (1884), on the 7th of June, at Pine Station, Ind. The length of the lake makes a difference of three or four weeks in the maturity of plants. I had not expected so much difference, and was surprised to see a bouquet of *Cypripedium spectabile* in the hand of a lady that came aboard the boat at Fayette, on the way to Escanaba. Near Chicago, its time of anthesis is ordinarily from the 5th to 25th of June. *Potentilla tridentata* was equally abundant where the soil was dry, spreading in the open woods where *Pinus Banksiana* was thickly coming in, supplanting *P. resinosa*.

The evening stroll proved of sufficient interest to induce a stay for another day at Escanaba, and take in a wider circuit, south and west of the town. The land is quite level, and soon becomes swampy, with low sand ridges interspersed. Among the more interesting plants noticed, and not seen at the south end of the lake, may be mentioned *Carex trisperma*, Dew., *C. flava*, L. (in place of which we have the allied *C. Œderi*, Ehrh), abundant in the wet meadows, *Eriophorum vaginatum*, L., the first I had seen of it, and regarded as rare, in similar places. *Rhynchospora fusca*, R. & S., also rare, and new to my herbarium (not mentioned in Wheeler & Smith's Catalogue of the Plants of Michigan). *Lonicera oblongifolia*, Muhl., was found in the wet woods. Occurring near Chicago, but not so abundantly, may be mentioned *Salix myrtilloides*, L., growing everywhere on the peat bogs, when not too wet. *Pyrola chlorantha*, Swartz, in the dry woods, and *Eriocaulon septangulare*, withering, in the shallow ponds. In the Tamarack Swamps *Potentilla palustris* often had a singular look, its stems and leaves becoming hoary with long white hairs, since it is commonly quite smooth, except the stipules and under side of the leaves. The genuine *Ranunculus Flammula*, L., not the variety *reptans* usually seen, was met with in the wet sands. The stems were ascending, or erect, with rather large flowers, looking so different in its habit from the form we generally find that at first it was hardly recognized as the same species. Some of the stems were seven inches high, with linear or lance-linear leaves, and the flowers nearly half an inch in diameter (7-16 inch by measurement). It is evidently var. *intermedia*, Gray, but with larger flowers than indicated in the description in the Manual. Some mosses were gathered, among which was *Mnium serratum*, Brid.

George Bentham.

The *Journal of Botany*, for December, gives a short account (with portrait) of this very distinguished botanist. It is prepared by Mr. B. D Jackson, Secretary of the Linnean Society, of which Mr. Bentham was President for 13 years (1861–1874). Mr. Bentham had one very great advantage in his life work, his means and family arrangements being such that he could devote his whole time systematically to the study of botany. The salient facts in the life of such a man should be known to botanists, and for this reason this *resume* has been prepared.

He was born at Stoke, a village near Portsmouth, on September 22d, 1800. He was the second son of Sir Samuel Bentham, and in his early years (1805–1807) he resided in St. Petersburg, to which capital his father had been sent by the English Government, and where he acquired a knowledge of the Russian and Scandinavian languages. In 1807 the family returned to England and resided at Hampstead until the peace which followed the banishment of Napoleon to Elba, when they removed to France, spending the most of their time in Southern France. The training of young Bentham was mainly committed to private tutors, he never having attended a school, which may have been to his advantage.

It was in Southern France that his attention was first turned to botany, a copy of DeCandolle's *Flore francaise* accidentally falling into his hands. His methodical mind was at once struck by the analytical tables, and testing them with the first plant he saw (*Salvia pratensis*), his success in naming it encouraged further study.

For a time he managed his father's estate near Montpellier, his studies being quite varied, not only plants, but insects and philosphy also occupying his attention, the last under the influance of John Stuart Mill, who was his father's guest for some months. To his credit it should be said that his agricultural operations were very successful, but he took time from them to botanize in the Pyrenees and the Cevennes.

In 1826 the family returned to England, and Bentham entered Lincoln's Inn and read for the bar, until 1832, when at the death of his uncle he found himself master of a house, and his father having died the year before, he entered into his independence. During these six years he worked incessantly. In 1826 he was elected Fellow of the Linnean Society. In 1827 he published his "Outlines of a New System of Logic," in which the doctrine of the quantification of the predicate is for the first time set forth. In 1829 he was appointed Secretary of the Royal Horticultural Society, which position he held until 1840. During this time he described most of the numerous species introduced by Hartweg, Douglas, and others, and raised from seeds. His first great botanical work was published in 1832–1836, being the *Labiatarum Genera et Species*. Before that time this great order was in utter confusion, and this classical work proved first the author's distinguished ability as a monographer.

In 1842 he left London for Herefordshire, working constantly on botany, and residing there until 1854, when he found that his increasing herbarium and library were growing beyond his means. His books and plants were therefore presented to the Royal Gardens, at Kew, and he himself returned to London, residing at 25 Wilton Place until his death.

For the last 30 years of his life he devoted his time to botany as constantly and systematically as a bank clerk, and one day was like every other, but the result was a marvellous amount of work. Even this daily routine is interesting. At a few minutes after nine he left home, drove to Vauxhall, thence by rail to Kew, where he worked from ten to nearly four. Returning home, an hour or two was spent in writing out the notes of the day's work, and then dinner was eaten, being the second and last meal for the day. Two months' holiday was taken in autumn, and each Thursday was devoted to the Linnean Society, while he was its President.

A bibliography of Bentham's writings is an extensive affair, but an elaborate one has been prepared by Dr. Kanitz, and published in *Magyar Novenytani Lapok*, for September and October. Among the great works undertaken after Mr. Bentham's establishment, at Kew, may be mentioned the series of Colonial Floras. Then came the great work on the wonderful Australian flora, in which Baron Ferd. Von Müller rendered great assistance. But the last, and crowning work of his life, was undertaken at 60 years of age, in conjunction with Sir Joseph Hooker. It was no less than a complete revision of the genera of phanerogams based on a careful study of the enormous mass of material collected at Kew. The first part was published in 1862, and when, in 1883, the last part appeared, and the *Genera Plantarum* was complete, it was felt that the venerable author had earned his rest. From this time his health declined, and on September 20th, 1884, he died at his house in Wilton Place.

No systematic botanist has done more faithful and lasting work than Mr. Bentham, or was more fortunate in finishing what he undertook, and his very long life resulted in great things for the science he loved.

It is said that personally he was very reserved, as is natural to a modest man and one saving of his time, but to those who were fortunate enough to know him, he revealed a kind and generous nature.

GENERAL NOTES.

A Rose astray.—On a common climbing double red rose in my yard there is a sprout, on which, at about the middle, grows a whorl of four bracts, subtending a cluster of ordinary petals, giving the appearance of a stem growing through the center of a rose. The bracts are oblanceolate and toothed.—E. B. HARGER, *Oxford, Conn.*

Geographical Distribution of Plants.—In *Harper's Magazine*, November, 1871, is an account of a curious character known as Johnny Appleseed, who devoted his life, commencing before 1801, to planting apple seeds in favorable locations in advance of settlement, and thus securing a wide distribution of apple trees for the coming settler. In this article is mention of the distribution by the same party of seeds of dog-fennel or May-weed, under a belief in its antimalarial virtues. This circumstance is illustration how the acts of a single "crank" can serve as a factor in the geographical distribution of plants.

The ox-eye daisy, now so fashionable a flower, is said to be springing up on the lines of our Western railroads, the flowers carried by the ladies from the East until wilted, and then thrown from the car window, furnishing the seed supply for the distribution.

In Northern Maine this same ox-eye daisy has secured strong foothold, introduced through the former purchase of bale hay from other localities, for the feeding of logging teams in the woods in winter, at times when the local crop was short.—E. LEWIS STURTEVANT, *Geneva, N. Y.*

Dionæa muscipula.—I am much puzzled by a plant which I have been carefully nursing for some months past, and appeal to the BOTANICAL GAZETTE for light on the subject. Last April a friend brought to me, from the vicinity of Wilmington, N. C., a *Dionæa muscipula*, the first and only one I have ever seen, consisting of a small bunch of rounded leaves, and a number of winged, foliaceous petioles, bearing the peculiar trap appendages at the summit. I had the plant set out in a damp, shady nook of the garden, and have carefully tended and watched it with interest ever since. At first it seemed to thrive; several new traps gradually developed, the mature ones remained green and healthy-looking, one of which entrapped an insect, and after a fortnight or so, two flower stalks, as I supposed, shot up from the center of the plant, and I had strong hopes of seeing my cherished Dionæa in bloom. But they soon withered away, and one by one the traps died also, leaving no trace save in the cluster of cordate, dentate leaves, which flourished vigorously, and have continued to increase, sending out runners, which have taken root all round the parent plant, until now the group of independent bunches (except for the creeping, recumbent stem, which seems to link them all together) numbers about twenty-five.

The only description (technical) of *Dionæa muscipula* which I have seen is by Darby (from Ellis), which begins: "Without stem. Leaves spreading. Petioles winged, foliaceous," etc., etc. Whereas my plant has creeping stems in abundance, bearing, at intervals of two to three inches, a pair of opposite leaves, from which invariably descend rootlets, while the axils are nuclei of new plants, and leaves having petioles of two inches in length when fully grown. I have come to the conclusion that I have been hoodwinked, and that very unusual prey has this time been a victim of Venus's Fly-trap! Is it not possible that the Dionæa grew in close and intimate connection with the roots and stems of some companion, and that it is the foster plant which flourishes, while the Fly-trap perished?—ELIZABETH L. H. WILLIS, *Charleston, S. C.*

EDITORIAL NOTES.

DR. J. G. BAKER has described, in the *Journal of Botany*, six new species of ferns from Costa Rica, collected by Mr. P. G. Harrison. They are equally divided among *Asplenium*, *Nephrodium*, and *Polypodium*.

CHINA seems to be yielding much new material to the authorities at Kew. It is somewhat of a pity that the native plants of China have felt for so long a time the pressure of man's presence before they could be studied. It will be hard to eliminate the human factor and get a true view of the indigenous flora, although Chinese customs would prevent much inroad of foreign plants. In the December *Journal of Botany* Dr. Hance describes two new epiphytic orchids, and four *Cæsalpinieæ*. Among the latter a new *Gymnocladus* is especially notable. A few years ago our North American *G. Canadensis*, L., was the only representative of the genus; then *G. Chinensis*, Baill., a Chinese species, was discovered; and now a second Chinese species, *G. Williamsi*, Hance, is described, and curiously enough it is much more nearly related to the American form than to *G. Chinensis*. A new *Gleditschia* is also one of the four.

REV. B. SCORTECHINI has described a new genus of Rubiaceous trees from the Malayan Peninsula. It is called *Creaghia*, and belongs to the tribe *Cinchoneæ*. This type species is about 40 feet high, and bears the name of *C. fagrææopsis*.

IN THE DECEMBER number of the *American Monthly Microscopical Journal* the editor makes a complaint that Mr. J. Kruttschnitt's work on fertilization of the ovule has not attracted the attention it deserves. It is rather sweeping, to say the least, to observe that botanists have ignored it without giving it the slightest attention, as though they had some small spite against Mr. Kruttschnitt. Valuable work is appreciated by every botanist, and none are more eager to hail any discovery that will break up some encrusted theory. In fact, we rather incline to startling deductions too eagerly. But when a man undertakes to prove that the descent of the pollen tube to the ovule is a myth he contradicts, not our text-books, for in modern botany these are not depended on, but the every day experience of our laboratories. The demonstration of pollen tubes in the ovary cavity, and in the micropyle itself, is so comparatively easy that no class has advanced very far into laboratory work without successfully accomplishing it. It is almost like a man denying that hydrogen and oxygen do not exist in water. What chemist would stop to notice a theory based upon that supposition? What botanist has time to devote to one who stands upon such a plane that no starting point can be found short of the elements of botany?

The inference is fairly ridiculous that in these days of keen investigation botanists would accept upon faith one of the most fundamental statements of their science, and that too, when vastly improved instruments and methods have rendered its testing a matter of comparative ease. The fact that it is not such a very recondite thing is shown by the statement already made that its demonstration is a very ordinary operation of the botanical laboratories of to-day, and the path broken by Amici in the early part of this century has often been traveled since. We do not pretend to say that everything has been discovered with reference to this process of fertilization. Very far from it, for many things yet remain to be told. But when a worker begins by saying that pollen-tubes are not found even in the cavity of the ovary, much less connected with the ovules, we must shake our heads, for too many of us have seen them in both places. And then what will bôtanists think of the statement that "comparatively few of the botanists ever use a compound microscope, and of those who do not many are aware of the amount of labor involved in a thorough microscopical investigation by means of thin sections!" Now, we do not wonder at the rest of the editorial, for such lack of information concerning the botanical laboratories and methods of to-day could only mean unqualified ignorance of their results. It is freely granted that the old methods are still extensively used, but far from enough to justify any such statement as quoted above, and not at all by the recognized leaders in botany. The closing statement we heartily accept. and see no good reason why we should not, for it says, "It is well known that competent observers claim to have traced the pollen-tubes through the styles of certain plants. This, however, does not prove that this process of fertilization is universal." We should say not.

Let some microscopist, laying aside all but the simplest parts of his paraphernalia, take the flowers of any common small plant, as *Capsella* for instance. and clearing with potash examine a section of the ovary, and it will be a strange chance if any number of the pollen-tubes are not found in the cavity of the ovary and some even sticking to micropyles. In conclusion it should be said that the writer has examined a full series of Mr. Kruttschnitt's slides.

IN THE LAST (January) *American Naturalist* Prof. Bessey refers to a difference of opinion, rather warmly expressed in *Nature*, between Rev. George Henslow and W. T. Thistleton Dyer. These distinguished botanists somewhat represent the old and new methods of teaching botany. As in every reform the first tendency is to swing to the opposite extreme, so the new botany begins by scouting the old and fairly abhorring classification. It is the case of a superstructure despising the foundation upon which it rests, for systematic botany necessarily came first, and if it does not contain all the botanical problems, or even the most important ones, it certainly presents some that are extremely important and worthy any student's consideration. That systematic botany is a dried pod, out of which all the seeds have rattled, is a grand mistake, for our material is now but fairly brought together for the work of the monographer to begin. This is no plea for the study of systematic botany as opposed to the structural and physiological, as the writer's own laboratory will abundantly testify. But it is meant to call attention to the fact that the pendulum has swung farther away from the old side than it can stay, and that a study of botany must include the systematic phase. Whether a class should begin with Gray's text-books and Manual, and then follow Bessey, or begin with protoplasm and run the whole gamut of tissues and tissue systems, and then study classification, is for the individual teacher to decide, and is as often a question of convenience as anything else. The point is that both kinds of work should be done. If the time allotted to such work is comparatively short, the very best method is to combine the two, and beginning with Protococcus, let types of classification and of structure advance with equal step. The writer is not sure but that this is the best way to begin the study of botany at any rate, as it surely results in a broader, more comprehensive view of plants than either of the other methods alone. But for convenience of application, as well as a means of awakening general interest in plants, systematic botany holds, and always will hold, a very important place. Of course it becomes disastrous when the impression is left that all of a plant is its name, just as it would be if the examination of some dozen types should lead to the conclusion that all plant structures had been studied.

C. R. ORCUTT has begun the publication of a scientific paper at San Diego, California, entitled *The West-American Scientist*, and is meant to be "a popular review and record for the Pacific coast." It is a four-page octavo, issued monthly, and costs fifty cents a year.

IT IS REMARKABLE what an amount of material can be collected with reference to a single plant. The last number (No. 4) of the quarterly *Drugs and Medicines of North America* continues the subject of *Hydrastis Canadensis*, and the next number will pursue it still farther.

THE DOUBT THROWN upon Koch's cholera bacillus by the work of Finkler and Pryor has been completely dispelled by Koch himself, who not only convicts his critics of cultures that are not pure, but also has readily produced cholera by the inoculation of a solution of a pure culture, even in so small an amount as .01 of a drop. Koch's results have been amply confirmed also by E. von Ermengen, and the so-called cholera bacillus and cholera seem bound together by ties that can not be broken.

IT HAS GENERALLY been supposed by biologists that a distinct department of "microscopy" had about as good a right to exist as a department of razors or sewing-machines. And this is true when taken as such a department is sometimes conducted; but any biologist reading Dr. Whitman's note in the January *American Naturalist* will discover that he wants to keep his eye on that department as Dr. Whitman proposes to conduct it or he will miss something he ought to know. When "microscopy" becomes less subjective and more objective, biologists had better prick up their ears.

CURRENT LITERATURE.

Select Extra-tropical Plants readily eligible for industrial culture or naturalization. By Baron Ferd. von Mueller. 8vo. 450 pp. Geo. S. Davis, Detroit, Mich., 1884.

This is a book of great value to all engaged in cultivating plants, and of great interest to every botanist. Its author has long been recognized as a leader in this sort of work, and his success at the Melbourne Botanic Garden is well known. This book is no new thought, but rather an enlargement and adaptation for North America of what has already been done by the same author for less extensive regions. Published by an enterprising American publisher, it is to be hoped his risk will be justified by the generous response of all interested in the subject. Species are arranged in alphabetical order, regardless of family relations, but the relative importance of families for industrial culture is pointed out in a special table at the end of the book. The notes under each species are very concise and well selected, in view of the fact that they could have been almost indefinitely extended. Range, use and treatment are the subjects considered, and not scientific characters. It is to be hoped that this book will greatly stimulate the desire for cultivating a much greater variety of plants, for it surely furnishes every convenience for their judicious selection. A geographic index is quite a feature, by means of which plants from any geographical division can be readily selected. A grouping of genera under their uses is also very instructive; such groupings as "Alimentary Plants" (subdivided according to the part used, such as herbage, root, esculent fruits, etc.), "Condiment Plants," "Fodder-Plants," "Honey-Plants," "Medicinal Plants," "Scenic Plants," etc., being used. In the systematic index of genera it is interesting to note the relative importance of families in this respect. *Gramineæ* heads the list with 77 genera; then *Leguminosæ* with 73; *Compositæ* 37; *Palmaceæ* 34; *Umbelliferæ* 32; *Liliaceæ* 20; *Labiatæ* 20, and so on, Dicotyledons and Monocotyledons successively vieing with each other in the display of useful genera. Owing to the much greater number of families, of course Dicotyledons eventually outnumber Monocotyledons; but the two great families, *Gramineæ* and *Leguminosæ* stand preeminently above all others in their relation to man's needs.

Preliminary List of the Parasitic Fungi of Wisconsin. By William Trelease. From Trans. Wisconsin Acad. Sci., vol. vi. 40 pp.

The author modestly calls this a provisional list and as such he intends to make it. It contains about 270 species, several of which are new, on about the same number of host-plants, mostly phænogams. Most of the species have been collected about Madison by the author, assisted by Mr. L. H. Pammel, a special laboratory student. This list will be very rapidly increased by a few seasons' collecting, and it is a move in exactly the right direction. As our state lists of the more prominent plants have been for the most part completed, what is more interesting or important than a catalogue of the parasitic fungi? Such lists can be valuable or worthless, and as competent cryptogamic botanists are as yet comparatively few in number, it is doubtful whether many states should attempt such a catalogue. But when a man of Prof. Trelease's experience and connections comes into an unexplored state it would be a shame if such work was not done. An index of host-plants is given and is so invaluable in such a catalogue that there should never be even a thought of omitting it. The botanists of Wisconsin should send Prof. Trelease specimens from all parts of the state, that the list may be made as quickly and as complete as possible.

BOTANICAL GAZETTE.

VOL. X. FEBRUARY 1885. NO. 2.

Notes on Fungi.

BY W. G. FARLOW.

The following notes include a number of corrections of errors and some additional information with regard to species mentioned in some recent papers. In Proc. Amer. Acad. xviii. 76, it was stated that *Uredo Toxicodendri*, Berk. and Rav., is the teleutosporic form with which *Pileolaria brevipes*, Berk. and Rav., is to be associated as the uredo form. I was lead to this conclusion because, in the large number of cases which I had examined, the *U. Toxicodendri* appeared to be the prevailing form late in the season. Although the number of cases examined by me seemed large enough to allow the conclusion which I drew, the only means of deciding with certainty which is the uredo and which the teleutosporic form is the mode of germination which, at the time of writing, I had never been able to observe. During the past summer I obtained the germination of the spores of the so-called *Uredo Toxicodendri*, and found that their mode of germinating is that of a uredo and not of a teleutospore. The germinal tubes are large, and, in spite of the prominent apical papilla, the tubes in the cases I saw were more frequently lateral than apical. The spores of the so-called *Pileolaria brevipes* I have not yet been able to make germinate, after repeated attempts.

While preparing a catalogue of exotic *Peronosporæ*, a species on *Cyclanthera hystrix*, a South American cucurbitaceous plant, was noticed in the Anales de la Sociedad Cientifica Argentina, xii. 81. The species, *P. australis*, was described in 1881 by Spegazzini, but the description was not received until after my paper in the October number of the GAZETTE appeared. From the description, *P. australis* seems identical with *P. Sicyicola*, described in the GAZETTE, and the former name has priority, unless, indeed, the species should prove to be the same as *P. Cuben-*

sis, B. & C., a point which can only be settled by a comparison with the type of *P. Cubensis* in the Berkeley herbarium at Kew, the specimen in the Curtis herbarium not being satisfactory. During the past year I have received specimens of *Peronosporæ* from various sources, including a few forms new to this country, and largely increasing the list of host-plants of species already known to occur with us. *P. Halstedii* appears to be on the whole our most widely diffused species, and to the comparatively large list of hosts already enumerated in the GAZETTE, thirteen in all, several more species are to be added. The species reaches its most luxuriant development on species of *Silphium* and *Helianthus* in the Western States but, abundant as are the conidia, the oospores are not often met with. Mr. Holway has found what appears to be *Peronospora calotheca*, De Bary, although no oospores were seen, on *Galium Aparine* in Iowa, and *P. Viciæ* on *V. Americana*, as well as *P. Sicyicola* on *Echinocystis lobata*. I received from Mr. J. Fletcher some grapes gathered at Ottawa, Canada, in August, 1884. The young grapes and their pedicels were covered with a dense growth of *Peronospora viticola*, in fact, denser than I have ever seen on the leaves of vines. Mr. Fletcher reports that the fungus was very destructive to grapes near Ottawa. It is somewhat surprising to find such a luxuriant growth of the fungus on the grapes themselves in so high a latitude as that of Ottawa, for most of the reports of the occurrence of the fungus on the grapes have come hitherto from warmer climates.

In Proc Amer. Acad xviii. 85, I mentioned a form of *Exoascus*, which grows on *Rhus copallina* in Massachusetts, and stated that I believed that a similar form had been found on an African *Rhus*, but I could not recall the reference. The notice which I had in mind was a paper by Dr. F. Thomas in the Sitzungsbericht, Bot. Ver. Brandenburg, xxii. 62. The paper is entitled "Ueber ein südafrikanisches Cecidium von *Rhus pyroides* Burch," and Dr. Thomas states that No. 34 of Thuemen's Herbar. Mycolog. Oeconom. Suppl. I, which is called an *Erineum*, is not due to the action of insects, as in most of the so-called *Erinea*, but is caused by a fungus which he thinks is probably a species of *Exobasidium*. In the deformities which they produce the *Exobasidia* resemble the species of *Exoascus*, and judging by Dr. Thomas's account of the fungus found by him in a sterile condition, it seems not unlikely that it was an *Exoascus* like our own. Persons owning copies of the Herbar. Mycolog. may be able to give further information on this subject. One would not naturally look to South Africa for fungous forms corresponding to those of New England, although a few fungi first described from the Cape have since been discovered in this country, of which an example is *Entyloma* (*Protomyces*) *Physalidis*, Cke. & Kalch., which, on the authority of Winter, who has examined the type of the species from the Cape of Good Hope, is the same as the form subsequently described as *Ent. Besseyi* in the GAZETTE of August, 1883, where the possible connection with *Protomyces Physalidis* was hinted.

Salix macrocarpa, Nutt., not of Andersson.

BY M. S. BEBB.

"SALIX MACROCARPA, Nutt. Leaves lanceolate, 2′–3′ long, ½′ wide, acute at both ends, at first covered with a brownish, silky down, at length glabrous, dark-green above, and bluish-white or glaucous beneath, mostly entire; stipules obsolete: aments appearing with the leaves, small, oblong, with 2–3 leaves at base: scales of the male small, blackish, oval, obtuse, somewhat hairy; of the female narrow and linear: capsules ventricose-lanceolate with long points, pedicelled, somewhat villous, but at length nearly smooth; stigmas subsessile, quadrifid."

"This species, like our pond willow (*S. grisea*), to which it is closely related, is found forming clumps in wet places where the water is stagnant, situations which it always seems to prefer to the banks of running streams. It attains a height of 3–4 ft. The branches are smooth and brownish-black, sometimes glaucous or whitish."—Sylva i. 67.

For the sake of brevity the above is condensed and rearranged from the original, but without the addition of a single word to supply any deficiency. It shows how well Mr. Nuttall distinguished the features of this marked species. Specimens received from Mr. Suksdorf, who has lately rediscovered the plant on the banks of the Columbia, where it was first found, attest the accuracy of the description given in the Sylva, as do likewise the authentic specimens in the Hookerian herbarium. The latter were in Prof. Andersson's hands, accompanied by Nuttall's characteristic label (with * to indicate n. sp), and the habitat plainly written—*Oregon!* It does seem that nothing short of sheer willfulness could have led to any mistake, and yet Prof. Andersson gratuitously transferred the name to a single specimen from "Hudson Bay, *Burke*," which Nuttall never saw, and described a new species of his own, *S. Geyeriana*, which (with a single exception, to be accounted for further on) *coincides absolutely* with *S. macrocarpa*, Nutt.

True, Nuttall in his Sylva omitted to mention the habitat of his species, and in so far opened the way for misapprehension, but on the other hand, the earliest description of *S. macrocarpa* published by Andersson (Sal. Bor.-Amer. p. 19) is ostensibly drawn from "Nutt. in Herb. Hook." (not from the Sylva at all, which, we are led to infer from Dr. Gray's note, l. c. p. 32, was at this time unknown to him), and if so, why were Nuttall's own specimens not described, and the recorded habitat given, instead of something very different from the other side of the continent!

It is well known that Prof. Andersson carried forward his elaboration of the genus *Salix* under exceptionally favorable circumstances. The richest collections were placed in his hands, and every possible facility accorded him by the most eminent botanists of Europe and America. It is therefore altogether reasonable and fitting that those of more limited opportunities should accept without questioning, as I myself have done, opinions apparently reached after a careful survey of the most reliable sources of information. Such being our confidence in this distinguished monographer, it is all the more to be regretted that he did not in the present instance show a fairer appreciation of the work of Mr. Nuttall, and a more impartial criticism of his own, whereby the astonishing coincidence between *S. Geyeriana* and the older *S. macrocarpa* could scarcely have escaped his attention. The single exception, to which allusion has already been made, consists in what is said of the male aments of *Geyeriana* being "sessile, scarcely bracted, larger and thicker," and this we are able to explain in a quite unexpected and satisfactory way. Of Geyer's two specimens only the female, from which the description is almost wholly drawn, belongs to *S. macrocarpa*, the male briefly mentioned as above, belongs to an altogether different species—*S. rostrata!* And here, too, we have at last the explanation of what has all along seemed so unintelligible, the comparison by Andersson of *S. Geyeriana* with *rostrata*, and the arrangement of the two side by side, when the affinity of the plant in question—as Nuttall had the sagacity to see—is really with *S. sericea*.

I have great pleasure in restoring Mr. Nuttall's name to the plant of the Far West, which he discovered and so clearly distinguished. It may be well to remark right here, lest the name itself prove misleading, that the capsules are by no means large. The beautiful form described in the Botany of California differs in its more conspicuously pruinose twigs, narrower leaves grayish rather than brownish silky, and may be called *S. macrocarpa*, Nutt., var. *argentea*. The extravagant height which it is said to attain, "10–15 ft." is a quotation from Geyer's notes, and has reference doubtless to *S. rostrata*.

Some New Grasses.

BY GEO. VASEY.

BROMUS SUKSDORFII. Culms 2 to 2½ ft. high, firm, leafy: leaves 5 or 6, 3 to 6 inches long, 3 to 4 lines wide, the 2 or 3 lower ones short, the middle ones longest, all erect, smooth; sheaths smooth, striate, all but the lower ones shorter than the internodes; ligule short and obtuse: panicle erect, narrow, 3 to 4 inches long, the branches appressed, short (½ to 1½ inches long), in twos or threes, mostly flowering to the base, with few spikelets: spikelets short-pedicelled or sessile, 3 to 5 flowered: outer glumes smooth, unequal; upper one oblong lanceolate, 5 to 6 lines long, obtusish, 3-nerved; the lower one one-fourth shorter, lanceolate, acute, 1-nerved or obscurely 3 nerved: flowering glumes 6 to 7 lines long, obtuse or acutish, soft pubescent, 5-nerved, rounded on the back; the awn 2 lines long: palet about one fifth shorter, acute, sparsely ciliate on the keels.

Collected by Mr. Suksdorf in Washington Territory, and also by Mr. Cusick in Oregon; altitude about 7,000 ft.; growing in tufts with the crowded culms perfectly erect.

BROMUS ORCUTTIANUS. Culms 3 to 4 ft. high, erect, leafy below, scabrous above: leaves 4 to 6 inches long, erect, rather rigid, smooth except on the margins; ligule short, obtuse, somewhat cartilaginous: panicle 4 to 6 lines long, erect, rather scabrous, the branches short (1 to 2 inches long), in twos or threes, rigidly spreading horizontally, sparsely flowered: spikelets 2 to 5 flowered, short pedicelled: outer glumes smoothish, scabrous on the nerves; the upper one oblong-lanceolate, 5 to 6 lines long, 3-nerved, obtuse; the lower one ¼ shorter, 1-nerved, narrower and acute: flowering glumes scabrous-pubescent, 5-nerved, rounded on the back, acutish; awn 2 to 4 lines long: palet rather shorter than the glumes, sparsely ciliate on the keels.

Collected on the mountains near San Diego by C. R. Orcutt, and also by Mr. Suksdorf on Mt. Adams, Washington Territory.

These two species are strikingly different in general appearance and habit, although the flowers are quiet similar

DEYEUXIA CUSICKII. Culms 3 to 4 ft. high, erect from a creeping rhizoma, smooth, nodes about three, distant: radical tufts numerous, with flexible curving leaves $\frac{1}{3}$ as long as the culm: culm leaves 3 to 4, light green, 9 to 12 inches long, 3 to 4 lines wide, slightly scabrous, the upper one nearly equalling the culm; sheaths smooth, 4 to 5 inches long, the upper one 7 or 8 inches; ligule conspicuous, 2 to 4 lines long, membranaceous: panicle 6 inches long, erect, rather close, $\frac{3}{4}$ to $1\frac{1}{2}$ inches wide, the branches whorled, numerous, mostly short and flowering to the base, the longer ones 1 to $1\frac{1}{2}$ inches, densely flowered, the lower whorls about 1 inch distant: spikelets closely approximated, very short pedicelled: outer glumes about 2 lines long, acute or acuminate, smooth, rather thin; the lower one 1-nerved; the upper 3-nerved and a little shorter: flowering glumes nearly as long as the outer ones, narrowly lanceolate, acuminate, smooth, thinnish, 5-nerved, bifid at the apex; awn erect, inserted a little below the middle, slightly exceeding its glume: palet nearly equalling the glume, membranaceous: hairs scanty, $\frac{1}{2}$ to $\frac{2}{3}$ as long as the flower.

Found by Mr. W. C Cusick in the Eagle Mountains, Eastern Oregon, at an altitude of 5 to 6,000 ft., growing in the shade of *Pinus contorta*, very conspicuous, but rarely sending up culms.

DESCHAMPSIA GRACILIS. Apparently annual: culms about 2 ft. high, slender, smooth: leaves filiform, not rigid, the lower ones recurving, 3–4 inches long; sheaths smooth, loose and open, the lower longer than the internodes; ligule conspicuous, 2 to 3 lines long, triangular-acuminate, sometimes split; upper half of culm leafless: panicle 6 to 8 inches long, lax and open, branches mostly in twos, the lower ones 2–3 inches long, slender, smooth, flower bearing to or below the middle, the lower joints 1 to 2 inches distant: spikelets small: outer glumes nearly 2 lines long, equal, linear-lanceolate, acute, 3-nerved, smooth, purplish, $\frac{1}{3}$ longer than both flowers: flowering glumes $\frac{1}{2}$ to $\frac{3}{4}$ line long, oblong, smooth, faintly nerved, apex broad and 4-toothed; the awn from near the base 4 times as long as its glume, bent at the middle: palet as long as its glume, narrow, ciliate above: villous hairs at the base half as long as the flower: the rhachilla also villous.

A slender, graceful species found by Mr. C. R. Orcutt on the mesas about San Diego, California.

The Menominee Iron Region and its Flora.—II.

BY E. J. HILL.

Leaving Escanaba the next morning, I went from this important shipping port for iron to the iron region proper. The village of Quinnesec, the oldest in the mining section, was chosen as a center, from which to make excursions in various directions. It is located on the southern slope of the Iron Range, a low ridge running a little north of west, in which most of the iron mines of the Menominee are found. To the west is Iron Mountain and its cluster of mines; eastward are Norway, Vulcan and the Breen mine, places where many mines are opened. This ridge crosses the Menominee River, into Wisconsin, where are other mines, but my excursions were confined to that part lying in Michigan, as far east as the Sturgeon River. After cutting through the range, the Menominee bends eastward, and for a while runs nearly parallel with it It is often rapid, from the rocks in its bed, and has two waterfalls in the vicinity of Quinnesec, the Big and the Little Quinnesec Falls, where there is a rapid change of levels, of eighty and fifty feet, respectively, each fall occupying a space of the river's course two or three times as great. As a considerable volume of water passes down these steep rapids, they are well worthy of a visit, but are now somewhat marred by the "chutes" the lumbermen have blasted through the rocks along their banks, to make a safer grade for the passage of logs. The smaller of the two, the upper, is being utilized for compressing air, to take the place of steam in the numerous mines at Iron Mountain, whither it is to be conveyed several miles in a large pipe. South of the lower fall, the Sturgeon River enters the Menominee, crossing the Iron Range from the north, also with rapids and falls and wild gorges, particularly where it cuts through the adjoining quartzites lying northward. South of the ridge the land is mostly a pine plain. On the north slope, and in the valley of Pine River, a branch of the Sturgeon from the west, the land is richer, and the hard woods are more abundant, as well as on the less sandy parts of the range itself and the quartzite formation.

The three lakes already mentioned are but a short distance from Quinnesec, and easily reached on foot or by cars. The outlets of Lakes Antoine and Fumee cross the southern barrier and enter the Menominee. Lake Hanbury lies south of the range, hence the botanical collector gets a varied field for examination.

Where the ground had been freed from timber by the ax or fire, there was but little variety, the Bracken Fern (*Pteris aquilina*) often almost hiding the ground. Interspersed were the blackberry, red raspberry, and the Hispid Aralia. The trees taking the place of the old ones were the two poplars, *P. tremuloides* and *P. grandidentata*, *Betula papyracea*, and the oaks, *Quercus coccinea* and *Q. rubra*, rather small and shrubby. On the whole, these desolated tracts were a barren, uninviting field for exploration. In clearings and burnt districts the tall, symmetrical form of *Arabis perfoliata*, Lam., was noticeable. *Epilobium angustifoliun* was everywhere present in such localities. Here, also, was found *Physalis grandiflora*, Hook., with large, white flowers, the largest of the genus in our flora, a representative of the Lake Superior district.

Waldsteinia fragarioides, Tratt, was seen throughout on the hills and in dry open woods. In similar places was *Cynoglossum Virginicum*, L., replacing *C. officinale* as a weed. Dense patches of the white-flowered raspberry (*Rubus Nutkanus*, Moçino) were often met with, so like the purple-flowered in foliage and general appearance, differing mainly in its large white flowers. On the high hills grew the Mountain Alder (*Alnus viridis*, DC.), now in fruit, and bearing quite a close resemblance to small forms of its relative, *Betula pumila*, L, found in bogs farther south. The soil of these hills is a sandy or clayey loam, usually thin, stony and reddish, from the presence of iron oxides. Where firm and more solid, the maple, elm, basswood, birch, hemlocks and other hardwoods grow, making quite a dense and heavy forest growth.

On the lower sandy hills and pine plains, largely covered with a thick growth of *Pinus resinosa*, if the forest was still intact, a different flora is seen, not indeed exclusively confined to them, but characteristic. It is not extremelv varied, but always interesting, the Ericaceæ predominating. Among the more noticeable plants were *Moneses uniflora*, various Pyrolas, *Monotropa Hypopitys*, L., *Lysimachia quadrifolia*, L., the grass *Brachyelytrum aristatum*, Beauv., *Vaccinium Canadense*, *V. Pennsylvanicum*, and *Gaultheria procumbens*. The low blueberry; from the middle to the 25th of July, was ripening its fruit abundantly, producing the largest and finest berries I had ever seen, which could be picked by the handful from almost any bush, and with which the appetite was often satisfied on these solitary walks. The greatest profusion of fruit was in the open woods, or where the trees had been removed from tracts not yet overrun by taller shrubs. The ground was also reddened in many spots by the ripe fruit of the common wintergreen Birds were not abundant, a fact I had noticed two years before at Sault St. Marie, and the berries are so plentiful that even if they were a vast number would be left untouched. In the open plains grew great quantities of *Polygala polygama*, Walt , with aerial and subterranean stems branching by the score from a single root, making a large tuft of stems, seemingly to rival Vaccinium and Gaultheria in the effort to keep the ground stocked with seed. And it doubtless had one advantage from its floral habit, its seeds being planted from the first.

In the colder and denser woods, where the white pine and hemlock were more common, the fetid-current, *Ribes prostratum*, L'Her., frequently occurred. In such places, growing among the moss, the dwarf Pyrola (*P. secunda*, var. *pumila*), was not uncommon. Here also, or in higher lands by streams, or in damp woods, was the prettiest of the wood sorrels, *Oxalis Acetosella*, L., with handsome flowers of purple and white.

Along the streams in copses grew a large-leaved honeysuckle, *Lonicera hirsuta*, Eaton. In open, grassy places, or on the rocky banks of streams, the common strawberry was *Fragaria vesca*, L., almost wholly replacing *F. Virginiana*. The latter was also found, but not very abundantly, in such situations. *F. vesca* was plainly native. Its fruit, sometimes three-fourths of an inch long, often as tapering as a sugar-loaf, as well as having the achenia superficial, is quite in contrast with that of its congener. In the muddy places of a stream that drains a swamp at Norvay was gathered the terrestrial form of *Callitriche verna*, L. Growing along with it, the water having been dried away, was a terrestrial form of *Hippuris vulgaris*, fruiting at a height of two to six inches, and seemingly at first sight a plant quite unlike the ordinary one found in water. It was dwarfed by drought, and showed that water was not absolutely necessary to its existence, though the want of it materially affected its size.

In the peat bogs, and cedar and tamarack swamps, the vegetation was quite different. *Cypripedium spectabile* was found in bloom in one at Norvay as late as July 18th. I was also able to get *Ledum latifolium*, Ait., and *Valeriana sylvatica*, Richards, in flower at the same time and place. In the bogs by the side of Hanbury Lake, *Habenaria dilata*, Gray, was common. *Eriophorum vaginatum* also grew here. Orchids in the contiguous cedar swamp were *H. obtusata*, Richardson, here, as elsewhere, exhibiting a great variety in the form of its leaves, so that a number of specimens are needed to exhaust the list of them. *H. orbiculata*, Torr., with its two large leaves close to the ground, round or roundish in outline, was another kind. A single specimen only of *Listera cordata*, R. Brown, was seen, though more were diligently sought after. In the cedar swamp at the west end of Lake Fumee, near the Norvay mine located there, I came across *Habenaria rotundifolia*, Richardson, with handsome rose-purple flowers. The leaves were generally oblong. I had never seen it till then, and it is evidently quite rare from the few stations assigned it. It is not mentioned in any catalogue of Michigan plants. *Pyrola rotundifolia*, L., var. *uliginosa*, Gray, grew in the same locality. Deep beds of moss often covered the dryer places of these swamps, aside from species of *Sphagnum* that everywhere formed a covering in damper parts among the tamaracks and cedars. Species of *Dicranum* and *Hypnum* were particularly abundant, as *Dicranum scoparium*, Hedw., and *D. undulatum*, James, growing upon the hummocks.

A day was taken for Lake Antoine, a beautiful expanse of water near Iron Mountain, but not many new things rewarded the search. *Danthonia spicata*, Beauv., grew along its rocky shores, varying a little in some characters, *Habenaria Hookeri*, Torr., and *Liparis Loeselii*, Richard., were found in the adjoining open woods. *Eleocharis palustris*, R. Br., var. *calva*, Gray, grew on the wet gravelly shores, and *Eriocaulon septangulare* in the shallow water. In neighboring sloughs *Utricularia intermedia*, Hayne, abounded.

The rock-flora is still to be mentioned, not an insignificant factor in a region where there are so many outcrops and ledges, into which streams had cut deep channels, and were often hemmed in by high cliffs. Precipitous ledges were met with in the midst of the woods, their crevices being occupied by mosses and ferns, among which other plants gained a foothold. *Polypodium vulgare* and *Cystopteris fragilis* were among the most usual ferns. *Woodsia Ilvensis*, R. Br., was found near the lower falls of the Quinnesec. *Corydalis aurea*, Willd., grew in large mats on the rocks at the same place, and on those of the hills at Quinnesec, its stems sometimes being three feet long, many branching from the same root. I had never before seen such a luxurious growth of it. The petals were wing crested and pointed, varying towards *C. flavula*, Raf., but it can only be called an intermediate form, though the common descriptions do not embrace its characters. Other gatherings here were *Oenothera pumila*, L., and the little moss, *Rhabdoweisia fugax*, Br., & Sch. At the Sandy

Portage, a few miles down the river, *Hypericum Kalmianum*, L., grew in hollow places of the rocks near the water, quite different in habitat from that in the wettish sands at the head of Lake Michigan. *Rhabdoweisia fugax* also grows in the dry sands near Englewood, and at Whitings, Ind. The hare-bell, *Campanula rotundifolia*, was everywhere abundant in such places.

On ledges of the Iron Range at Quinnesec were gathered *Dracocephalum parviflorum*, Nutt., with purple flowers, and *Symphoricarpos racemosus*, Michx., var. *pauciflorus*, Robbins, and *Bromus Kalmii*, Gray. On the cliffs of the stream which forms the outlet of Lake Fumee, which has several pretty waterfalls as it crosses the Iron Range to the river below, was a form of *Arabis Drummondii*, Gray, with rose-colored petals scarcely longer than the calyx Covering the faces of the dripping rocks *Hypnum filicinum*, L., grew in large sheets.

One more moss may be mentioned, of quite singular appearance, growing by paths in sandy and clayey woods, *Trematodon longicollis*, Rich. Nor must an introduced plant, found near the railroad at Vulcan, be omitted, *Echium vulgare*, L., that has taken a long stride northward and become well established.

The foregoing is not designed to be a complete account of even the summer flora of the Iron Region, but only as indicative of some of its more striking features, such as interested the writer, and presumably may also interest others. Many mosses were collected, the greater part of which still remain to be critically studied, having been partly left in anticipation of the work of Lesquereux and James, since the reception of which time has not been at command. But so far as studied, the moss flora does not materially differ from that already made out for the region around Sault St. Marie, and at Mackinaw, and the northern counties of the southern peninsula of Michigan, where several summers have been spent more or less in personal investigation. It is varied and luxuriant, and has features that, to some extent, characterize that of Lake Superior, or even British America.

GENERAL NOTES.

A New Classification of Plant Tissues.—In Dr. G. Haberlandt's recent work on the "Physiological Anatomy of Plants," published by Engelmann, of Leipzig, there are several changes in doctrine which teachers and workers would do well to note, and adopt or not as they see fit. Sachs' "Fundamental System" of tissues is rejected, as we think, with good reason. It could only be defined in a negative way, as those tissues which were neither epidermal nor fibro-vascular, no real positive character grouping them together. The author proposes rather a basis of function, which sounds well, provided function can always be clearly made out. We have then such groupings as "Protective System," "Mechanical System," "Conducting System," etc., all grouped under the two general heads of protection and nutrition. Such arrangement, for instance, puts bast and wood-cells among protecting tissues, and tracheary tissue, sieve vessels, soft bast, etc., among conducting tissues, under the nutritive group. This may do for a physiological grouping, but the anatomist will yet demand that the fibro-vascular bundle, for instance, be considered some how as a whole. Dr. Haberlandt thinks that wood-cells are purely mechanical and not at all conductive, and that tracheary tissue conducts, not air, but water. The fact that tracheary vessels have no connection with intercellular spaces or stomata is taken as evidence of a low pressure of air within them, thus, perhaps, inducing suction to some extent. The ordinary tracheary vessels are for the "through passage" of water, but tracheides for local distribution and so abound in leaves. The conductive tissue for proteids consists of the soft bast and sieve tubes. The book is a valuable one, but is itself an illustration of the fact that a classification of tissues upon the basis of function, however desirable, is not practicable in the present state of our knowledge.

Dr. H. C. Beardslee.—It is our painful duty to record the death (in December last) of a constant subscriber and contributor to the GAZETTE, Dr. H. C. Beardslee, of Painesville, Ohio. Some years ago he published a catalogue of the plants of Ohio, which he perfected before his death. Owing to a failure in the appropriation for the publication of the Geological Survey of Ohio this completed catalogue has never been printed. Dr. Beardslee's herbarium is now at Oberlin, consisting of about 4,000 species, and being especially rich in Carices, Grasses, and Salices.

EDITORIAL NOTES.

MR. GEORGE BENTHAM bequeathed £1,000 to the Linnean Society.

DR. PARRY will remain abroad during the winter. He is spending much time at the Kew Herbarium.

CENT. XIV AND XV of Ellis' North American Fungi will be issued soon. Cent. XV is to be devoted to Uredineæ.

THE HERBARIUM of Dr. Göppert, recently deceased, has been bought for the botanical garden at Breslau for $1,000.

THE HERBARIUM of Cornell University has been estimated to be worth $1,800, as evidence in the McGraw-Fiske will suit.

THE CHAIR OF BOTANY in the Iowa Agricultural College has been tendered to Dr. B. D. Halsted, editor of the *American Agriculturist.*

THE HERBARIUM of the late Duval-Jouve has fallen to the Faculté des Sciences, at Montpellier, the place of his residence.

A FRENCH SOCIÉTÉ MYCOLOGIQUE will be established with the beginning of the new year, with Dr. A. Mougost, of Bruyères, Vosges, as secretary.

OF THE WORKERS who have been really studying the diatom shell, none seems entitled to greater credit than Dr. J. D. Cox, ex-Governor of Ohio.

THE TRYING PERIOD through which the study of the rusts (*Uredineæ*) is now passing is leaving its impress upon the nomenclature in such specific names as *vexans* (Farlow) and *perplexans* (Plowright).

THE POLLEN GRAINS and an anther of *Papaver Rhœas*, taken from funereal garlands found in Egypt, have been figured by C. A. White, in the Journal of the Linnean Society. The Garlands were made about 1000 B. C.

H. KLEBAHN believes that the chief function of lenticels is to facilitate the admission of gases to the interior portions of the cortex. Otherwise their entrance would be almost blocked by the impervious outer portions.

THE AMOUNT of insoluble mineral substances which acumulate in the leaves of plants has been found to be in some cases as much as 20–25 per cent. of their weight. In stems the per centage is much lower, and in roots still less.

MARSILEA MACROPUS Hook., bearing the common name of Nardoo, is recommended by R. Schomburgk, Director of the Botanic Garden of South Australia, as a valuable forage plant for that country. The sporocarps are used as food by the natives.

A PAPER ON THE MYXOMYCETES, their habitats, modes of collection, preservation, etc., prepared by Dr. George A. Rex, of Philadelphia, one of the most successful and enthusiastic students of these plants in this country, will be given in an early number of the GAZETTE.

THE FIRST ANNUAL REPORT of the Agricultural Experiment Station of the University of Wisconsin contains botanical matter of special interest. Corn smut is treated by Prof. W. A. Henry, and the onion mold, apple scab and leaf blight, and when the leaves appear, by Prof. W. Trelease.

MR. HENRY O. FORBES, studying the contrivances for fertilization in certain tropical orchids, comes to the conclusion that "a number of orchids are not fertilized by insects, but are so constructed as to enable them to fertilize themselves." The paper was read before the Linnean Society.

MR. E. S. GOFF, in an article on the "Relation of Color to Flavor in Fruits and Vegetables," in the *American Naturalist* for December, points out what appears to be a constant relation between the variation in color of the edible portion and its mildness and flavor—the lightest colored being the mildest.

MR. CHAS. PLOWRIGHT, at a recent meeting of the Linnean Society, speaking with reference to the reproduction of certain *Uredineæ*, affirmed that when reproduction takes place without æcidiospores, the resulting uredospores are far more abundant than when they come from æcidiospores sown upon the host-plant.

MR. ROMEYN B. HOUGH, of Lowville, N. Y., is preparing a work of very thin sections of wood and accompanying text. The first volume, to be issued in the spring, will embrace twenty-five species, each with radial, tangential and transverse sections. It promises to be superior to any work of the kind yet published.

WE SEEM to be nearing a solution of the vexed question of the structure of the diatom shell; therefore the discussion becomes of some interest to botanists. Let us be thankful that there are found students who are not content with "resolving" *Pleurosigma* or "fighting objectives" on some of the numerous "test (?) objects," "dry," "in balsam," with "central" or "oblique" light!

THE JOURNAL OF MYCOLOGY is announced as a new monthly journal, devoted to fungi, edited by Prof. Kellerman, of the Agricultural College of Kansas, J. B. Ellis, of Newfield, N. J., and B. M. Everhart, of Westchester, Pa. It is to be issued in place of *Schweinitzia*, mentioned some time since. It proposes to give an account of the current literature of the subject with descriptions of new North American species and monographs of genera.

JOURNALS THAT PUBLISH new species, or make any important announcements, should be compelled to print the date of their publication. A journal bearing the imprint of January, and distributed to its subscribers in March, is manufacturing priority in a wholesale way, and if any question of priority should arise, as is often bound to be the case in descriptions of new species, some very unjust decisions might be made. The GAZETTE is ready to follow its own suggestion.

MR. J. D. KING, of Cottage City, Mass., offers for sale carefully prepared and mounted sets of microscopic slides, showing the position of the resin ducts and development of the hypoderm cells of the 60 species of *Abietineæ* which occur within the limits of the United States, and which botanists will now be able to examine critically. The specimens are made from material furnished by Professor Sargent, of Harvard College. The price of entire sets of 60 slides is $25, and selections of a less number $6 a dozen.

WHAT IS BELIEVED to be the first described case of the occurrence of a three-sided conical apical cell in the leaf of any plant has been published by F. O. Bower, in the *Proceedings of the Royal Society*, of London. The apices of the young leaves of *Todea superba* and *Osmunda cinnamomea* are occupied by such cells, from the three sides of which segments are cut off in the usual way. The cell is so placed that one side faces the upper surface, while the other two stand obliquely to the under surface. The discovery is an important one, as it helps still further to bridge the gap between the Ferns and Cycadeæ.

THE FOLLOWING BOTANICAL papers have been presented to societies recently: The grasses mechanically injurious to live stock, by Prof. W. H. Brewer, before the National Academy, at Newport, in October: Illinois forests and forestry, by Prof. T. J. Burrill; Notes on marine algae, Recent investigations on the rise of sap in trees, and Some corn fungi, by Mr. A. B. Seymour, before the Illinois State Natural History Society, in July: Trees and shrubs of

Northern Japan, before the Montreal Horticultural Society; and Plants in their relation to disease, before the Massachusetts Horticultural Society, both by Prof. D. P. Penhallow.

MR DAVID F. DAY tells us, in the *Gardener's Monthly*, for January, that he has given much thought to the relation of the form of the flower to its position on the plant, and has arrived at the following conclusions: (1) "A flower, completely regular, is normally either erect or pendulous, and (2) a flower which is irregular, is normally always lateral," and furthermore adds that he has failed to find any published statement to this effect. By consulting Gray's Structural Botany, p. 219, he will see that Sprengel made the observation nearly a century ago, and also had a fair notion of its significance. Mr. Day also notes that where the flower is erect the stamens exceed the pistils in length, but where pendulous the pistils exceed the stamens, i. e., the anthers in either case are above the stigmas. This is, however, an empirical rule to which many exceptions are easily found, and is only valuable as in the preceding case, when considered in connection with the mode of fertilization.

CURRENT LITERATURE.

List of, and Notes upon, the Lichens collected by Dr. T. H. Bean in Alaska and the adjacent region in 1880. By Dr. J. T. Rothrock. Proc. U. S. Nat. Mus. vii. 1, 1884, Washington, D. C.

This is quite a creditable collection of lichens, especially when we consider that Dr. Bean was busy about everything else. Dr. Rothrock says that the accuracy of specific names is due to Mr. Henry Willey, whose name is a very familiar one to students of this group. The list contains 110 species, one being a new *Biatora* from E. Siberia.

Catalogue of Canadian Plants. Part II. Gamopetalæ. By John Macoun. Montreal: Dawson Bros., 1884. 100 pp.

This, like its fellow, is an exceedingly handsome pamphlet. The catalogue is a very complete one, and it would be hard to say what it needed to make it more so. Range, stations, habitat, collectors, and important synonymy are well given, and one turns over these handsomely printed pages with the feeling that our Canadian friends are working together in a good cause, with a hearty good will, and a liberal backing in the Geological and Natural History Survey of Canada. The Gamopetalæ embrace 255 genera and 908 species. This remarkably resembles the display of the Polypetalæ, which numbered 243 genera and 907 species. Naturally we turn to our great family of Compositæ and find it includes 81 genera with 374 species, and in this family the great genus *Aster* numbers 54 species, with the acknowledgment, at the close, that Aster is in "great confusion." When will it not be? *Erigeron* numbers 25 species, which can not really be separated from *Aster*, thus making the group contain about 80 species, with several other outlying genera. The other genera then fall pretty much into the same order that American botanists are familiar with. We note that *Collomia* is still retained as a genus, although all distinctions between it and *Gilia* have broken down. Another part will complete the exogens.

Catalogue of the Flora of Minnesota, including its Phænogamous and Vascular Cryptogamous Plants. By Warren Upham. Minneapolis, 1884. 8vo. 193 pp.

This is in many respects a model local flora. It has received the utmost care in preparation, and contains all that is known regarding the occurrence and distribution of the plants of the State, enumerating 1,650 species and varieties. Its compilation has been in progress several years during the more active labors of the author on the geology of the State, it being in fact a portion of the work of the Natural History Survey of the State, and forming a part of the annual report of progress for 1883. If we, therefore, consider it to be chiefly a report of progress as it professes to be, a systematic account of the observations of others supplemented by the very full observations of the author, we can not conceive of a more admirable preparation for the final work of the survey in which the plants of the State will be catalogued with an adequate herbarium as a substantial basis to put its genuineness beyond all question, and such a catalogue we are assured is in contemplation, to include also the lower cryptogams.

A number of features of this list are worthy of special mention. The excellent account of the sources of information shows that twenty-one lists of plants, partially or wholly belonging to Minnesota, have been published at various time, beginning in 1822, and that some forty collectors lent their assistance in addition. The conditions determining the character of the flora, the range of species, introduced plants, review of the catalogue and comparison with the flora of other States and Europe, are topics treated with much interest, but our space will only permit their mention. An excellent map shows the extent of forests, and the limits of a number of trees and shrubs. Species not in Gray's Manual are described at the foot of the page where they occur. A caution should be noted for those who copy descriptions from Gray's Synoptical Flora, pointed out by Mr. Sereno Watson. The specific descriptions of the large genera are partly distributed to the sub-characters, so that if only the characters following the specific name be taken they will not always be sufficient to distinguish the species, particularly in Aster and Solidago.

The excellent typography, ample citation of localities, frequent interesting notes, latest nomenclature, and an ample index lend value to the catalogue.

Comparative Anatomy of the Phanerogams and Ferns. By Dr. A. De Bary. Translated and annotated by F. O. Bower and D. H. Scott. Clarendon Press: Oxford, 1884. 659 pp.

Botanists will hail with delight this English translation of De Bary's Vergleichende Anatomie, just issued from the Clarendon Press. The original has long been in demand in our laboratories, but this translation will put many workers upon an easier footing. Its 660 pages contain an enormous mass of facts with reference to vegetable histology, and a complete index brings all of it within easy reach of the student. The book is divided into two parts, viz., Forms of Tissue and their Arrangement. The forms of tissue are given as *cellular tissue* (epidermis, cork and parenchyma), *sclerenchyma, secretory reservoirs, tracheæ, sieve tubes,* and *laticiferous tubes.* It is an indispensable book to every student of vegetable histology and should find large sale in this country.

FARLOW ON SYNCHYTRIA.

BOTANICAL GAZETTE.

VOL. X. MARCH, 1885. No. 3.

The Synchytria of the United States.

BY W. G. FARLOW.

The genus *Synchytrium* includes a number of species which are parasitic in the epidermal cells of land plants, and produce deformities not unlike the galls caused by the attacks of some insects. In a previous paper[1] I gave an account of the species known in this country, and since then I have received additional material from different parts of the United States. As it is necessary, in order to obtain a satisfactory knowledge of the species, to study their development as well as their morphological characters, I have, in the present paper, given an account of the species which are known to me in the United States, hoping that, to the information which I have obtained principally from dried specimens, others who live in the regions where the species abound may, hereafter, add observations on the development of the imperfectly known forms.

Our first exact knowledge of the genus *Synchytrium* dates from the classic paper of de Bary and Woronin on the Development of the *Chytridiaceæ*[2], and since then Woronin[3] and Schroeter[4] have published important papers on the subject.

Before describing our species in detail, I shall give a short account of the development and structure of *Synchytria*, but it is impossible, in this connection, to refer to the systematic position of the genus further than to say that it belongs to the *Chytridiaceæ*, an order including a number of genera, most of which are colorless parasites in aquatic plants, and differ from *Synchytrium* in generally having a rudimentary mycelium or rhizoidal

[1]Bulletin of the Bussey Institution, ii. p. 229.
[2]Bericht Naturforsch. Gesell. Freiburg, 1863.
[3]Bot. Zeitung, xxvi.
[4]Beitr. zur Biologie, ii, part 1.

apparatus connected with the reproductive cells, while in *Synchytrium* there is no trace of mycelium. For an account of the relations of this group of parasites to other fungi the reader should consult de Bary's[1] recent work.

The parasite while in its zoosporic stage makes its way into an epidermal cell, which then increases rapidly in size. In the simplest cases, as *S. papillatum* and *S. Myosotidis*, the cells grow out beyond the surface of the leaves in the form of more or less spherical sacks, which look to the naked eye like small glands. In other cases the epidermal cells do not rise above the surface, but protrude inwards into the leaf. More frequently, however, the epidermal cells swell and push outwards, and at the same time the neighboring cells increase in number, so that a protuberance or gall is formed on the leaves. The shape and general appearance of the galls vary with the different species, and are, as a rule, characteristic. When the galls are abundant the leaves or stems on which they are borne are frequently curled or knotted. There is usually a discoloration, which is not unfrequently striking. This is sometimes due to the presence of a colored fluid in the cells which are attacked by the parasite, and which may be called *host-cells;* but, more frequently, it is in the adjoining cells.

Once inside its host-cell the parasite increases in size and develops into a spherical or elliptical cell, which as it matures becomes either a resting spore or a sorus In the simplest cases, as *S. Anemones*, the cell wall thickens, and is composed of two coats, an epispore and an endospore, the former being dark, thick and brittle, and the latter thin and lighter colored. Generally only one resting spore is found in a single host-cell, but it sometimes happens that the cells are attacked by more than one parasite, and then we may have several resting spores in a cell. In extreme cases, as *S. pluriannulatum*, there are as many as 25, or even more, resting spores in a cell. The resting spores are produced principally towards the end of the season, and are set free by the rotting away of the leaves in which they are contained. In species like *S. papillatum*, where the host-cells form bladders on the surface of the leaves, the cells are brittle and readily break off, and in this way the resting spores escape.

The spores germinate in one of two ways. In the first the epispore cracks open and the endospore and its contents exude

[1] Vergleichende Morphologie und Biologie der Pilze, Mycetozoen and Bacterien.

and form a sphere, which is attached at one point to the remains of the epispore. The contents of the sphere then divide so as to form a number of closely packed cells, the *zoosporangia.* The whole mass of zoosporangia constitutes a *sorus.* The zoosporangia soon separate from one another, and, when free, they are at first irregularly polyedral, but become afterwards more or less spherical. The contents of each zoosporangium then separate into a large number of zoospores, which escape by a rupture of the wall of the zoosporangium The individual zoospores have, in general, a circular form with a bright orange spot in the interior and a single cilium, or, in exceptional cases, two cilia. The zoospores, after swimming about for an indefinite period, attach themselves to the epidermal cells of some host plant and again develop into resting spores. In the second mode of germination the endospore and its contents do not protrude in the form of a bladder, but are transformed into zoosporangia while within the epispore.

A considerable number of the species of *Synchytrium* develop in the manner described above; that is, briefly, from the zoospores arising from the germination of the resting spores in spring, new resting spores are produced in the host cells. The species which develop in this way are placed by de Bary in the subgenus *Pycnochytrium.* In the subgenus *Eusynchytrium* the development is more complicated. The resting spores germinate as before, but after the zoospores have made their way into a host-cell they do not at once form new resting spores, but develop into what have been called summer sori, and in the specific descriptions which follow this is what is referred to under the term sorus, and not the sori formed directly in the germination of the resting spores. In *Eusynchytrium* the zoospores make their way into the epidermal cells and grow into large cells which generally almost completely fill the host-cells. These large cells are sori, and the contents form at once zoosporangia, whose appearance and subsequent development are the same as in *Pycnochytrium.* This formation of summer sori may be repeated several times during the season, but ultimately the zoospores produce resting spores at the end of the season. In a few of the species of *Eusynchytrium*, the summer sorus does not fill the host cell, but, when mature, the wall of the sorus ruptures within the host-cell and the mass of zoosporangia is set free in the host-cell, the wall of the sorus remaining behind as a shrivelled membrane.

Those who wish to study the formation of the sori and zoospores will find excellent material in the species which forms bright yellow spots looking like a uredo on *Amphicarpæa monoica.* The leaves may be gathered and placed in a moist place, or dipped into water on glass slides or in watch-glasses. In a few hours the water will be colored orange from the abundance of escaped zoosporangia and zoospores. All the stages of development may easily be seen, and healthy leaves may be infected by leaving them a short time in the water and then removing them and keeping them in a moist place for a few days. One who wishes to experiment on the motions of chlorophyl-free zoospores can obtain an abundance of zoospores by placing a few infected leaves of *Amphicarpæa* in glasses of water.

From an economical point of view the *Synchytria* are not of great importance. None of our species attack important agricultural or ornamental plants. These parasites do not spread with great rapidity, and as they do not grow through the hosts which they inhabit but only attack them in superficial spots, they are not very destructive. Unlike many other fungi which attack living plants, the *Synchytria* are supposed not to be limited to one species of host, or to species nearly related botanically, but the same *Synchytrium* may inhabit plants belonging to different orders. The species of *Synchytrium* are distinguished by the presence or absence of summer sori, the nature of the galls or deformities produced, and the shape and size of the resting spores, and it may be asked how far these points might be modified by the host plant in case of species which are said to inhabit several different hosts. A study of the development and cultures are necessary in order to settle the limits of the species accurately.

The following account includes all the species known to me in the United States. The synonyms are given with references to American works where the species are mentioned, and also the original European references. Of the species not yet known in this country we might expect to find *S. Taraxaci*, D.By. and Wor., *S. Stellariæ*, Fuckel, and *S. globosum*, Schrt. on *Viola*.

SYNCHYTRIUM D.By. & Wor.

Unicellular fungi inhabiting the epidermal cells of living plants, entirely destitute of mycelium. Reproduction by resting spores and sori containing zoosporangia from which are produced zoospores having one, or rarely two, cilia. Conjugation wanting.

A. EUSYNCHYTRIUM. Resting spores and summer sori both present[1].

[1] In *S. decipiens*, here placed on account of its apparently close relation to *S. Taraxaci* and *S. fulgens*, no resting spores have yet been found.

1. S. PAPILLATUM Farlow.

Bull. Bussey Inst. ii, p. 233.
Catalogue Pacific Fungi, p. 25.
Ellis N. Am. Fungi no. 202.

Spots dark purple, galls glandular, formed of papillate, pyriformly swollen epidermal cells, resting spores elliptical, .06–.07 mm. by .04–.05mm., epispore brown, somewhat roughened. Sori superficial, spherical, .10–.12mm. in diameter.

On leaves of *Erodium cicutarium*, L'Her.

California.

The distortions produced by this species are confined to the epidermal cells, which swell into large pyriform sacks, whose surface is raised in large, conical, scattered papillæ. To the naked eye the swollen cells look like purple glands, which are often so abundant as to nearly cover the surface of the leaves, and remind one of the so-called species of *Erineum*. Each cell contains from one to three resting spores which are small in comparison with the host-cell, while the contrary is true in *S. Myosotidis*, in which the galls are somewhat similar to those of the present species. The sori in the specimens examined were much less abundant than the resting spores, and were formed in epidermal cells which became more or less spherical and projected above the surface of the leaf. The species is known only in California, although *Erodium cicutarium* is a common European weed, and occurs somewhat rarely as an introduced plant in our Atlantic States. If the *Synchytrium* is really, as it seems to be, an endemic species in California, one would expect to find it on some other host than the *Erodium*, which is an introduced plant. The species is easily recognized, and may very likely be found hereafter on other hosts.

2. S. HOLWAYI Farlow.

Spots purple, galls hemispherical or subglobose, resting spores spherical, .07–.09mm. in diameter, epispore smooth, dark brown. Sori spherical, .09–.10mm. in diameter, maturing in the host cell.

On leaves of *Monarda*.

Decorah, Iowa.

This is another of the interesting forms found by Mr. Holway, who states that the parasite is common near Decorah. The affected leaves assume a dingy purple color, and the galls are abundant, especially on the bases of the leaves and petioles. Sections show that the galls are formed of large host-cells surrounded by the leaf-cells, the whole forming a hemispherical, or frequently almost a spherical, protuberance on the surface of the leaves. Some of the host-cells contain resting spores which are generally solitary. Other host-cells contain the sori, which are yellow colored spheres resting on the bottom of the host-cells. The wall of the sorus ruptures before it has escaped from the host-cell and the zoosporangia remain in a mass at the base of the host-cell, while the shrivelled wall of the sorus remains at the apex of the cell, as in *S. Stellariæ* Fuckel figured by Schroeter.

As far as the galls and resting spores are concerned the present species might be considered a form of *S. aureum*, which is said by Schroeter to occur on *Prunella vulgaris* in Europe; but in *S. aureum* sori have never been found, so far as I know, while in our form they are common, and, as has already been said, like those of *S. Stellariæ*, a species abundantly different from ours in the resting spores and deformities produced. *S. Holwayi* may then be considered distinct, at least until it shall hereafter be discovered that *S. aureum* has similar sori.

3. S. FULGENS Schroeter.

Hedwigia, xii, p. 141 and Fung. Eur. no. 1656.
Catalogue Pacific Fungi, p. 25.

Spots minute, purple, resting spores spherical, .066–.082mm. in diameter, epispore dark brown, smooth. Sori spherical or elliptical, .06–.10mm. in diameter, bright yellow.

On *Œnothera biennis*, L.

California. Europe.

This species is reported by Harkness and Moore in California in their Catalogue l. c. It is to be expected in the Eastern States, but I have never been able to detect it near Cambridge. It is also said to occur in Illinois. The description given above is taken from Schroeter.

4. S. INNOMINATUM.

Spots dark red, resting spores globose or slightly elliptical, .07–.10mm. in diameter, epispore thin and smooth, in oval host-cells which do not project beyond the surface of the leaves. Sori yellow, about .12–.15mm. in diameter, sunk in the leaves.

On leaves of *Malacothrix*.

Santa Cruz, Cal.

The present form was found by Dr. C. L. Anderson on leaves of *Malacothrix*. When the parasite is not very abundant the leaves are turned dark red, but not distorted. When it is abundant, however, the leaves are reduced in size and become irregularly knotted and twisted. The affected cells swell to a considerable size, but are always sunk in the leaves and do not rise above the surface, so as to form galls properly speaking. The resting spores are found one or two in a cell. The sori, unlike those of *S. Holwayi*, completely fill the host-cell when mature. The species is certainly closely related to *S. Taraxaci*, D. By. & Wor., and it may be the *S. sanguineum* Schroeter, said in Bericht. Schlesisch. Gesell. 1875, to be nearly related to *S. Taraxaci*, but of which I have seen no description. I have thought best to avoid giving a name to our form until it shall be proved, on further examination, to be clearly distinct from the two species just mentioned.

5. S. DECIPIENS.

Uredo Leguminosarum and *U. Fabæ* in Herb. Curtis.
Uredo æcidioides Peck in 24th Report New York State Museum, p. 88.
Uredo Peckii Thuemen, Mycologia Universalis no. 538; Peck 29th Rept. p. 75.
Synchytrium fulgens var. *decipiens* Farlow, Bull. Bussey Inst. ii, p. 229; Ellis N. Am. Fungi no. 201; Trans. Wisconsin Acad. i, p. 4.

Spots bright yellow, galls hemispherical, sori spherical, .18–.20 mm. in diameter, zoosporangia about .015mm. in diameter, generally very numerous. Resting spores unknown.

On leaves and stems of *Amphicarpæa monoica*, Nutt.

Massachusetts to Minnesota and southward to Maryland.

The most common and striking species in the Northern States, but the southern limit is not sufficiently known. In Bull. Bussey Inst. l. c. I gave a detailed account of the development of the sori and their germination, but common as the species is I have never found resting spores. The species abounds near Cambridge from the middle of May until the middle of October. The young plants, as soon as they can be recognized in the spring, are often covered with the bright yellow sori, which are frequently mistaken for a uredo. After the sporangia have been discharged the spots resemble æcidia. I can find no difference later in the season, and when vegetation is killed by the frost in October the sori are as abundant as ever, but no trace of resting spores has been found. Surely, if our plant bears resting spores which resemble those of *S. fulgens*, there ought to be no difficulty in detecting them. As it is, it seems to me best to consider our form as distinct from *S. fulgens*, of which I formerly considered it a variety, relying on the resemblance of the sori which, in both cases, are bright yellow, and project rather prominently at first, but afterwards assume an æcidium-like form.

B. Pycnochytrium. Resting spores present, but summer sori wanting.

6. S. Anemones Wor.

Bot Zeit. xxvi, Pl. 3, f. 31–36.
Bull. Bussey Inst. ii, 224, 229.
Trans. Wisconsin Acad. vi, 4.
Ellis N. Am. Fung. no. 203.

Spots minute, dark violet, galls hemispherical, resting spores solitary, or sometimes two in a cell, spherical or slightly elliptical, about .08–.12mm. in length, epispore dark brown, somewhat rough.

On leaves and petioles of *Anemone nemorosa*, L.

Massachusetts to Wisconsin. Europe.

Probably common wherever the *Anemone* is found. Usually in company with other fungi, but easily recognized by the minute dark-violet spots which are generally scattered, but sometimes densely crowded, especially on the lower parts of the leaves and petioles.

7. S. anomalum Schroeter.

Beit. zur Biologie i, part 1, 40, Pl. 1, f. 5–7.

Spots minute, pale yellow becoming darker, galls flattened hemispherical, resting spores elliptical, about .12–.20mm. by .09–.12mm., epispore dark brown, smooth.

On leaves and petioles of *Adoxa Moschatellina*, L.

Decorah, Iowa. Europe.

The only American specimens which I have received were collected by Mr. E. W. Holway. The fungus is, I think, without doubt the same as that described by Schroeter. Mr. Holway's specimens, however, showed great uniformity in the size and shape of the spores, which were distinctly elliptical, whereas Schroeter describes them as very variable. The galls differ from those of the last named species in that the host-cell enlarges so as to occupy a great part of the thickness of the leaf, but does not project much above the surface and is there only loosely covered by the neighboring cells. Occasionally the parasite develops in a subepidermal cell, in which case there is but little swelling of the leaf.

8. S. AUREUM Schroeter.

Beit. zur Biol. i, part 1, p. 40, Pl. 3, f. 8-12.

Spots golden yellow often bordered with red, galls hemispherical, resting spores spherical, about .10–.20mm., epispore brown, smooth.

On leaves and stalks of *Lysimachia quadrifolia*, L.

Granville, Mass. Europe.

In Europe this species grows upon *L. nummularia*, but I have searched in vain for it upon that host near Cambridge. The specimens from Granville were collected by Mr. A. B. Seymour. The galls are thickly scattered over the leaves, but are of small size. The host-cell is usually spherical and the surrounding cells form rather a thick layer, except at the top of the gall, where there is a depression, at the base of which the host-cell is exposed. The resting spores are large for the genus, as shown by our own as well as European specimens.

9. S. MYOSOTIDIS, Kuehn. var. POTENTILLÆ, Schroeter.

Beit. zur Biol. i, part 1, p. 48.
Bull. Bussey Inst. ii, p. 224, 229.

Spots glandular, deep red, often densely aggregated, galls formed of swollen, externally projecting epidermal cells, resting spores globose, .07–.12mm. in diameter, epispore dark brown.

On leaves and petioles of *Potentilla Canadensis*, L.

Jamaica Plain, Mass. Europe.

An easily recognized but not very common species, which closely resembles the epidermal deformities placed in the old genus *Erineum*. The typical form is found on *Borraginaceæ* in Europe, but our form is precisely that which grows on *P. argentea*, in Europe. To the naked eye the leaves attacked seem to be spotted with shining deep red glands, which are sometimes so abundant as nearly to cover the surface. When young the glands seem to have a white spot in the center, and when old they collapse and become cup-shaped. The glands are nothing but the epidermal cells attacked by the parasite, which causes them to swell into oval or obovate sacks, whose contents become deep red. This species has, I believe, never been known to produce sori. Our nearest related species is *S. papillatum*, in which the deformity is also confined to the epidermal cells, which swell to a greater size than in the present species and are constantly papillate. *S. papillatum*, however, produces sori of zoösporangia, and belongs to the subgenus *Eusynchytrium*.

What seems to me to be the typical form of the species has recently been found on *Pectocarya linearis*, DC., in Sonora, Mexico, by Mr. C. G. Pringle. The swollen epidermal cells are very numerous, and completely cover the petioles and young stems. When the parasite is immature the cells are yellow, but as the resting spores mature the cells assume the usual deep red color.

10. S. PLURIANNULATUM.

Uredo pluriannulata in Herb. Curtis.
Uromyces pluriannulatus B. & C., Grevillea iii, p. 57.

Spots yellowish brown, galls generally pulvinate or discoidal, composed of several host-cells united into one mass, resting spores numerous (10–50) in a cell, globose or slightly elliptical, .04–.06 mm. in diameter, epispore brown, thick, slightly roughened.

On *Sanicula Marylandica* and *S. Menziesii*, Hook & Arn.

Alabama to Illinois. California.

A very striking species, the development of which should be studied by western botanists. The parasite is abundant on the leaves, petioles and stems. On the leaves it appears in the form of more or less circular, disk-like spots. On the stems the spots are elliptical or lenticular. The disks vary very much in size. The smallest are scarcely raised above the surface of the leaves, and are yellow in color and the surface appears granulated. The larger disks, which are sometimes .40mm. in diameter, have a silvery brown color, and the surface is also granulated. The granulated appearance is owing to the fact that the parasite attacks simultaneously a number of cells lying near one another, which then swell into spherical or elliptical sacks. In the meanwhile the surrounding cells of the leaf which have not been attacked by the parasite multiply rapidly, and the result is a solid disk-like mass in which lie the host-cells, which, seen from above, look like granules. This compound nature of the gall, if we may so term it, is seldom seen in any of our species, but is common in one or two European forms. It is only the very smallest spots that consist of a single host-cell, which is then usually spherical and covered by a thin layer of leaf cells, and I have seen cases where it protruded on both sides of the leaf. The most curious form of the galls is one sometimes found on the petioles and young stems. Here the superficial tissues, as far as one can tell from dried specimens only, grow out at right angles to the stem, so as to form a sort of pedicel, sometimes an eighth of an inch long, and bear at the tip a dark brown head, which contains the host-cells and resting spores. On the larger stems the parasite looks to the naked eye like the sori of a *Puccinia*, owing to the lenticular shape of the spots, which are often surrounded by a fold of the epidermis.

The resting spores are more numerous in a cell than in any other species. I have frequently counted as many as 25, and in some cases the number is undoubtedly greater. The spores are pretty uniform in size, and are spherical or flattened on one side. The epispore is brown, about .004mm. thick, and very brittle, so that it is easily split and separated from the endospore, which has a thin wall, about .0015mm. thick, and yellow oily contents. When the spores are young the epispores closely envelop the endospores, but when mature it is generally the case that the endospore and its contents lie loose in the epispore, thus reminding one of the oospores of *Peronosporeæ.* I have never found sori in this species.

This parasite was first found by Mr. T. M. Peters on *Sanicula* in Alabama, in 1853, and sent to Curtis, who called it *Uredo pluriannulata.* It was first described in Grevillea, iii, p. 57, December, 1874, as *Uromyces pluriannulatus* B. & C. The original specimen of Peters which I have examined has exactly the structure of specimens received from Illinois, collected by Mr. C. A. Hart. I have also, through the kindness of Dr. W. H. Harkness, examined specimens marked *Puccinia Saniculæ*, collected at San Rafael, California, which I can not distinguish from the present species. In all cases the structure is different from that of the *Uredineæ*, and seems to me to be that of *Synchytrium.* The peculiarity of the ripe resting spores, however, shows that the development must be studied before the exact position of the fungus can be decided. In this connection it should be said that there is a *Synchytrium* on *Umbelliferæ, S. Bonærense* Spegazzini, which occurs on *Hydrocotyle bonariensis* in South America, which is known to me only from the description, from which I judge that it is distinct from the present species.

Besides the forms mentioned above, a *Synchytrium* occurs on *Draba Lyallii*, S. Watson. in the Sierra Nevada, but my material is too scanty to warrant a specific description. In my small specimen the leaf is much swollen and irregularly distorted, and a section shows large elliptical resting spores, .13–.18mm. by .08–.10mm., in elliptical host-cells which are closely aggregated and project slightly at the surface of the leaves. It may be that this is only a form of *S. aureum*, known to occur on *Cardamine pratensis*, L., but all the resting spores which I have seen were elliptical, and not globose. With regard to the *Synchytrium* which occurs near Cambridge on *Marrubium vulgare*, on the leaves of which it produces purple spots, I have nothing to add to the account given in my paper in the Bussey Bulletin. Spherical bodies about .06–.075mm. in diameter, which are apparently the resting spores of a *Synchytrium*, are contained in epidermal cells which enlarge in the tissue of the leaf but do not protrude beyond the surface, in this respect resembling the form described on *Malcothrix* It would be rash to give a name to a parasite of which so little is known.

In the BOTANICAL GAZETTE, ii. p. 240, a *Synchytrium Jonesii* Peck was described, which grew on *Zauschneria Californica* and *Vicia Americana.* Through the kindness of Mr. Peck I have been able to examine authentic specimens of the parasite on *Vicia* and *Zauschneria.* Sections in both cases show that spores arise from the clavate tips of hyphæ which extend into the leaf, and therefore the species must be excluded from the genus *Synchytrium.* It seems to me that the fungus is nearly related to *Tubercularia persiana* Ditm., and on the leaves of *Vicia* it is in company with an *Æcidium*, as is stated in the original description.

EXPLANATION OF PLATE IV.—Figs. 1–3. *Synchytrium papillatum*, showing (2) a sorus with zoosporangia, and two epidermal galls (1 and 3), one of which is cut open so as to show two resting spores. 500 diam.

4–6. *S. decipiens*, showing section of a gall with a small sorus (4). 400 diam.; 5, a zoosporangium in which zoospores are forming; 6, free zoospores. 600 diam.

7–8. *S. mercurialis* Fuckel. 7, a resting spore with a sorus containing zoosporangia (8) formed by the protruding epispore and its contents. After Woronin.

9. *S. pluriannulatum.* Section through a compound gall showing three host-cells with numerous resting spores. 350 diam.

10. *S. Myosotidis* var. *Potentillæ.* Section through epidermal gall showing a resting spore. 500 diam.

11–12. *S. Holwayi.* Section through two galls showing a resting spore (11) and sorus (12) in which the wall has ruptured and fallen off in the host-cell.

EDITORIAL NOTES

DR. KARL SPEGAZZINI has been appointed professor and director of the botanic garden of Buenos Ayres.

MR. C. G. PRINGLE has left for a season of collecting along the line of the Mexican Central R. R., especially in W. Chihuahua.

DR. JUST has resigned the editorship of the *Botanischer Jahresbericht* at the close of vol. x, and it will be continued by Drs. Koehne of Berlin, and Geyler of Frankfort, conjointly.

PASTEUR, in recent experiments, found that beans and peas did not germinate in soil freed from all bacteria, but what relation the bacteria hold to germination is not known.

THE PAPER on the mite gall of the black walnut, by Miss Lillie J. Martin, which was read before the Amer. Association at Philadelphia, is published in the *Amer. Naturalist* for February, illustrated with three plates. We gave a notice of the paper at p. 155 of the preceding volume.

THE GROUNDS of Buchner's belief that the virulent *Bacillus Anthracis* is only a form of the harmless hay bacteria, *Bacillus subtilis*, has been carefully reviewed by Pragmowski, who finds that they are absolutely distinct species. There is doubtless more autonomy among the bacteria than many observers are inclined to admit.

EVEN THE BACTERIA themselves are subject to disease! Inflated forms, called "involution forms" by Nägeli and Buchner, are to be met with in cultures, which De Bary regards as resulting from a disease or degenerate condition, due to insufficient nourishment, and it may be to other causes not well understood.

THE DISEASES of the potato have been well described and illustrated by Mr. C. B. Plowright in recent numbers of the *Gardeners' Chronicle*. The principal ones are the epidemic or common rot (*Phytophthora infestans*), wet rot (*Bacillus amylobacter*), dry rot, scab, and mottled tubers. The cause of the last three diseases is not known.

WE HAVE examined the preparations of transverse sections of coniferous leaves put up by Rev. J. D. King, mentioned in our last issue, and find them admirably done, and thoroughly satisfactory for critical study even under high powers. They are mounted in glycerine jelly, balsam not being suitable for such tissues, and the several sections are arranged and keep their places, which, so far as we know, has never before been successfully accomplished in this medium.

IN THE *West-American Scientist*, for February, Dr. C. C. Parry edits Engelmann's new Euphorbiaceous genus *Tetracoccus*, of which the lamented author left incomplete manuscript notes. Dr. Parry calls the species, a Lower Californian one, *T. dioicus*. But he has worked at cross purposes with Mr. Sereno Watson, who, in Proc. Am. Acad. xx. 372, issued February 21, edits the same genus and names the species *T. Engelmanni*. It becomes a nice question whether Dr. Parry's or Mr. Watson's name should stand.

THE ESTATE of Mr. George Bentham, according to the *Illustrated London News*, amounted to $115,000, of which he bequeathed $5,000 each to the Linnean Society of London and the Royal Society's Scientific Relief Fund. The part of the estate remaining after settling the personal bequests is to be applied "in preparing and publishing botanical works, or in the purchase of books or specimens for the botanical establishment at Kew, or in such other manner as his trustees may consider best for the promotion of botanical science."

DR. JULES SCHAARSCHMIDT gives in a recent number of *Nature* a summary of his own and others' investigations into the continuity of protoplasm in plants. He states that it extends from cell to cell through most kinds of tissue, that it often occupies the intercellular spaces where it may secrete a cell wall about itself and form a true cell, and that it even extends as a thin plate of protoplasm between the layers of the cell-wall (e. g. in leaves of mistletoe). This last statement is so remarkable that it needs full confirmation before it is entitled to acceptance.

THE REMARKS of Professor C. E. Bessey, in his report as dean of the Industrial College of the University of Nebraska, show a broad appreciation of the need of careful experiments and observations in the sciences underlying agriculture, and of the direction these should take. In the same report the following are mentioned among the illustrative collections that such a college requires: a botanic garden, forage garden, grain garden, collections of dried grasses, dried grain-producing plants, samples of grains, seeds, fruits and vegetables (natural, and in wax casts), of woods and of injurious fungi.

PROFESSOR C. E. BESSEY, in a recent bulletin of the Iowa Agricultural College, speaking of the confusion in popular names for the diseases of plants, says: "It would be well if the teachers in botany and agriculture in our agricultural colleges, and the editors of our agricultural papers could come to some agreement in the use of popular names, for, until this is done, there will always be a great deal of confusion in the reports and communications which have to deal with diseases having these ambiguous names." There can be no doubt of the great need of a standard nomenclature in this respect, and some means should be devised for securing it.

THE NEW *Journal of Mycology* has been received for January and February. We confess to some feeling of disappointment in finding so much space occupied with matter that is not new, and which, in its original form, is quite accessible to most workers. The original purpose of its publication (see vol. ix., p. 180) would have more nearly met our idea of the needs of American mycology; still age and experience may remedy the present defects. The January number contains descriptions of new fungi from Iowa and Kansas. The February number has an article by Professor Trelease on Heterœcismal Uredineæ, and the beginning of an enumeration of the North American *Cercosporæ* by Messrs. Ellis and Everhart.

THE SOCIÉTÉ MYCOLOGIQUE has been founded for the encouragement and extension of a knowledge of esculent fungi, particularly as to their Natural History, hygienic relations and economic uses. It is eminently fitting that such a movement should be instituted by Frenchmen, than whom none have so great a reputation for appreciation of good *cuisine*. The society is not, however, intended to be local, but desires representatives in all countries. The annual dues are 10 fr. ($2.00) for full members, and 5 fr. ($1.00) for corresponding members; the latter receive the reports of the sessions, and the former all publications of the society. Address the secretary, Dr. A. Mougeot, Bruyères, Vosges, France, or the editors of this journal, who will gladly give any further information.

IN A PAPER communicated to the American Academy of Arts and Sciences, Dr. W. G. Farlow gives the results obtained in sowing the spores of several species of *Gymnosporangium* on various *Pomaceæ*. They were not quite satisfactory, but far more so than those detailed in a former paper on *Gymnosporangia* (1880), being due to better methods. The matter of cultures with *Uredineæ* is a very simple one, but requires considerable experience to insure success. His conclusions are that the æcidium of *G. biseptatum* is probably *Ræstelia botryapites*, and that of *G. globosum* is possibly *R. aurantiaca*, while that of our most common cedar-apple, *G. macropus*, remains quite undecided. In the same paper are notes on several interesting forms of *Chrysomyxa*, and the uredo of *C. Ledi* is distinguished from the very similar *Uredo ledicola* Peck.

CURRENT LITERATURE.

Gray's Botanical Text-Book, Vol. II., Physiological Botany; i., Outlines of the Histology of Phænogamous Plants. By George Lincoln Goodale. Ivison, Blakeman, Taylor & Co., New York and Chicago, 1885.

In 1879 the first volume of this work appeared, and even at that time the claims of histology and physiology were so pressing that a second volume was set apart for their consideration, only as applied to phanerogams. The first part of this volume is before us now, but in the meantime some other text-books have appeared to meet this demand. An English translation of Sachs had already appeared, in 1880 both Bessey's Botany and Vines' edition of Prantl's Botany were published, and now we have the magnificent work of De Bary issued from the Clarendon Press, all these supplemented by foreign books. Into this goodly array we are exceedingly glad to welcome Dr. Goodale, for whose work many of us have been anxiously waiting. The second part is promised in the course of the year, and it is to be sincerely hoped that six more years will not elapse before Dr. Farlow's volume appears.

A first glance through the volume is decidedly refreshing, for we had become so accustomed to Sachs' figures staring at us from almost every page, that the new figures are very attractive. They have been well selected, in many cases from memoirs so inaccessible that they have all the flavor of originality, and pains seems to have been taken to avoid any "stock" figures.

In figures and text many structures have been presented more satisfactorily than ever before in an English book, and the summing up of contesting views, with the copious references to the literature of various subjects, make this part almost encyclopedaic. The small space devoted to so great a subject will at first impress the special student unhappily, but conciseness has been the aim, and very much has been packed into these 170 pages, probably fully as much as would be proper when we consider the object of the text-book.

Dr. Goodale's classification of tissues is simple enough, which is certainly a thing to be much desired. It is surely a most perplexing thing to try to classify things which are not distinct and constantly intergrade. Whether Haberlandt's classification[1] upon a physiological basis, given by our author in his closing chapter, is going to stand, remains to be seen.

In the book before us four primary divisions are made, viz., parenchyma, prosenchyma, sieve-cells, and latex-cells. Of course the first two are taken in the most liberal sense, parenchyma including cells of the fundamental system under the three subdivisions of parenchyma cells proper (including collenchyma and sclerenchyma modification), epidermal cells, and cork-cells. Prosenchyma includes the cells of the fibro-vascular system, under the subdivision of prosenchyma proper (including wood fibres and tracheids), ducts, and bast-cells.

Whether botanists will consider prosenchyma as just the most suitable word in this connection is uncertain. It is certain that the classification has the merit of simplicity.

An introduction of 24 pages deals with histological appliances, treating in a very practical way such subjects as microscopes, dissecting instruments, media and reagents, staining fluids, etc. Chapter I presents the vegetable cell in general, its structure, composition, and principal contents. Chapter II is entitled Cells in their modifications and kinds, and the tissues they compose. Chapter III treats of the minute structure and development of root, stem, and leaf. Chapter IV contains the minute structure and development of the flower, fruit, and seed. Chapter V (the last) deals with the physiological classification of tissues, under the headings of division of labor in the plant, and me-

[1] Bot. Gazette, x. p. 229.

chanics of tissues, which furnishes an easy transition to Part II, to be devoted to physiology. Those of us who have known Dr. Goodale as a teacher are familiar with his rare power of "putting things", a feature which is well carried out in the volume before us, but apparently somewhat repressed by the mass of details and the necessity of following a pattern already set. We look for the second part with great interest, for the first is simply introductory, and in the department of physiology Dr. Goodale finds his strength, and the science of botany some of its most interesting and difficult problems.

Bulletin of the Iowa Agricultural College, issued by the Department of Botany. Charles E. Bessey, Professor. November, 1884.

The Iowa Agricultural College is doing a commendable work in publishing a series of bulletins from the different departments of the College, for the cultivation of popular interest in the sciences related to agriculture. The third of the series, edited by Professor Bessey, is just printed, and forms a fitting monument to his work in the State he has recently left.

Two phænogams (*Crotalaria sagittalis* and *Stipa spartea*) are described and figured as of economic interest; the former affecting horses much as certain other leguminous weeds ("loco") do in the farther west; while the fruit of the latter is said to burrow into the flesh of sheep and other animals, as that of other grasses has been shown in nature to do elsewhere. An interesting peculiarity of this and other self-planting fruits (*Erodium*, etc.), which the writer has several times observed, does not seem to have been noticed, viz., a joint at the insertion of the awn, which softens in the damp soil, so that the awn is easily broken off by any force which might tend to withdraw the fruit. *Tilletia tritici*, *Ustilago segetum*, *U. Zeæ-mays*, and *Claviceps purpurea*, are illustrated and described as examples of noxious cryptogams.

The second part of the bulletin is occupied with two lists of cryptogams; the first, by Prof. Bessey, covering the vicinity of Ames; the second, by Mr. Arthur, including the Uredineæ and Ustilagineæ of the State. The character of the local flora may be gathered from the following summary based on the first list: Myxomycetes 18, Saccharomycetes 3, Bacteria 16, Cyanophyceæ 16, Chlorophyllophyceæ 5, Zoosporeæ 8, Desmids 4, Diatoms 7 (genera), Zygnemaceæ 7, Mucorinæ 3, Oophyceæ 8, Saprolegnieæ 2, Chytridineæ 3, Entomophthoreæ 2, Peronosporeæ 16, Perisporiaceæ 17, Pyrenomycetes 13, other Ascomycetes 15, Lichenes 24, Uredineæ 51, Ustilagineæ 16, Gasteromycetes 17, Hymenomycetes 65, Liverworts 6, Mosses 33.

While the list shows a great deal of industry on the part of the collector, the absence of critical notes, and the use of only the popular names of the hosts of parasitic species, must somewhat lesson its usefulness. A curious feature of the flora of the State is the entire absence of Sphagnum mosses, so far as is now known.

A most valuable part of the bulletin, for collectors and students, is the preliminary list of Uredineæ and Ustilagineæ, which comprises 135 species of the former (of which a dozen æcidia might have been connected with teleutosporic forms), and 25 of the latter. It may be of interest to note that the same groups are represented, so far as is now known, by 100 and 21 species respectively in Wisconsin, and 46 and 6 in Kansas. The list of host-plants and localities adds much to the value of the list, and "every locality cited is represented by a specimen which may be the subject of further study at any time." Eight of the Uredineæ and two smuts are described as new, though it is doubtful if *Uromyces rudbeckiæ* A. & Holw. is really distinct from *U. solidaginis* Niessl., to which it has previously been referred.

Some fault might be found with the press work and the large number of errors which have escaped correction in the bulletin; but every one who has dealt with the public printer must feel disposed to pass them by with a good deal of sympathy for the author, however annoying they may be.—T.

Contributions to the Botany of North America, XII By Asa Gray. From Proc. Am. Acad. xx. 257–310. Issued January 26, 1885.

The most important contribution is that which gives a revision of certain genera of *Borraginaceæ*. The large genus *Eritrichium* has suddenly collapsed, and its species have been scattered among three others, two of which had for some time appeared among its sections, and to the third *Eritrichium* itself has now been subordinated as a section. It has all come from putting too much confidence in "the degree of obliquity of the nutlets, of their extension above the gynobase, and of the extent of their attachment to it." From a tangled maze of characters ill-understood and misunderstood Dr. Gray has eliminated these results:

Omphalodes, Tourn., has nutlets attached above the base or ventrally, and with depressed back surrounded by a wing or margin which is revolute at maturity. To this *Eritrichium* is made a subgenus, including but two species, *O. nana* with vars. (*E. nana*, Schrad.) and *O. Howardi* (*Cynoglossum Howardi*, Gr.)

Krynitzkia, Fisch. & Meyer, has nutlets attached by the inner side of the base, or from this upward to the apex, on separation leaving a clean naked scar; and the nutlets are naked and convex on the back. This includes the greater number of species formerly marshalled under *Eritrichium*, such as belonged to the old sections *Krynitzkia*, *Eueritrichium Myosotidea*, and *Antiphytum*. The number of necessary changes in nomenclature are too many to be enumerated here. It is sufficient to say that about all the old specific names have been retained, except that the most of *E. ciocarpum*, Watson, becomes *K. Torreyana*, and the rest of it is *K. leiocarpa*, F. & M., *K. affinis*, n. sp., *K. Watsoni*, n. sp., *K. Fendleri*, n. sp., which does very well for one species. To the genus are added eight new species, there being 46 in all.

Plagiobothrys, Fisch. & Meyer, has the nutlets attached by a small portion of the ventral face, by means of a sort of caruncle which comes off with the seed, leaving an excavation on the gynobase. This includes the species which appeared under *Eritrichium* § *Plagiobothrys*, and all of *Echidiocarya* except its original species, *E. Arizonica*. The typical species, *P. rufescens*, has at last turned up in North America, having been found in California. The genus numbers 14 species.

In the second part are given notes on some American species of *Utricularia*, suggested by an examination of the colored drawings made by Major John Le Conte to illustrate his memoir upon this genus. The drawings are now in the possession of Mr. I. C. Martindale.

In the third part are described six new genera, all from that prolific southwest of ours. Two of them, we are glad to see, commemorate our very good friends Dr. Rothrock and Mr. Pringle. The genera are *Veatchia* (Anacardiaceæ), from Lower California, discovered by Dr. J. A. Veatch; *Lyonothamnus* (Rosaceæ?), from Sta. Catalina Island, California, discovered by Wm. S. Lyon; *Pringleophytum* (Acanthaceæ), from Sonora, Mexico, discovered by C. G. Pringle; *Phaulothamnus* (Phytolaccaceæ), from Sonora, Mexico, discovered by C. G. Pringle, a very interesting addition to a small order; *Himantostemma* (Asclepiadaceæ), from Sonora, Mexico, discovered by C. G. Pringle; and *Rothrockia* (Asclepiadaceæ), from S. Arizona, collected by Lemmon and Pringle.

Part four is mostly devoted to the description of new Gamopetalæ, chief among which must be mentioned a new species of *Schweinitzia*, from Florida, discovered by Miss Mary C. Reynolds, and bearing her name. Such an addition to a genus which was thought to be monotypic, and very peculiar at that, is a notable discovery. The other (*S. odorata*) ranges from Maryland to North Carolina.

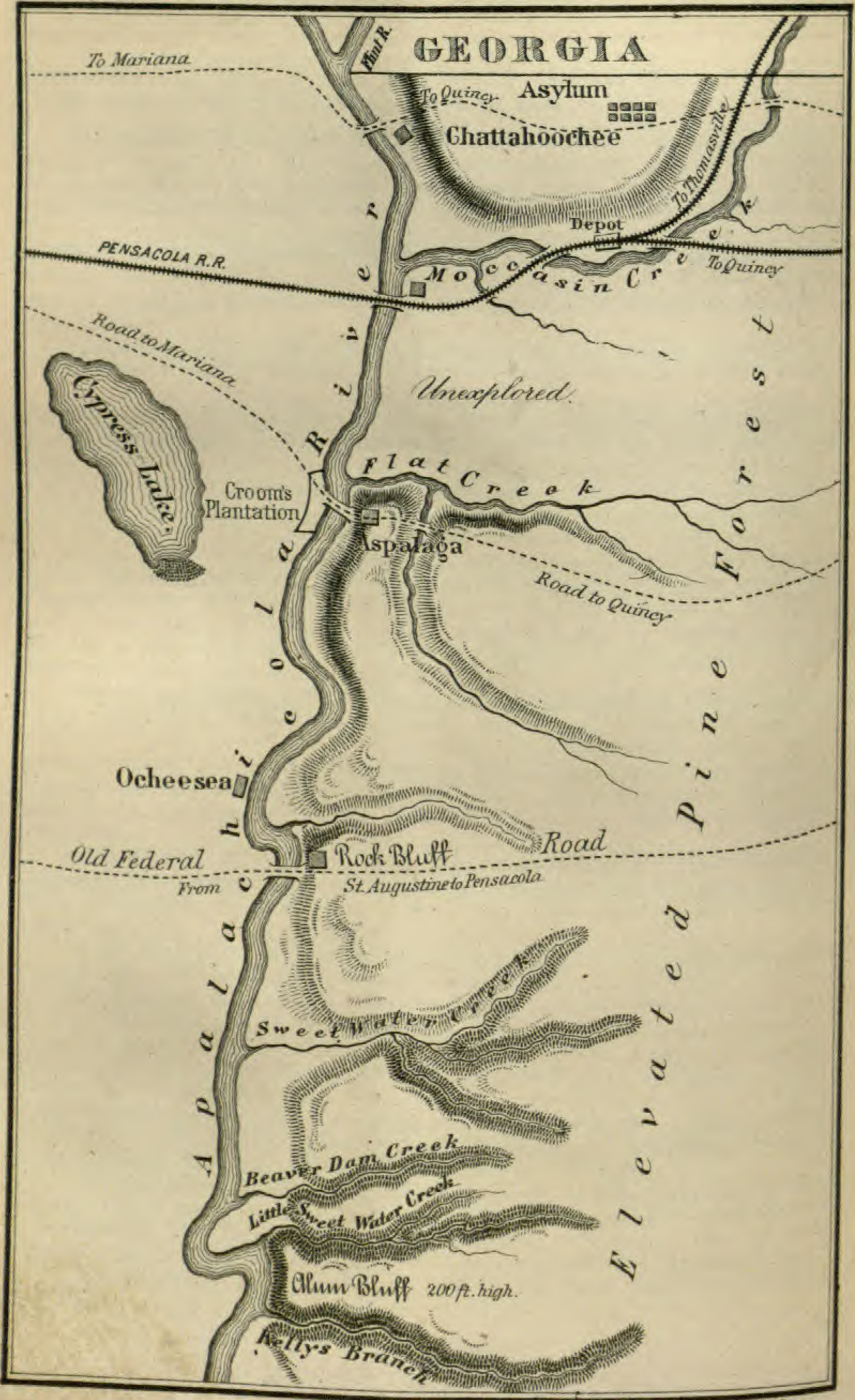


CHART of the Country occupied by the Torreya.

BOTANICAL GAZETTE.

VOL. X. APRIL, 1885. No. 4.

Torreya taxifolia, Arnott.

A REMINISCENCE.

BY A. W. CHAPMAN.

[Being the only survivor of the quaternary band engaged in the erection of the Torrey monument, I have thought that I might perform a service acceptable to the readers of the GAZETTE, by placing before them a record of the circumstances and events connected with it. The accompaning map will, I hope, serve to assist in forming a correct idea of its surroundings, and the appended list of plants, exhibiting a strange intermingling of low-country and mountain forms, will not be uninteresting to the botanist.]

Fifty years ago, on one of those calm, hazy October evenings, peculiar to the climate of Florida, the quiet of the pleasant town of Quincy was interrupted by the rapid approach of a carriage with attendant outriders, which, having made part of the circuit of the public square, drew up before my office, and a gentleman of middle age, spare habit, light hair, and blue eyes, came forth and introduced himself as Mr. Croom, of North Carolina.

This was the commencement of my brief intercourse with Hardy B. Croom, the discoverer of *Torreya;* for, as is well remembered, a year afterwards he was lost at sea, with all of his family, on the passage from New York to Charleston.

Of his personal traits it is needless here to say more than that he belonged to that class of wealthy and intelligent southern gentlemen, whose homes, renowned for their unostentatious hospitality, were the abode of all that is most charming in the refinements of domestic life; but which now, by impoverishment resulting from disastrous civil conflict, and consequent change of social customs and duties, and by the invasion of ruder manners and looser ethics, have entirely disappeared.

At that time I was a mere tyro in botany, groping among the "*andrias*" of Eaton's Manual, attracted thereto by the strange vegetation of a new and unexplored country that met my view on all sides, and had recently entered upon a friendly and instructive correspondence with Dr. Torrey, which was continued until his death.

And here I may remark, parenthetically, that judging from a list of plants, still preserved, that I had sent to him, one might fancy that the distinguishing characters of genera and species, notably of *Carex* and *Scleria*, were not then quite so clearly defined as they are now. Indeed, the student of to-day, with a royal road before him, and all inequalities removed, can not appreciate the difficulties encountered by a lone botanist in the wilds of Florida fifty years ago.

Mr. Croom was then on one of his annual journeys from New Berne, North Carolina, the residence of the family, to his plantation in the adjoining county of Leon; but previously to settling permanently in that county, he had rented a plantation on the west bank of the Apalachicola river opposite the calcareous cliffs at Aspalaga on the east bank, which at that time were covered by a dense grove of *Torreya*, and it was here, probably in 1833, that he first saw it.

Recognizing it as likely to be new, at least to our Flora, he sent a flowerless branch to Mr. Nuttall, who briefly noticed it in the *Journal of the Philadelphia Academy*, Vol. VII, p. 96, with the suggestion that it might be the *Taxus montana*, of Mexico.

At the time of our first meeting in 1835 it appears that he had made the acquaintance of Dr. Torrey in New York, and had supplied him with specimens in flower and fruit; and it was during the previous summer, and at the latter's request for additional information and material, that my connection with the tree commenced.

His first impressions were, I believe, that it might be a species of *Podocarpus*, but these, after a minute analysis of all its parts, he soon abandoned, and came to the conclusion that it constituted the type of a new genus among the Taxoid Conifers, a conclusion also entertained by his friend and correspondent, Dr. Arnott, of Edinburgh, to whom he had communicated specimens together with a report of his analyses, and the latter, after disposing of the *Torreya* of Sprengel, which was proved to be a species of *Clerodendron*, and ignoring sundry lesser Torreyas, transferred the name to the Florida tree, and published a full description and figure of it in *Annals of Natural History*, Vol. I, p. 126, under the name of *Torreya taxifolia*.

Since then, other species, from widely distant regions, have been added to the genus, which, like the Florida tree, appear to be confined to restricted localities. Ours occupies a narrow strip of land extending along the east bank of the Apalachicola river, from Chattahooche on the north, to Alum Bluff on the south, a distance of about twenty miles, and forming a continuous forest, but in detached and often widely separated clumps or groves, generally mingled with, or overshadowed by, magnolias, oaks and other native trees. There are, also, a few trees at the southern extremity of Cypress Lake, three miles west of the river. It is a wild, hilly region, abounding in rocky cliffs and deep sandy ravines ("spring-heads,") and unlike in scenery and vegetation any other part of the low country known to me. To these cliffs, and to the precipitous sides of these ravines, the tree appears to be exclusively confined; for it is never seen in the low ground along the river, nor on the elevated plateau east of it, nor, indeed, on level ground anywhere. Hence, although the suggestion may appear a startling one, were the trees of the whole region growing side by side in one body, I estimate that an area of a few hundred acres would suffice to contain all of them.

It is seldom more than forty feet high, and eighteen inches in diameter, and of a brighter green than is exhibited by most trees of the order. Its branches are in whorls, and spread horizontally, gradually diminishing in length upwards, in the manner of the northern hemlock. It is called *Savin*, or *Stinking Cedar* (the latter on account of its strong and disagreeable terebinthine odor when bruised), names also applied, I believe, to the Florida Yew (*Taxus Floridana*), a rarer tree, which is sometimes seen growing with it.

In unskillful hands it seldom survives removal, and therefore is rarely seen as a shade-tree around dwellings, or as an ornamental tree on lawns, and the only successful attempts in this regard that occur to me were made by the late Judge Dupont in Quincy, and by Mr. Croom in the grounds of the Capitol at Tallahassee, where, I am informed, two or three of the trees still survive.

But its chief value is due to the remarkable durability of its wood when exposed to the vicissitudes of climate; for it is credibly reported that some fences constructed of it sixty years ago still remain in sound condition. In consequence of this peculiarity it is now extensively employed by the inhabitants of the surrounding country for posts, shingles, and other exposed constructions. In view of these facts, the future of our *Torreya* is a matter calculated to excite very grave apprehensions. A tree possessed of such valuable qualities, occupying an area so limited in extent, and in the midst of a population where the old rule of

"Let him take who has the power,
And let him keep who can"—

has unlimited sway, is destined, it is to be feared, to ultimate extinction.

Let us indulge the hope that the interest which is beginning to be manifested in regard to the preservation of our forests generally, may result in measures statutory or otherwise for its preservation.

SELECTIONS FROM THE BOTANY OF THE REGION OF THE TORREYA.

Plants peculiar to the Region.

Calamintha dentata.
Carex Baltzellii.
Taxus Floridana.
Torreya taxifolia.

Plants not seen by me elsewhere South of the Mountains of Georgia.

Aristolochia tomentosa.
Cornus alternifolia.
Dentaria laciniata.
Calycocarpum Lyoni.
Zanthorhiza apiifolia.
Spiræa opulifolia.
Thalictrum anemonoides.
Trautvetteria palmata.
Viola Muhlenbergii, var.

Plants not seen by me elsewhere in Florida.

Actinomeris squarrosa.
Archangelica hirsuta
Bumelia lycioides.
Carex rosea.
  Cherokeensis
  Halei.
  gynandra.
Clematis Viorna.
Croomia pauciflora.
Cynoglossum Virginicum.
Epigæa repens.
Euonymus atropurpureus.
Eupatorium ageratoides.
Forrestiera acuminata.
Gonolobus Baldwinianus.
Hepatica triloba.
Hypericum nudiflorum.
  galioides, var.
Lupinus perennis, var.
Luzula campestris.
Magnolia macrophylla.
Philadelphus grandiflorus.
Phryma leptostachya.
Polygala Boykinii.
Rudbeckia laciniata.
Sabbatia gentianoides.
Silene Baldwinii.
Zornia tetraphylla.

EXPLANATION OF MAP.—The localities occupied by *Torreya* are indicated by heavy shading, chiefly along the bluffs.

Notes on Naiadaceæ.

BY THOMAS MORONG.

POTAMOGETON PAUCIFLORUS, Pursh, var. CALIFORNICUS.—A vigorous growth, with stems 12 to 18 inches high, flattened or a little winged, half a line broad below: leaves 1 or 2 inches long, nearly a line wide, 3 to 5-nerved, the midrib thick and prominent as in *P. obtusifolius*: peduncles erect, thick, clavate: spike containing sometimes as many as 12 roundish fruits, which are crested or undulate and frequently shouldered on the back, commonly angled on the face, varying from $\frac{3}{4}$ to 1 line in length.

The form is well distinguished by its stout stem, large and strongly marked leaves, and its spikes of large and numerous fruit.

San Diego County, California. *S. B. & W. F. Parish.*

ZANNICHELLIA PALUSTRIS, L.—The distinctions founded upon the presence or absence of peduncles and pedicels (such as *Z. pedunculata*, Reich., *Z. palustris*, L. var. *pedicellata*, J. Gay, var. *pedunculata*, Gray) will not hold good, as these distinctions may all be noted occasionally upon the same plant; but the following form appears well marked:

Var. MURICATA.—Fruit largely or entirely muricate, sometimes armed with distinct and numerous teeth.

Texas, *J. Reverchon*. San Diego Co. Cal., *Parish*.

NAIAS MAJOR, All. var. GRACILIS.—Internodes long (1 to 3 inches), and nearly naked, with only a few teeth above: leaves very narrow, less than ½mm. broad, with 15 to 24 large teeth on the margin, dorsal teeth few: the teeth are of the *N. major* type, having a many-celled base, and a yellowish 1-celled spiny tip, curved upwards: the sheaths bear two or three teeth on each side: fruit quite small for the species, not over 3mm. long, the surface sculptured with about 25 rows of nearly square or irregularly oblong reticulations. The whole plant, at least when dry, is purple tinged.

The aspect of this plant is so unlike that of the type, that I should call it a new species if any distinctive specific characters could be clearly perceived. It is a good sub-species.

Florida, *A. H. Curtiss*. Distributed as No. 2705.

NAIAS FLEXILIS, Rostk. and Schmidt.—A polymorphous species, found throughout N. America and Europe, and probably in Asia.

The teeth on the margins of the leaves are one-celled; on the sheaths they are often raised above the margin by a basal prominence of several cells. This species occurs in forms with leaves narrow and broad, linear and abruptly acute, and linear-lanceolate, tapering to a sharp point; also in plants which are small, bushy and densely leaved and branched, as well as in forms a foot or more high and quite slender. The following is an extreme form, almost distinct enough to be ranked as a sub-species:

Var. ROBUSTA.—Stem stout, few-leaved, sparsely branching, elongated: leaves linear, 1½–2mm. broad and 10 to 15mm. long, flat, abruptly acute. I have found it rising to the surface in still ponds, in water 4 to 6 feet deep! Sterile plants only seen.

Eastern Mass. Also collected by *L. H. Bailey, Jr.*, in Mich., and *C. Wright*, in Texas.

NAIAS MICRODON, A. Braun.—Sheaths and teeth similar to those of *N. flexilis*, with which it was formerly classed by Braun, except that the teeth are very minute and sometimes very numerous (30–100): leaves less than 1mm. broad, 5 to 8mm. long, somewhat recurved, undulate, not revolute. The species is mainly characterized by its fruit, which is very short (1 to 2mm.), sculptured on the surface by 16 to 20 rows of nearly square reticulations, and scarcely shining. The fruit of *N. flexilis* is 2½ to 3mm. in length, conspicuously smooth and shining, especially in the denuded nutlet, the superficial marking indistinct in mature fruit, but consisting of about 40 rows of roundish-square or irregular shallow reticulations.

Perdinales river, Texas, coll. *Lindheimer*, 1847.

By the courtesy of the curator of the Chapman Herb. at Columbia College, Prof. N. L. Britton, I have been permitted to see the original specimen of Chapman's *N. flexilis*, var.? *fusiformis*, and I fully agree with Braun that it is *N. microdon*, so that our localities for this species in N. America must include Florida. Our form of the species is classed by Braun as *N. microdon*, var. *Guadalupensis*, it having been originally collected by Duchassaing at the French West India Island Guadaloupe.

Biology of the Conjugatæ.

BY WM. TRELEASE.

The common Brook-Silks (*Spirogyra* and *Zygnema*) have served an excellent purpose in the biological laboratory because of the large size of their cells, and the distinctness with which the parts of the latter stand out; and the completeness of their reproductive processes, which can be followed even by students who have had little training in laboratory manipulations. Yet the details of their vital processes, and even of their structure, are known to comparatively few who use them, and the statements concerning both are scattered through isolated papers, of recent publication, by Strasburger, Schmitz, and others, which are still inaccessible to most teachers. Bringing the most important of these facts together, and verifying them by observations on something more than 130 species, has been a task well performed by Professor Gay, of the School of Pharmacy at Montpellier, whose local monograph of the group[1] is a worthy model for monographers elsewhere.

Aside from the behavior of the nucleus in cell-division, which Strasburger has clearly elucidated in his "Zellbildung und Zelltheilung," the most interesting part of their history relates to the structure of their chlorophyll bodies, and to their reproduction.

By allowing the cells to lie for a time in a saturated solution of picric acid, the protoplasm of the well known chromatophores is sufficiently contracted, without distortion, to show its reticulated structure with a high power, and this is rendered still more evident by such contracting reagents as alcohol.

The same treatment brings out the so-called pyrenoids, minute bodies .5–.15μ in diameter, which their discoverer, Schmitz,[2] homologizes, rightly or wrongly, with the nucleoli, which divide as the chromatophores enlarge, and whose division precedes that of the chlorophyll bands in which they lie. Their position is indicated, even before they are seen, by the clusters of starch grains which always surround them, and which rarely occur away from them, as though they were instrumental in forming the grains. A good method for the demonstration of the latter is indicated in the employment of acetic acid, in which the cells are placed for a few moments to remove much of the protoplasmic structures, after which they are rinsed in water preparatory to examination.

Containing a nucleus, chromatophores, and pyrenoids, which multiply apparently independently one of the other, the cell is fast losing its claim to recognition as the unit of plant structure.

The family Conjugatæ is of peculiar interest in its bearings on general biology, since in it appears not only sexuality, but the differentiation of the sexes. From plants which are exclusively apogamic (*Gonatonema*, *Spirogyra mirabilis*), a series is traced through the Desmids, where similar vegetative cells conjugate, and the Mesocarpeæ, where, though still similar, their protoplasm undergoes a rearrangement, to the Zygnemaceæ—

[1] Fr. Gay: Essai d'une Monographie locale des Conjuguées. Montpellier. Boehm et Fils, 1884. 8° 110 pp. 4 pl.

[2] Chromatophoren der Algen.—Verh. naturh. Ver. d. preuss. Rheinl. u Westf., 1883.

Zygnema, *Spirogyra longa*, *S. inflata*, *S. conspicua*, and *S. punctata*, illustrating an increasing sexual differentiation, that culminates in *Sirogonium sticticum*, in which there is not only a difference between the mother cells of the gametæ, but a difference in size between the latter after their renovation previous to union.

Some New Grasses.

BY GEO. VASEY.

ELYMUS ORCUTTIANUS.—Culms generally several from one root, 2 or 3 feet high, rather slender, leafy; nodes 4 to 5: leaves 8 to 10 inches long, erect but not rigid, narrow and more or less involute when dry, scabrous on the margins, upper leaf equalling or exceeding the culm; sheaths striate, smooth; ligule a short ciliate line or nearly obsolete: spike 4 to 6 inches long, erect, loosely flowered, with 15 to 20 spikelets, two or frequently only one at each joint, mostly flat and 2-ranked: spikelets 5 to 7-flowered; outer glumes linear-lanceolate, rigid, long-pointed, 4 to 6 lines long, one or indistinctly three-nerved, equalling or exceeding the lower flowers; lower flowering glumes 4 to 5 lines long, rigid, lanceolate, acuminate, rounded and smooth on the back, finely punctate, 5-nerved on the inside, the point scabrous; the upper flowering glumes gradually shorter and less pointed, and more scabrous above; palet ¼ to ⅓ shorter than the glumes, 2-toothed at apex, 2-keeled, the keels ciliate.

This is one of those species which may with almost equal propriety be classed in *Elymus* or *Agropyrum*. The narrow rigid glumes, and the general position of the spikelets seem best to refer it to *Elymus*, although in the weaker plants the spikelets are single.

Collected near San Diego, California, by *C. R. Orcutt.*

AGROPYRUM TENERUM.—Culms in tufts or patches, without running rootstocks, apparently annual, about 3 feet high, erect, smooth: leaves narrow, one or two lines wide, 3 to 6 inches long; sheaths striate, smoothish; ligule short: spike slender, cylindrical, 4 to 6 inches long, one or two lines wide, with the spikelets ⅓ to ½ inch distant, sometimes wider and with the spikelets closer; axis scabrous: spikelets 3 to 5-flowered; outer glumes 5 to 6 lines long, rigid, lanceolate, acute or awn-pointed, strongly 5-nerved; flowering glumes lanceolate, acute, 4 to 5 lines long, rounded on the back, smooth or smoothish and with the nerves indistinct below, above conspicuously 5-nerved and scabrous, terminated with a stiff, straight awn ½ line to 2 lines long; palet nearly as long as its glume, entire or obtusely 2-toothed at the apex, the keels ciliate or hispid-ciliate.

This has been named in some collections *Triticum* (*Agropyrum*) *repens*, var. *tenerum*. It is often difficult to distinguish it from that species except in wanting the running rootstock. It is common throughout the Rocky Mountains, and in bottom lands it is often cut for hay, of which it makes an excellent quality.

Another very common *Agropyrum* of the mountains and plains, also valuable for forage and hay, and known among stockmen from Montana to New Mexico as "blue stem, or blue grass," is the *Agropyrum glaucum*, R. & S. of which the following is a description:

Agropyrum glaucum, R. & S.—Culms from running rootstocks, 1 to 3 feet high, erect, rigid, smooth, with about 3 erect, rigid, narrow leaves, 4 to 6 inches long: spike distichous, 4 to 6 inches long, 4 to 6 lines wide, generally close or compact: spikelets 5 to 9-flowered, smoothish or sometimes pubescent; outer glumes slightly unequal, narrowly lanceolate, acuminate or awn-pointed, the lower 4 to 5 lines, and the upper 5 to 6 lines long, the lower 1 to 3-nerved and the upper about 5-nerved, the lateral nerves mostly all on one side of the midrib; flowering glumes 4 to 6 lines long, lanceolate, obtusish, or acute, or awn-pointed, usually sparsely pubescent, 5-nerved, the nerves indistinct below; palet about equalling its glume, rather acute, slightly bidentate, the keels hispid-ciliate, the back sparsely softly pubescent.

The whole plant is usually glaucous. In rich soil the spikelets are sometimes double at the joints.

Lowest Germination of Maize.

BY E. LEWIS STURTEVANT.

At the New York Agricultural Experiment Station we have obtained the following data relating to the germination of maize. The temperatures given are of a thermometer with the bulb in with the seed used, and each degree carefully corrected with a standard. Readings were taken hourly from 7 A. M. to 11 and 12

P. M., as a check upon the accuracy of our apparatus, which was designed to keep at a constant temperature with a variation of but two degrees. Our success with the lowest temperatures was perfect. The higher temperatures were with trial apparatus, and had a wider range until experience led to perfecting.

The following table gives the hour at which first germination was observed at the various temperatures, the seed from the same ear for each variety:

	Exp. IV. 41°.5 to 43°.7	Exp. III. 43°.5 to 47°.8	Exp. III. 43°.5 to 49°.6	Exp. II. 45°.5 to 50°.1	Exp. I. 48°.5 to 55°.5
Dent Corn.					
Adams' Early	233	......	......	180	142
Chester Co. Mammoth	233	264	......	168	142
Flint Corn.					
Waushakum	331	336	......	228	142
Eight-rowed White	331	......	......	216	150
Soft Corn.					
Tuscarora	378	......	408	228	161
Zuni Blue	431	......	......	228	185
Pop Corn.					
White Pearl	378	336	......	228	142
Amber Rice	378	......	......	228	142
Dwarf Golden	498	......	......	228	142
Sweet Corn.					
Stowell's Evergreen	452	......	504	228	195
Narragansett	498	......	......	300	209

Twenty-five seed of a kind, in duplicate trials, were used. Yet even with this number we did not succeed in eliminating the individual variability, one pocket furnishing germinating seed many hours before another. Thus, one trial with Naragansett Sweet gave first germination of one seed in 209 hours, its duplicate in 222 hours in Experiment I; and in Experiment IV the same seed germinated in one trial in 498 hours and its duplicate in 523 hours. Dwarf Golden pop, in Experiment IV, germinated in 498 hours in one trial and 738 hours in its duplicate.

In Experiments I and II, one hundred per cent. germinated, the trials extending 281 hours in I and 408 hours in II. Experiment III continued 1008 hours, and Experiment IV 708 hours, the average germination after this interval being as below, but the ungerminated seeds in all cases sound at the conclusion of the trial.

PER CENT. SEEDS GERMINATED, AND SOUND BUT UNGERMINATED IN EACH EXPERIMENT.

	Exp. I. 281 hours.	Exp. II. 408 hours.	Experiment III. 1008 hours.		Experiment IV. 708 hours.	
	Germ.	Germ.	Germ.	Ungerm.	Germ.	Ungerm.
Dent Corn.						
Adams' Early.........	100	100	......	......	100	......
Chester Co. Mam'th..	100	100	100	......	100	......
Flint Corn.						
Waushakum...........	100	100	92	8	100	......
Eight-rowed White..	100	100	......	......	84	16
Soft Corn.						
Tuscarora...............	100	100	84	16	50	50
Zuni Blue..............	100	100	......	......	74	26
Pop Corn.						
White Pearl	100	100	80	20	44	56
Amber Rice............	100	100	......	......	46	54
Dwarf Golden..........	100	100	......	......	18	82
Sweet Corn.						
Stowell's Evergreen..	100	100	84	16	62	38
Narragansett...........	100	100	......	......	60	40

We have thus carried the lowest temperature at which maize will germinate to below 43°.7 F. for all the form species. It is probable that further trial will place the lowest temperature at 42° or below, but the difficulty of keeping an unquestioned record between close limits for a long period is very great. In Experiment IV we succeeded for 29½ days, when repairs to our water service necessitated the concluding.

The apparatus used was a double box, made especially tight, and lined on three sides with a flat copper pipe, through which spring water, at a temperature of 36°, was kept constantly circulating. A thermostat within operated upon a clock outside through electrical communication, and when the temperature dropped below the point at which it was set, shutters were opened which admitted the warm air of the room until the thermostat again closed them through the agency of the clock. The germinator was a copper box, containing water, and fitted with cloth pockets, and a thermometer passing through a cork inserted in the refrigerator box had its bulb included within the pockets along with the seed, and its readings served as a check upon the working of the thermostat.

GENERAL NOTES.

A Correction.—A correspondent, Mr. Oliver Farwell, of Clifton, Mich., calls attention to an oversight in my article on "The Menominee Iron Region and its Flora." It is stated that *Habenaria rotundifolia*, Richardson, is not mentioned in any catalogue of Michigan plants. It is given in that of Wheeler & Smith, as *Orchis rotundifolia*, Pursh, and as habitats, "Flint, Mich., and shore of Lake Michigan in Wisconsin."—E. J. HILL, *Englewood, Ill.*

The Palms of California.—Recent correspondence on the palms of California has resulted in my becoming aware that *Brahea glauca* of seedsmen, is undoubtedly the *Erythea armata* (Watson) of the adjacent borders of Lower California, while *Brahea Roezlii* (Wendland) of nurserymen, is also a synonym of the same, and not of *E. edulis* (Watson), as had been supposed. *Washingtonia robusta* (Wendland) is found to have originated in Lower California, instead of Sacramento valley, where there are no indigenous palms. I am indebted to George A. Purdie, of Boston, for information not otherwise accessible to me, and which has led largely to the above results, and any one in a position to give further information regarding these species would confer a favor by addressing C. R. ORCUTT, *San Diego, Cal.*

Some Indiana Plants.—There are a few plants to add to the list of those already published for Indiana, or additional stations. All are from Lake or Porter County:

Hepatica triloba, Chaix. Hobart. Generally on north slopes.—*Cornus Canadensis*, L. Pine Station.—*Aphyllon fasciculatum*, Torr. & Gray. In sand by shore of Lake Michigan, Pine Station. Usually parasitic on roots of species of Artemisia.—*Potamogeton pulcher*, Tuck. In "sloughs" at Pine Station. Leaves not as large as those of species described in Gray's Manual, resembling those of some forms of P. natans. The fruit is earlier, specimens with mature fruit having been collected June 21. P. natans fruits in August or later. This peculiarity may call attention to it. This adds another locality to the few already given for this species. In Gray's Manual it is ascribed to E. Mass., and ponds on hills north of St. Louis, and Georgia. In *Torrey Bulletin*, River Head, L. I., Mr. Morong writes that he has seen it from Delaware and East New York.—*Carex arida*, Schw. & Torr., and *C. squarrosa*, L., at Wheeler's.—*Festuca ovina*, L. Banks of Calumet river. Hammond. A locality showing many evidences of former occupation by Indians, such as arrow-heads, flint chips, broken pottery and teeth of deer. If not indigenous, probably naturalized long ago, as it was on uncultivated timbered ground.—*Vaccinium Pennsylvanicum*, Lam. A noticeable variety of this is found at Hammond. Leaves glaucous, as in V. vacillans: fruit black, without bloom, somewhat depressed globular and very sweet. Shrub mostly taller than the common form and growing with it. Seemingly affecting rather damper and richer soil. The fruit ripens at the same time as that of the blueberry. Having noticed it first while gathering blueberries, I am not able to say whether it differs in flower.—*Thalictrum anemonoides*, Michx. Flowers greatly doubled, of 20 to 30 purplish sepals, alternating in whorls, and very handsome. Woods near Hobart.—*Rubus triflorus* Richardson. White fruited. Quite a patch in the pine woods at Pine Station.—*Calopogon pulchellus*, R. Br. White flowered. Clarke Station.—E. J. HILL, *Englewood, Ill.*

Reproduction in Ferns.—Mr. W. T. Thiselton Dyer, in *Nature*, refers to a most interesting discovery recently made by Mr. E. T. Druery. A variety of *Asplenium filix-fœmina* was discovered upon which the sporangia developed into prothallia bearing antheridia and archegonia. Mr. F. O. Bowen also found an *Aspidium* in which the apex of the pinnules developed in the same way. Aposporous ferns are looking very strongly towards phanerogams. The same writer sums up the progress of discovery in reproduction of ferns in the following concise and instructive way: Observed seedling plants near parents, Gerarde (1597); Sporangia, Cæsius (1648); Spores, Cole (1669); Hygroscopic movements of sporangia, Ray (1686); Raised seedlings from spores, Morison (1715); Prothallium, Ehrhart (1788); Germination of spores, Lindsay (1789); Development of prothallium, Kaulfuss (1827); Antheridia, Nägeli (1844); Archegonia, Suminski (1846); Apogamy, Farlow (1874); Apospory, Druery (1884).

EDITORIAL NOTES.

MR. SERENO WATSON is collecting in Guatemala.

MR. F. LAMSON SCRIBNER, in Proc. Philad. Acad., p. 289, 1884, describes, with plate, a new species of *Cinna*.

A NEW WORK on methods of bacteria investigation as conducted by the most eminent bacteriologists is announced by Cassino & Co. The author is Dr. C. S. Dolley.

FRANK BUSH and Cameron Mann have published a supplement to their catalogue of the plants of Jackson County, Missouri, which carries the number of species from 609 to 905.

HEDWIGIA, the German cryptogamic journal, edited by Dr. Winter, has just completed its twenty-third volume, and announces that it will hereafter be much enlarged and improved, and the subscription price increased to 8½ marks.

THE LIBRARY of the late Charles Downing, the eminent horticulturist, has become the property of the Iowa Agricultural College by bequest. This is a valuable acquisition, and a choice compliment to the horticultural department of the college.

DR. M. C. COOKE announces in *Grevillea* that he is now engaged on a monograph of the genus *Polyporus*, to be based upon a personal examination of each species so far as possible, and to contain a full description of the species with spore measurements and critical notes. A preliminary list of 261 species is given.

WE LEARN from *Science* that Montreal is to have a fine botanic garden under the joint control of McGill University and the Horticultural Society. Professor D. P. Penhallow is entrusted with controlling influence in the execution of the plans.

THE FIFTEENTH CENTURY of Ellis's North American Fungi is devoted to the parasitic species. There are 34 species of *Puccinia*, 18 of *Æcidium*, 7 of *Uromyces*, 17 of *Peronospora*, and 7 of *Entyloma*, the remaining species being distributed to 9 genera.

IN THE JOURNAL OF BOTANY for March, Mr. F. Townsend presents an illustrated paper to prove "that the pale in the floret of grasses is the homologue of the ochrea and utriculus in Carex, and that the latter is a single floral envelope, therefore the pale is also single."

DR. J. T. ROTHROCK, at a recent meeting of the Botanical Section of the Philadelphia Academy, called attention to the internal cambium ring in the stem of *Gelsemium sempervirens*. The result was that the pith was constantly being encroached upon and finally almost disappeared.

OWING TO WORK for the New Orleans Exposition, Mr. A. H. Curtiss was prevented last season from preparing a new fascicle of Florida plants. He has been able, however, to collect sufficiently to offer what may be called a second issue of his first fascicle. It contains 240 species and is sold for $18.

DRS. ASA GRAY and W. G. Farlow have been on a collecting tour through Mexico by way of the City of Mexico and Vera Cruz, and are now at Los Angeles, Cal., which is to be their principal stopping place. On the way to Vera Cruz they found the flora and scenery remarkably fine.

MR. JOHN ROBINSON read a very interesting paper last June before the Essex Institute, and published in their *Bulletin*, entitled "Botany in Essex County." The record is a rare one, and with such names as Cutler, Oakes, Pickering, Osgood, and Russell, it is no wonder that the science became popular.

THE WESTERN DRUGGIST comes to us from Chicago with a department of "Botany and Microscopy," under the direction of Prof. E. S. Bastin. The chief article under it is entitled "Directions for Preparing and Mounting Sections of Stems and Leaves." In another place Prof. Bastin gives an illustrated account of plant hairs.

THE JOURNAL OF BOTANY always brings to us descriptions of new species of plants. The February number contains descriptions of five new Desmids (with plate), a new *Carex* from Sumatra, a new *Loranthus* from China, and four new species of *Selaginella*. The synopsis of the last genus by Dr. Baker has now reached 232 species.

THE FIRST NUMBER of *Nuovo Giornale Botanico Italiano* for 1885 contains a continuation of the Veronese flora, by A. Goiran, a reply by F. Tassi to Prof. Luigi Macchiati in reference to the effect of anesthetics upon flowers, and an anatomical description (with four plates) of the inflorescence of the female flower of *Dioon edule* (a Cycad) by G. Cugini.

MR. J. REVERCHON will collect extensively in Western Texas this season, and if sufficiently encouraged, will undertake in subsequent years a thorough exploration of that very interesting region. We hope that all botanists who can will promise to Mr. Reverchon their share of support in this great undertaking. His address is 411 Houston street, Dallas, Texas.

IN THE CURRENT VOLUME of the Proceedings of the Philadelphia Academy, Dr. Gray makes some remarks upon Mr. Meehan's discovery of the retraction of the anther-tube in *Helianthus*. It is similar to that which takes place in the thistle tribe generally, but Dr. Gray claims that it is the "result of automatic or irritable shortening of the filaments," and not of the "elasticity of the filaments," which Mr. Meehan had suggested.

THE FIRST TWO numbers of the *Journal of the New York Microscopical Society* give excellent promise for this new venture. The number of journals shows that if in America microscopical science has not sent its roots down very deep, they are at least spreading widely. The new claimant for favor is well gotten up and well printed, and its matter interesting and appropriate. Only nine numbers a year are to be issued. We shall look to it for some valuable contributions to knowledge.

DR. A. C. ABBOTT, of Baltimore, Md., has offered a series of twelve slides of pathogenic bacteria, which we have examined with more than usual interest. They have been prepared from material furnished by Dr. G. M. Sternberg, the most noted American bacteriologist, and include several slides of *Bacillus Anthracis*, *B. tuberculosis*, and a number of species of *Micrococcus*, including that of swine plague. The fine slide of *B. Anthracis* showing spores will be especially appreciated by morphologists.

WALTER GARDINER, in a recent number of *Nature*, comments upon Dr. Schaarschmidt's paper on continuity of protoplasm, mentioned in our last issue. Among other things he points out that several eminent investigators have been led astray by the tests they have relied upon to demonstrate protoplasm in intercellular spaces. He believes that its existence has not yet been demonstrated, and that the substance mistaken for it is mucilage. As to interlamellar protoplasm he considers it simply impossible, as does also Russow.

LECLERC DU SABLON has studied the mechanism, as we learn from the *Botanisches Centralblatt*, by which the leaves of certain trees, e. g., beeches, oaks, hornbeams, etc., are retained on the tree long after they are dead. At about the time the leaves begin to change color, the base of the leaf-stalk for some two or three millimeters becomes lignified, and the cells and vessels thickened, offering complete obstruction to the passage of water. The leaves then dry up and remain so. They are pushed off in the spring by the swelling of the living tissue just underneath.

THE BULLETIN of the Royal Botanical Society of Belgium, for 1884, contains a paper (with two plates) by E. Bernimoulin, upon the division of the nuclei in *Tradescantia Virginica*. The breaking up into worm-like filaments is quite remarkable and the plant so easily obtained that these observations could be readily verified in almost any laboratory. The parts used are pollen mother-cells, stamen hairs, and shreds of young epidermis, and the method of their treatment is fully explained. In the same volume a synoptical catalogue of the mycologic flora in the neighborhood of Brussels is given by E. Bommer and M. Russeau. It occupies (with full index) some 350 pages.

CURRENT LITERATURE.

Bulletin of the California Academy of Sciences. No. 3. February, 1885.

This number is chiefly made up of botanical papers of considerable importance, and contains thirteen botanical plates, most of them colored. Mr. Edward Lee Greene, in a paper entitled "Studies in the Botany of California and Parts Adjacent," describes many new species and some new genera, and gives a synopsis of certain groups. A new *Vancouveria* from Oregon is described, five new species of *Eschscholtzia*, and two new genera of Cruciferæ, *Heterodraba* and *Athysanus*. The former is *Draba unilateralis*, M. E. Jones, and the latter *Thysanocarpus pusillus*, Hook. A synopsis of *Sidalcea* is given with five new species. *Horkelia* is represented by four new species, and *Ribes* by two. A synopsis of *Pentachæta* is given and many new Compositæ described, among which is a new genus called *Crockeria*. The sections *Diplacus* and *Eunanus* of *Mimulus* are raised to generic rank, the latter containing 20 species, and then follows a synopsis of *Mimulus*. The only trouble with regard to certain distinctions drawn under *Mimulus*, *Eschscholtzia*, etc., is that one must have fresh specimens for determination, a thing so inconvenient as to largely preclude the use of such characters. *Polygonum Douglasii* and *P. Engelmanni* are two new species separated from *P. tenue*.

In the same number, Mary K. Curran gives a list of plants described by Drs. Albert Kellogg and H. H. Behr, with an attempt at their identification.

Mr. E. L. Greene also describes eight new species of the genus *Astragalus*.

Mr. H. W. Harkness gives a list of the Fungi of the Pacific Coast, with descriptions of several new species, and calls attention to certain generic names which are used twice, principally once among phanerogams and again among fungi, such as *Antennaria*, *Læstadia*, *Phyllactinia*, *Clypeola*, *Eurotia*. In the last two instances the termination is *um* in the case of the fungus, too close a resemblance, but not so absolutely inexcusable as in the other cases given.

Altogether, the *Bulletin* surprises one with its evidence of great botanical activity upon our Pacific Coast.

Canadian Filicineæ. Macoun & Burgess. From the Trans. Roy. Soc. Canada. Read May 23, 1884.

This is a sumptuously printed pamphlet of over sixty pages, and is intended to be all that is necessary for a Canadian pteridologist. There are 64 species given, with references to literature, synonymy, descriptions, stations and collectors. A history of the subject, remarks upon distribution, and a short account of the life history of Ferns prefaces the synopsis. Two tables give some interesting views as to distribution. The first is made upon the basis of Mr. Redfield's division of the North American species into six great classes, the 64 Canadian species, being distributed as follows: Cosmopolitan, 4; Boreal, 23; Appalachian, 26; Pacific, 10; New Mexican, 1 (*Cheilanthes lanuginosa*); Tropical, 0. Twenty of the species are peculiar to North America. The second table divides the Dominion into five botanical areas, which show the following distribution of species: Atlantic Provinces and Eastern Quebec, 54; Ontario and Western Quebec, 55; the Great Plains to the Arctic Circle, 31; Rocky Mountains, 27; British Columbia, 31.

Contributions to American Botany. XII. By Sereno Watson. Proc. Amer. Acad. XX. pp. 324–378. Issued February 21, 1885.

A history and revision of the Roses of North America fills the first half of this contribution. The history is given with that painstaking reference to the literature of the subject so characteristic of Mr. Watson, and from the account of Gosnold's voyage in 1602 to Palmer's *R. Mexicana*, discovered in 1881, we have a complete account of successive discoveries and varying opinions as to the limits and arrangement of species.

In the revision two series are recognized, the one with persistent and connivent sepals, the other with sepals deciduous and spreading. The former is subdivided into two groups, dependent on the presence or absence of infrastipular spines. The armed group are entirely western, extending no farther east than the plains east of the Rocky Mountains. The unarmed group ranges from Colorado to Alaska, and eastward to Hudson Bay and the N. Atlantic States, and may be all called *R. blanda*, or separated into four species, according to the view taken as to the limits of species. The series with deciduous sepals is more general in its distribution. Very little attempt seems to have been made to give synomymy, probably from the fact of its inextricable confusion, but an exceedingly full list of stations and collectors answers really the same purpose, especially to those who have full sets of reports on western botany. The grouping and range is as follows:

I. Sepals connivent and persistent after flowering.

A. Without infrastipular spines.

1. *R. acicularis*, Lindl. (N. Alaska) 2. *R. blanda*, Ait. (Newfoundland to Lake Superior) 3. *R. Sayi*, Schwein. (Colorado to Brit. Am. and Lake Superior) 4. *R. Arkansana*, Porter (W. Texas to Brit. Am.).

B. Infrastipular spines present.

5. *R. Nutkana*, Presl (Idaho and Oregon to Alaska). 6. *R. pisocarpa*, Gray (Oregon and Washington Terr.). 7. *R. Californica*, C. & S. (Oregon and Calif.). 8. *R. Fendleri*, Crepin (from the Rocky Mts. to the Sierras and Cascades). 9. *R. Woodsii*, Lindl. (Col. to Brit. Am. and the Mississippi) 10. *R. minutifolia*, Eng. (Lower California)

II. Sepals spreading after flowering and deciduous.

11. *R. Carolina*, L. (Nova Scotia to Florida and the Mississippi) 12. *R. lucida*, Ehrh. (Newfoundland to N. Y.) 13. *R. humilis*, Marsh. (from the Atlantic to the Mississippi) 14. *R. nitida*, Willd. (Newfoundland to New England) 15. *R. foliosa*, Nutt. (Indian Terr. to Tex.) 16. *R. Mexicana*, Watson (Mexico). 17. *R. setigera*, Mx. (Ontario to Gulf of Mexico) 18. *R. gymnocarpa*, Nutt. (Brit. Col. to W. Montana and California)

It would be possible to reduce these 18 species to 9, as follows, indicated by the numbers given above: 2 (including 1, 3, 4), 5, 9 (incl. 6, 7, 8), 10, 11, 13 (incl. 12, 14), 15 (incl. 16), 17, 18.

The rest of the contribution is given up to the description of new species, chiefly from our western territories. Quite a notable new species is a *Picea*, from 100 to 150 feet in height, discovered by Thos. Howell at high elevations in the Siskiyou Mountains of California, and dedicated to Prof. W. H. Brewer, as *P. Breweriana*.

Thirty-fifth Annual Report of the New York State Museum of Natural History: Report of the Botanist. 8°. Albany, 1884. pp. 125–164.
Thirty-sixth Report of the same. Albany, 1884. pp. 29–49.

The present reports are for the years 1881 and 1882, respectively. The necessity of less tardy publication has been repeatedly urged by the friends of the museum, but without much apparent result. The public printer will not be hurried. The first of these reports contains the usual variety of interesting notes on New York plants, with descriptions of some forty-five new species of fungi, and one new genus, *Gymnascella*, related to *Ascomyces*. A very valuable feature of the report is the synopsis of N. Y. species of *Lepiota*, with full, specific descriptions and notes.

It has been the custom of Mr. Peck to make a collecting tour to some part of the state each summer, for which he advances the money and is reimbursed by an appropriation by the Legislature. Through some political intrigue this item for 1880 was vetoed by the Governor. Thinking it was not likely to occur again, he advanced the money for 1881, but again it was vetoed. He therefore did not collect in the year following, and in consequence the second of the present reports is shorter than usual and contains no new species. It has, however, a synopsis of the N. Y. species of *Psalliota*, including seven species, the common mushroom, *Agaricus campestris*, being one of them.

These reports, of which about a dozen and a half have now been issued, lose much of their value for want of an index. If a complete and accurate index could be furnished for all now published, botanists would be willing to sacrifice one of the annual reports for it, if need be.

KOEHNE ON LYTHRACEÆ.

BOTANICAL GAZETTE.

VOL. X. MAY, 1885. No. 5.

The Lythraceæ of the United States.

BY E. KOEHNE (Berlin-Friedenau).

Since I have been occupied during fourteen years with an investigation as careful as possible of the *Lythraceæ*, I think it will be of some interest to North American botanists to learn the results of my studies, as far as they concern species of the United States. The systematic part of my monograph has been published in the first four volumes of *Engler's Botanische Jahrbucher*. In the fifth and sixth volumes, in two extensive articles, I have treated of the morphology of the order, and in one of the following volumes I will speak with some completeness of its geographical distribution. The whole will be concluded by a complete index of names, including the synonyms.

It is not my intention to give, in the following notes, descriptions or diagnoses of the North American *Lythraceæ*, but only names, synonyms, and geographical range, accompanied by a few remarks. I hope the botanists of the United States will be compelled by these remarks to pay more attention to certain critical and interesting forms than they have as yet done. I will take pleasure in determining any Lythraceous plants which botanists will send me.

As for the descriptions, I must refer to my monograph, but it will be of use to supply this defect at least by short analytical keys.

KEY TO THE GENERA.

Flowers unsymmetrical, with 6 petals and 11 stamens. V. CUPHEA.
Flowers regular.
  Flowers solitary in the axils of the leaves, sessile or subsessile.
    Calyx shortly campanulate or semiglobose. Stamens 4.
      Capsule indehiscent. Petals none. III. PEPLIS.

Capsule dehiscent, with 3 or 4 elegant septicide valves. Petals 4. — I. ROTALA.
Calyx tubulose. Petals 6. Stamens 12. — IV. LYTHRUM.
Flowers solitary, but on very long (12-28mm.) pedicels. Petals generally 6. Stamens 12 or 13. — VI. NESÆA.
Flowers in three- or many-flowered cymes, that rarely are reduced to a single axillary flower.
Capsule bursting irregularly. Petals generally 4, or none. Flowers not trimorphous. — II. AMMANNIA.
Capsule 3-valved, or rarely 4-valved, loculicide. Petals 5, rarely 4. Stamens 10, rarely 8. Flowers trimorphous. — VII. DECODON.

I. ROTALA L. sens. ampl.

Petals 4: accessory teeth of the calyx as long as the lobes or shorter. — 1. *R. ramosior.*
Petals 0: accessory teeth of the calyx thrice as long as the lobes, subulate. — *R. dentifera.*

1. R. RAMOSIOR Koehne, no. 3 of Monograph, l. c. vol. i. p. 157. (*Ammannia ramosior* L. Sp. Pl. 1753, nec L. Mant., nec Pursh: *A. humilis Michx.* 1803: *Boykinia humilis* Raf. 1817: *Peplis occidentalis* Spreng. 1825: *Ammannia catholica* Cham. et Schl. 1827: *A. occidentalis* DC. 1828; Chapm. 1865, pro parte: *A. monoflora* Blanco, 1837: *Isnardia ascendens* Hall ed. Eat. sec. A. Gray.) From Boston and Florida to St. Louis and Texas; also in California and Oregon from the Yosemite Valley to the Columbia River; then from Mexico and the West Indies to Brazil and Ecuador, and on the Philippine Islands. It will be rather difficult, I fear, to convince North American botanists of the necessity of separating the genus *Rotala* from *Ammannia*, for, unfortunately, the only species met with in the United States has an Ammannia-like habit, which is not to be observed in the 31 other species of *Rotala*. The African *R. serpiculoides* only bears a character of the genus *Ammannia*, having its flowers disposed in axillary sessile cymes. Although I have to differ from such high authority as Bentham and Hooker, who brought *Rotala* under *Ammannia*, I can not but insist on the diversity of the two genera, for the latter differs from *Rotala* no less than from *Lythrum*. Whoever may have occasion to examine a great number of species of *Rotala* will be struck by the peculiarities, by which this genus proves to have pursued a course of evolution very divergent from that of *Ammannia*. The principal distinctive characters of the two are the following: the capsule of *Ammannia* bursts irregularly, that of *Rotala* separates into 3 or 4 septicide valves. Also, a bit of the capsule wall of *Rotala* mounted in water, and examined with a magnifying power of twenty diame-

ters or more, will be seen to be transversely and densely striated in a very elegant manner. Nothing of a similar kind is to be observed in any other genus of the whole order *Lythraceæ*. This microscopical character is sufficient for recognizing any Lythraceous plant as a *Rotala*. Besides, every species of *Ammannia* presents axillary cymes, while *Rotala* has solitary flowers in the axils of leaves or bracts, except the above mentioned African species. For more details see my Monograph, l. c. vol. i. pp. 146–148; vol. v. pp. 114, 117, 127; vol. vi. pp. 8, 24–26, 34, 35. I have been compelled by my studies to unite with *Rotala* two genera separated from *Ammannia* by Bentham and Hooker, viz., the Abyssinian *Rhyacophila* Hochst. and the East Indian *Hydrolythrum* Hook. fil. *Rotala ramosior* bears all the characters of the genus, and it is only its habit that has misled botanists into bringing it under *Ammannia* and, in general, to unite the whole genus with the latter.

R. DENTIFERA Koehne, no. 12 of Monograph, l. c. vol. 1. p. 161. (*Ammannia dentifera* A. Gray, 1853.) I have not seen this species, which has been found only near Santa Cruz, in the Mexican State of Sonora, but will probably be met with in the adjoining parts of the United States.

It may be added that the small *R. Mexicana* Cham. et Schl., a species widely spread from Mexico to the West Indies and Brazil, from Japan to Australia, and from the East Indies to Madagascar and West Africa, may possibly occur also in Southern Texas or in Florida.

II. AMMANNIA L. sens. restr.

Petals 4: stamens exserted.
- Capsule half exserted: peduncle 2mm. long: cymes rather loose: stamens 4, rarely 3. — 2. *A. auriculata.*
- Capsule totally included: cymes subsessile, dense: stamens 4-8. — 3. *A. coccinea.*

Petals 0: stamens 4, included: stigma subsessile. — 4. *A. latifolia.*

2. A. AURICULATA Willd. 1806 (?): no. 32 of Koehn. Mon. l. c. vol. i. p. 244. (*A. arenaria* HBK. 1823: *A. Senegalensis* DC. 1828; St. Hil. pro parte, nec Lam.: *A undulata* C. A. Meyer, 1842: *A. pusilla* Sonder. 1848: ?A. *sagittata* var. *angustifolia* A. Rich. 1845: *A. Wrightii* A. Gray, 1853: ?*A. longipes* Sauvalle, 1868.) I have seen no North American specimens except from New Orleans. The species extends from the Rio Grande del Norte to Ecuador and Brazil, from the Cape to Senegambia and Abyssinia, and along the Nile to its mouth, from the Caspian Sea through Eastern India to Southern China and Australia. It has sometimes been confounded with *A coccinea.*

3. A. COCCINEA Rottbœll. 1773: no. 35 of Koehn. Mon. l. c. vol. 1. p. 249. (*A. latifolia* L. 1753, pro parte?: *A. ramosior* L. Mant. 1771, nec L. Sp. Pl.: *A. purpurea* Lam. 1783: *A. sanguinolenta* Swartz. 1797: *A. octandra* var. β Poiret, 1810: *A. stylosa* Fisch. et Mey. 1841: ?*A. sagittata* var. *angustifolia* A. Rich. 1845: *A. Texana* Scheele, 1846: *A. humilis* Chapm. 1865, pro parte: ?*A. longipes* Sauvalle, 1868.) From New Jersey to St. Louis and New Orleans, then from Mexico to Brazil, and on the Sandwich, Marian, and Philippine Islands. I do not understand how this species could be united or confounded with *Rotala ramosior*, as has been done by Chapman, and long ago by Linnæus.

In my monograph I cited *A. Texana* Scheele as a synonym for *A. coccinea*, but I added a sign of interrogation. This sign was superfluous, as I have seen in a specimen collected by Dr. O. Kuntze, near St. Louis, in 1874. This specimen seemed to agree entirely with the diagnosis given by Scheele, running as follows: "Petala 4, stamina exserta, stylus capsula sextiplo brevior," etc. I was convinced for some time that the specimen was indeed *A. Texana* Scheele, for the stamens were exserted, but the *capsule* had a very short style ending in a distinct stigma, and I saw no flower with an elongated style. Then treating some younger flowers with hot water for the purpose of making drawings of the supposed *A. Texana*, I at once detected elongated styles on the *ovaries*, and settled the true nature of the presumed stigmas of the *capsules*. The styles break off before the capsules are ripe, and only their base persists on the top of the capsule. The upper end of this persistent base is somewhat thickened and presents the very aspect of a stigma. This observation induces the conviction that Scheele was deceived by the apparently short styles of the capsules (for he mentions the capsules only, not the ovaries) as I was at first. It must consequently be stated that there is no *Ammannia* with exserted stamens and short style, and that *A. Texana* is a synonym of *A. coccinea* Rottbœll.

4. A. LATIFOLIA L. Sp. Pl. 1753 (an pro parte?): no. 37 of Koehn. Mon. l. c. vol. i. p. 251. (*Isnardia subhastata* Ruiz et Pav. 1798: *Jussiæa sagittata* Poir. 1818: *Ammannia ramosior* Ell. 1821, pro parte: *A. pallida* Lehm. 1823: *A. hastata* et *A. sagittata* DC. 1828: *A humilis* var. β Torr. et Gray, 1838–40: *A. lingulata* Griseb. 1866: *Ludwigia scabriuscula* Kellogg, sec. Watson.) Mobile, New Orleans, Northern Mexico to the West Indies, to Peru (Lima), and Paraguay.

III. Peplis L.

5. *P. diandra* Nutt. ed. DC. 1828: no. 49 of Koehn. Mon. l. c. vol. i. p. 263. (*Callitriche autumnalis*? Michx. 1803, sec. Watson: *Didiplis linearis* Raf. 1833: *Hypobrichia Nuttallii* M. O. Curt. ed Torr. et Gray, 1838–40: *Ptilina aquatica* Nutt. Ms. sec. Endl.: *Didiplis diandra* Wood, 1855, sec. Watson: *Ammannia Nuttallii* Gray, Man. ed. 4.) From North Carolina and Florida through Illinois to Minnesota, St. Louis, and Texas. I can not detect differences of any weight between *Didiplis* and the true European *Peplis*. It is of little consequence that the flowers of the former are tetramerous, and those of the latter hexamerous, this character being variable in more than one genus of *Lythraceæ*. On the other hand, I can not agree with M. Baillon, who brings *Peplis* under *Ammannia*, for the European species of *Peplis* are much nearer allied to *Lythrum*, by means of *L. nummulariifolium* Loisleur, than to *Ammannia*. As to the number of stamens of *Peplis diandra*, it is often said to be two, but the numerous flowers I examined were all tetrandrous.

IV. Lythrum L. sens. restr.

Flowers solitary in the axils, rarely binate by an accessory flower.
- Flowers not dimorphous: petals rather small: stamens ordinarily 4 to 6, included. — 6. *L. Hyssopifolia.*
- Flowers dimorphous: petals rather large: stamens 6, the dorsal ones inserted lower than the ventral ones.
  - Ovary on a thick short stalk; no fleshy hypogynous ring: leaves linear, almost always opposite. — 7. *L. lineare.*
  - A fleshy hypogynous ring, often very small.
    - Calyx (with the accessory teeth) 1½ to 6½mm. long: stamens of the short-styled flowers exserted: leaves alternate, or the lower ones opposite.
      - The fleshy hypogynous ring small, or very small.
        - Leaves linear, or the cauline ones linear-lanceolate. — 8. *L. album.*
        - Leaves suborbicular or oblong. — 9. *L. ovalifolium.*
      - The height of the fleshy ring equalling its diameter.
        - Leaves oblong-linear or lanceolate, with an acute or cuneate base. — 10. *L. lanceolatum.*
        - Leaves oblong or linear-lanceolate, with a cordate or rounded base. — 11. *L. alatum.*
    - Calyx (with the accessory teeth) 8 to 14mm. long: the height of the fleshy ring equalling its diameter.
      - Leaves linear, alternate: stamens of the short-styled flowers exserted. — 12. *L. Californicum.*

Leaves oblong or ovate, with a cordate or rounded base, generally opposite: stamens of the short-styled flowers included or scarcely exserted. 13. *L. Vulneraria.*

Cymes of flowers arranged in terminal spikes: flowers trimorphous. 14. *L. Salicaria.*

6. L. HYSSOPIFOLIA L. 1753: no. 59 of Koehn. Mon. l. c. vol. i. p. 315. (The synonyms of this species may be passed by. It has often been confounded with *L. Thymifolia* L.) From Maine to Massachusetts near the coast, also in California near Calistoga and near the bay of West Berkeley, in Columbia near Quindiú, in the Argentine Republic, Uruguay and Rio Grande du Sud, in Chili and on the island of Juan Fernandez, in Europe from Spain and Ireland to Sarepta, thence in Siberia to the Altai region, on the Azores, Madeira, and the Canary Islands, in Northern Africa, in Abyssinia, at the Cape, in Eastern Australia and New Zealand.

7. L. LINEARE L. 1753: no. 64 of Koehn. Mon. l. c. vol. i. p. 320. (*Pythagorea linearis* Raf. 1819: *L. virgultosum* Griseb. 1866, excl. synom.)

8. L. ALBUM HBK. 1823: no. 65 of Koehn. Mon. l. c. vol. i. p. 320. (*L. albicaule* Bertero, 1829 and 1830: perhaps *L. alatum* var. δ Torr. et Gray, 1838–40: *L. Californicum* Torr. et Gray, nec Watson: *L. Græfferi* Gay, 1846, nec Tenore: *L. alatum* vars. *lanceolatum* et *linearifolium* A. Gray, 1846.) California, New Mexico, Texas, Mexico, Chili. This species differs undoubtedly from *L. alatum*, the latter being well characterized by its large hypogynous ring and the form of its leaves. This ring of the dimorphous *Lythra* has been overlooked before by all botanists. I have dissected numerous flowers for the purpose of ascertaining the diagnostic value of the ring, and I have found that it is absolutely constant in form and size.

9. L. OVALIFOLIUM Engelm. ed. Koehn.: no. 66 of Koehn. Mon. l. c. vol. i. p. 323. (*L. alatum* var. *ovalifolium* et var. *pumilum* A. Gray, 1846: ? *L. flagellare* Shuttleworth, sec. A. Gray et Watson.) Western Texas (and Florida?) This species differs from *L. alatum* chiefly in its very small hypogynous ring; from *L. album* in its habit and broader leaves. The ring of the latter is also twice as thick as in *L. ovalifolium*.

10. L. LANCEOLATUM Elliott, 1821: no. 69 of Koehn. Mon. l. c. vol. i. p. 323. (*L. virgatum* Walter, 1788, nec. L.: *L. satureifolium* fl. Mex. ined. sec. DC.: *L. Hyssopifolia* var. *virgultosum* DC. 1828: *L. alatum* var. *lanceolatum* Torr. et Gray, 1838–40: *L. Hyssopifolia* A. Rich. 1845; nec L.: *L. alatum* Hook.

1840, pro parte: *L. hyssopifolium* Curt. 1841: *L. alatum* var. *breviflorum* A. Gray, 1846: *L. breviflorum* Watson: ? *L. flagellare* Shuttlew.) From Carolina and Florida to Arkansas and Texas (also in New Scotland?), Mexico, Cuba, San Domingo. A very good species that may always be distinguished with certainty from *L. alatum*.

11. L. ALATUM Pursh, 1814: no. 70 of Koehn. Mon. l. c. vol. i. p. 324. (*Pythagorea alata* Rafin. 1819.) From Canada, Wisconsin, and Colorado (Denver), to Arkansas and Georgia. This species is by no means so variable as has been supposed. I could always distinguish it without any difficulty from all the other species enumerated in these notes.

12. L. CALIFORNICUM Watson, 1878; nec Torr. et Gray: no. 71 of Koehn. Mon. l. c. vol. i. p. 324. California, Napa Valley. It differs from the last in its linear leaves and larger flowers.

13. L. VULNERARIA Ait. ed. Schrank, 1819: no. 72 of Koehn. Mon. l. c. vol. i. p. 325. (*L. alatum* Sims, 1816; DC. 1828, pro parte; nec Pursh: *L. Kennedyanum* HBK. 1823: *L. alatum* var. Torr. et Gray, 1838–40, pro parte.) Philadelphia (cultivated?), St. Louis, Mexico. I do not understand how it is possible to mistake this excellent species for *L. alatum*. See its characters above in the analytical key.

14. L. SALICARIA L. 1753: no. 73 of Koehn. Mon. l. c. vol. i. p. 326. (The numerous synonyms of this species may be passed by.) From Canada and New Scotland to Delaware; in Europe, except the most northern parts; in Asia from a line drawn from Tobolsk to Sachalin and Japan southward to China, Thibet, Cashmir, and Persia; in Northern Africa (but not in Egypt); also in Eastern Australia.

V. CUPHEA P. Browne sens. ampl.

Dorsal lobe of calyx not longer than the ventral ones: calyx 6 to 9mm. long.
- Pedicels 1 to 2mm., rarely 4mm. long: leaves opposite: ovules 8 to 20, generally 14 or 15. — 15. *C. glutinosa*.
- Pedicels 5 to 15mm. long: leaves verticillate: ovules 3. — 16. *C. aspera*.

Dorsal lobe of the calyx much longer than the ventral ones: calyx 8 to 13mm. long: leaves opposite: ovules 7 to 13. generally 9 or 10. — 17. *C. petiolata*.

15. C. GLUTINOSA Cham. et Schl. 1827: no. 120 of Koehn. Mon. l. c. vol. ii. p. 148. (*C. hirsuta* Gillies ed. Hooker, 1833: *C. ingrata* var. *Platensis* St. Hil. 1833: *C. hyssopifolia* Griseb. 1874, pro parte, chiefly the var. *brachyphylla*.) From the interior of Bolivia to the Sierras Pampeanas in Patagonia, and to

Rio Grande du Sud, and Uruguay. I was greatly surprised to see specimens collected in 1884 by Mr. Langlois near Vermilionville in Western Louisiana, kindly sent me by Mr. Watson. They are quite identical with the ordinary South American forms, from which they differ only in the want of the small margin of the seeds; but this margin, that formerly seemed to me to be a section character, is often absent also in some species nearly allied to *C. glutinosa.*

16. C. ASPERA Chapm. 1865: no. 149 of Koehn. Mon. l. c. vol. ii. p. 161 and vol. iv. p. 400. St. Joseph, Florida. This species represents, geographically, a pendant to the preceding, for it belongs to the South American group *Oidemation*, which inhabits the extra-tropical parts of Brazil, Paraguay, and the northern parts of the Argentine Republic. It is very like the Brazilian *C. hyssopoides* St. Hil.

17. C. PETIOLATA Koehne: no. 178 of Koehn. Mon. l. c. vol. ii. p. 173. (*Lythrum petiolatum* L. 1753: *C. viscosissima* Jacq. 1772: *Lythr. Cuphea* L. fil. 1781, pro parte: *Silene axillaris* Leavenw. sec. Torr et Gray.) From Connecticut and Pennsylvania to Georgia, and from Missouri to Louisiana. Since Linnæus' son confounded this species with the subsequently distinguished *C. Balsamona* Cham. et Schlecht., and consequently said it was to be met with also in Brazil, all subsequent authors have made erroneous statements as to its geographical distribution. It inhabits only the United States from the region of the Mississippi eastward, and belongs to the very marked group *Heterodon*, which is exclusively Mexican or Central American.

It is not impossible that *C. Wrightii* A. Gray, a species nearly allied to the preceding and inhabiting Mexico northward to the Rio Grande, may be discovered in South-western Texas or in New Mexico.

VI. NESÆA Commers ed. HBK.

18. N. LONGIPES A. Gray, 1852: no. 306 of Koehn. Mon. l. c. vol. iii. p. 335. Western Texas and North-eastern Mexico. A very near ally of the West African *N. linifolia* Welw. ed. Hiern, and of the Australian *N. Robertsii* F. v. Muell., both of which are very similar to it. The genus *Nesæa* is probably the oldest of the whole order. It is nearly allied to *Ammannia*, from which it differs chiefly in the complete septa of the ovary, the septa of *Ammannia* being incomplete above the placenta.

Heimia salicifolia Link, that reaches the north of Mexico, may hereafter be discovered in New Mexico or Texas. *Heimia* is to be separated from *Nesæa*, although closely related, by the dehiscence of its capsule. The capsule of the former dehisces septicidally, while that of the latter opens by a little operculum and then slits septifragally but in a rather irregular way.

VII. DECODON Gmel.

19. D. VERTICILLATUS Ell. 1821: no. 315 of Koehn. Mon. l. c. vol. iii. p. 342. (*Lythrum verticillatum* L. 1753: *Anonymos aquatica* Walter, 1788: *Decodon aquaticus* Gmelin. 1791: *Nesæa verticillata* HBK. 1823.) From Canada and Wisconsin to Florida and Louisiana. *Decodon* could possibly be united with *Heimia* (but not with *Nesæa*), the capsule dehiscing in the same manner. Yet not only the different color of the petals and the different disposition of the flowers, but also the near relationship of *Decodon* and *Grislea* and *Adenaria* have decided me in keeping them separate. The relationship between *Decodon* and *Grislea secunda* Lœfl. is even greater than that between the former and *Heimia*.

EXPLANATION OF PLATE VI.—In all the figures *a* is the ovary stalk; *b*, the insertion of the calyx; *c*, the base of the ovary; *d*, the hypogynous fleshy ring; *e*, capsule valves; A, the calyx; B, the ovary; C, the lower part of the ovary.

Fig. 1. *L. lineare*, short-styled: Fig. 2. *L. album*, long-styled: Fig. 3. *L. ovalifolium*, long-styled: Fig. 4. *L. lanceolatum*, short-styled: Fig. 5. *L. alatum*, long-styled (C_1 the ventral, C_2 the lateral, C_3 the dorsal view, C_4 the longitudinal section): Fig. 6. *L. Californicum*, long-styled: Fig. 7. *L. Vulneraria*, short-styled (C_2 the longitudinal section, i· the calyx with dehiscing fruit).

Notes upon the Botany of the New Orleans Exposition.

BY CHARLES E. BESSEY.

The great Exposition at New Orleans has brought together a mass of material illustrating on a scale never before equalled the natural products, both vegetable and animal, of the United States and the countries adjoining. In all this there is much to interest and instruct the student of plants, and it will well repay our younger botanists to give this portion of the Exposition a week or two of observation. It is impossible, and indeed it is not advisable, to discuss fully the botany of the Exposition, but a few running notes may be of use to those who intend to visit New Orleans, at the same time serving as a summary record of the botanical results of this labor of the people.

In the government building many of the States have exhibits of botanical specimens, evidently extracted from the herbaria of colleges or of private individuals. With but few exceptions these are of such meagre proportions, and were selected with so little care, that they possess very little interest to the scientific student. In a few cases they were selected to illustrate the forest trees, or the grasses, which they fairly represent; but the wretched way in which they are shown, tacked to the walls, and entirely unprotectod from dust and injury from handling, detracts much from the pleasure one might otherwise have felt in examining them. And the labeling! who can do justice to it? Spelling, capitalization, and accuracy of identification are equally disregarded in some of the collections, even in some of those bearing college and university labels!

It is a pleasure to pass from the foregoing to what is without question the most interesting collection of herbarium specimens in the government building, viz., that of California—the work of the well-known botanist J. G. Lemmon. A thousand or more finely prepared specimens are mounted upon bristol-board, and each is enclosed in a light glass frame, the latter being arranged upon inclined frames, where they can be easily examined, or, if necessary, removed for closer study. The ferns of the Pacific coast constitute a striking feature of this collection.

There are many fine specimens of the woods of the northern, southern and western trees. Quite naturally these are pretty nearly confined to the trees of economic value; still one who is interested in the trees of the country can study with profit the wood of nearly every tree growing within the limits of the United States. The Southern States have excelled in this, having sent great truncheons often of the dimensions of logs. The only drawback to these wood collections is that of defective, not to say illiterate labeling, which is far too common.

The Department of Agriculture exhibits a large collection of colored drawings of the Fungi, the work of Dr. Thomas Taylor. While some of these are open to criticism, the collection as a whole is a very valuable one, and it is to be hoped that the department will provide for their early publication, accompanied by appropriate text furnished by some one of our specialists in the study of the Fungi.

Horticultural Hall is disappointing. There is not that variety of fruits which a visitor from the north might expect. Still the genus *Citrus* is well represented, and many a botanist from the Northern States will find it very instructive to spend some time in studying the many variations in the species of this genus. The collection of Cacti includes some striking plants, among which are half a dozen large Mexican specimens of *Cereus giganteus*, from a foot to eighteen inches in thickness, and from ten to fifteen or more feet in height. A dozen or more enormous plants of *Agave Americana*, from Mexico, have been hollowed out so as to show the secretion of juice which when fermented yields a favorite drink of the Mexicans.

In the main building there is little to attract the botanical student until he reaches the Mexican exhibit, which contains a collection of woods (not yet fully labeled) and a fine collection of seeds of economic interest. Some of the West Indian countries have similar collections of more or less value.

The exhibit made by Jamaica is well worth studying, and is full of interesting things. Thus may be mentioned fruits of *Anona*, *Persea*, *Myristica*, *Psidium*, *Achras*, and many others; woods of *Guaiacum*, *Cassia*, *Hæmatoxylon*, *Crescentia*, *Cinnamomum*, Rosewood (*Dalbergia*), Cedar (*Cedrella*), Satinwood (*Chloroxylon*), Lace-bark (*Lagetta*), Fiddle-wood, Bully-tree, Logwood, Braziletto, etc., etc. A collection of twenty-five economic products of the Cocoanut Palm gives one a little idea of the great value of this one tree to the inhabitants of the warm regions. The varieties of Coffee, Pimento, Cacao or Chocolate are well worthy of the attention of the botanist, as are also the large collections of fruits and seeds yielding spices and condiments, the collection of meals and starches, vegetable oils, dye-woods, medicinal products, and fibres.

GENERAL NOTES.

Notes on Forest Trees.—A careful perusal of Vol. IX of the Census Reports, devoted to a consideration of the forest trees of North America, has suggested the following notes upon the occurrence and distribution of some species. It is not intended to criticise that excellent report, but merely to give additional information upon the distribution and occurrence of forest trees in Arkansas, and to enumerate some species found in this State not mentioned in former notes.

Magnolia grandiflora probably is not indigenous to Arkansas. *Zanthoxylum Clova-Herculis* is common in low ground north of the Arkansas river in Arkansas. *Ptelea trifolia* was not included in former lists, as it is a shrub in this State, though quite common. *Ilex cassine* has not been mentioned in former lists by the writer, though credited to South Arkansas in the Census Report. It occurs in the mountains about Hot Springs, and is found on the tufa ledge deposited by the hot water. *Æsculus glabra* occurs as far south-west as the valley of the Red River in Arkansas. *Rhus venenata*, credited to South Arkansas in Census

Report, has not been rediscovered. We do not know the authority for its occurrence in Arkansas. Prof. Lesquereux admits it with an interrogation upon the authority of the people. We will be glad to add it to the list of Arkansas trees, upon good authority, regardless of its poisonous properties. *Cratægus spathulata*, Mx., occurs in the Arkansas River valley as far as the Indian Territory. *Cratægus cordata*, for some reason, was not credited to Arkansas, nor even to the west side of the Mississippi River, though common in North-west Arkansas. *Cornus asperifolia*, not admitted as a tree in Census Report, occurs in Central Arkansas in low ground, 0.14 meters in diameter, and has a well defined trunk, upright and 2 meters to the branches. *Myrica cerifera*, L., though not mentioned as occurring west of the Mississippi River, is common about Hot Springs in the mountains. It is a small shrub in this State. *Fraxinus quadrangulata*, said to occur in Arkansas at Du Voll's Bluff, upon the authority of Letterman. The writer reported it to the Census Department from that locality, but upon more careful examination found he was wrong. Mr. Letterman has not seen the species in Arkansas, but has found it in South-east Missouri, not far from the Arkansas line, and it, without doubt, will yet be found in this State. *Quercus aquatica* extends up the Arkansas River valley beyond the Arkansas line into the Indian Territory.—F. L. HARVEY, *Fayetteville, Ark.*

Nostoc and Penicillium in Na $C_2H_3O_2$.—Our chemist recently handed me a bottle containing a four per cent. solution of sodium acetate, in which there had developed an abundant plant growth of some kind. Grayish black flocculent looking masses were fastened to the bottom, and floating in the liquid (as if suspended) was an opalescent jelly-like mass extending nearly across the bottle, and having a flowing motion when disturbed. A microscopic examination revealed the fact that the latter was one of the *Nostocaceæ*, but with much smaller cells than any yet examined, and with heterocysts, if any, but little larger than the ordinary cells.

The grayish black hemispherical masses proved to be a species of *Penicillium*, but differing from any normal form. The medium in which it grew seemed to furnish it chance for a most rampant development. The conidiospores were regular and irregular, unusually Torula-like in structure, and were budding profusely as in the yeast plant. Single or double conidiospores were frequently seen sessile upon hyphal threads, without any interposed aërial hyphæ, and these also budding. The characteristic budding chains of the yeast plant were frequently to be seen arising from hyphal threads or supplementing a row of conidiospores. A medium so favorable for the development of these plants, and one so easily obtained should be of use in our laboratories.—JOE N. ROSE, *Botanical Laboratory, Wabash College.*

Abnormal Claytonia.—While botanizing to-day I found an unusual form of *Claytonia Virginica*, which illustrates what might be called condensed inflorescence. There were only two flowers in the raceme. The usual number is from ten to fifteen (more commonly twelve). The lower one had three sepals, which were twice as broad as in the usual form, eight petals, nine stamens (two opposite one of the petals), and a double pistil. The ovary was two-celled, placenta basilar but apparently attached to the partition, ovules six or seven in each cell. The upper part of the ovary was composed of small sacs opening into the common cavity. The apex of the ovules apparently projected into these sacs. A section near the top of the ovary had the appearance of being many celled. There were seven stigmas. The flower was larger than those of the normal form. The upper flower, which was in bud, had two sepals, seven petals, and seven stamens. The pistil, though small, was apparently normal.—F. L. HARVEY, *Fayetteville, Ark., April 12.*

New Species of Andropogon.—Prof. E. Hackel, who is preparing a Monograph of the *Andropogoneæ*, recognizes the following new species in the genus *Andropogon*, and publishes them with admirable descriptions in "Flora" (oder allgemeine botanische Zeitung) for 1885. Four of the species, as indicated in the list, are North American.

Sect. *Schizachyrium.*

1. Andropogon urceolatus.
2. A. nodulosus.
3. A. obliquiberbis.
4. A. Schweinfurthii.
5. A. cirratus. (Western Texas and New Mexico, nos. 804 and 2105, C. Wright. Silver City, E. L. Greene.)
6. A. imberbis.
7. A. gracilipes.
8. A. Cubensis.

Sect. *Heteropogon.*

9. A. leptocladus.
10. A. Bellariensis.

Sect. *Cymbopogon.*

11. A. diplandrus.
12. A. Barteri.
13. A. macrolepis.
14. A. cornucopiæ.
15. A. grandiflorus.

Sect. *Arthrolepis.*

16. A. longiberbis. (Florida, leg. Garber, Curtiss.)
17. A. Liebmanni.
18. A. Cabanisii. (Pennsylvania, Florida, leg. Cabanis—in Herb. reg. Berolin. Florida near Apalachicola, leg. Chapman.)
19. A. Bourgæi.
20. A. arenarius.
21. A. exaratus.
22. A. madagascariensis.
23. A. annuus.
24. A. longipes.

Sect. *Amphilophis.*

25. A. Wrightii. (New Mexico, no. 2104, C. Wright, 1851–52.)
26. A. asperifolius.
27. A. Hildebrandtii.

Sect. *Sorghum.*

28. A. bipennatus.

—F. L. SCRIBNER.

EDITORIAL NOTES.

DR. W. G. FARLOW is to give the fourth lecture in the course before the San Diego Society of Natural History, California.

MESSRS. C. R. AND J. H. ORCUTT will soon start on a botanical trip through Lower California, and Rev. E. L. Greene will explore the islands near the coast.

THE DEUTSCHE BOTANISCHE MONATSSCHRIFT, edited by Dr. Leimbach, has entered upon its third year enlarged and improved. It is an excellent local journal.

PROF. T. C. ARCHER, director of the Edinburgh Museum of Science and Art, and well known to American students as the author of a Handbook of Economic Botany, died on February 19.

HEDWIGIA comes to us enlarged, better printed and with a cover, and on the whole looking much like an American publication. We do not doubt that the high position it has held among cryptogamic journals will be proportionally advanced by this change.

THE UNIVERSITY OF NEBRASKA has made an appropriation of five thousand dollars for procuring apparatus and collections for its department of botany. It is needless to say that with such liberality Prof Bessey will soon have one of the best laboratories in the country.

THE AMERICAN ASSOCIATION for the Advancement of Science will hold its next meeting at Ann Arbor, Mich., beginning August 26. Special arrangements for the entertainment of the botanists have already been begun. Let those who contemplate attending prepare one or more well digested papers as a contribution to the success of the meeting.

IN THE LXXXIX. Bande der Sitzb. der k. Akad. d. Wissensch. I. Abth. März. Heft. Jahrg. 1884, Prof. E. Hackel of St. Pölten, Austria, describes the following new species of grasses, two of which, from Madagascar, form the proposed new genus *Pœcilostachys: Arundinellæ stipoides, Arthropogon stipitatus, Andropogon Hallii* (No. 651 Hall & Harbour Rocky Mt. coll. 1862.) *Stipa Regeliana, Pœcilostachys Hildebrandtii, P. geminata.*

PROFESSOR J. C. ARTHUR has been appointed botanist to the Geological and Natural History Survey of Minnesota, and will conduct the botanical survey of the State. This will include a study of the cryptogamic as well as the flowering plants, and is to be substantiated by a suitable herbarium. The work will extend through several years, and be terminated by the publication of final reports corresponding to those of the other departments of the survey.

IN ENGLER'S BOTANISCHEN JAHRBUCHERN (VI. Band 3 Heft. 1885) Prof. E. Hackel gives, in a paper of 15 pp., his elaboration of the *Gramineæ* collected by Dr. Naumann on the Expedition of Her Majesty's Ship "Gazelle." Six new species, one of which constitutes a new genus—*Anadelphia*—are proposed, viz., *Panicum tabulatum, Chamæraphis gracilis, Andropogon superciliatus, Anadelphia virgata, Agrostis paucinodes,* and *Chloris pallida.* The synonyms given and authorities quoted together with the numerous critical notes make this paper an especially valuable one to Agrostologists.

MR. MEEHAN, at a recent meeting of the Philadelphia Academy, displayed a specimen of *Cypripedium insigne* with spicate inflorescence. In addition to this there were other marked differences from the type in the structure of the flower, and Mr. Meehan suggested the thought that perhaps in some such way new species may have been formed, for the differences in these abnormal cases are sufficient to entitle to specific rank "if they were constantly produced in a separate state." The "if" is rather a large one in this case, but surely the method would have the merit of accounting for exceedingly rapid evolution.

MR. F. LAMSON SCRIBNER has published a revision of the North American *Melicæ* in the Proceedings of the Philadelphia Academy. The genus is divided into three sections, GLYCERIÆ (3 species), EUMELICA (8 species), and BROMELICA (4 species). The five new species proposed are (1) *M. Torreyana* (separated from *M. imperfecta* Trin.) from California, (2) *M. frutescens* from the same State, (3) *M. spectabile* (*M. bulbosa* of Bot. King's Exp. and Fl. Colorado), (4) *M. Californica* (*M. bulbosa*, Thurber, in Bot. Calif.), and (5) *M. subulata* (*Bromus subulatus*: *M. acuminata* of Bot. Calif.) *M. mutica*, var. *diffusa* is raised to specific rank as *M. diffusa*, Pursh. *M. Porteri*, Scribner, includes *M. mutica*, var. *parviflora* of Fl. Colorado, and *M. stricta* of Brandegee's Fl. S. W. Col. *M. mutica*, var. *glabra* of Gray's Manual is *M. mutica*, Walt. A full list of localities and collectors completes this excellent paper.

IN THE *Journal of Botany* for April Thomas Hick describes (with plate) protoplasmic continuity in *Fucaceæ*. *Ascophyllum nodosum* is the form chiefly described. All the methods of treatment are given so that confirmatory work is made very easy. In every case at the ends of the cells concerned there is an annular thickening on the internal wall, which is unlike the cell wall under the action of reagents, and seems to resist the action of the strongest acids and alkalies. Four types of continuity are given, viz., (1) the ring surrounds a comparatively wide and open pore, through which the protoplasm is continuous in a single thread; (2) a delicate diaphragm stretches across the space enclosed by the ring, and through this the protoplasm is continuous, as through a sieve plate, by a number of delicate threads (the commonest form); (3) like the second, except that the continuity is effected by a thin and delicate ribbon of protoplasm, which passes through a narrow slit in the diaphragm; (4) the diaphragm is complete except at the center, where is an extremely minute pore, through which a single delicate strand of protoplasm maintains the continuity.

CURRENT LITERATURE.

A Course of Practical Instruction in Botany; Part I. Phanerogamæ-Pteridophyta. By F. O. Bower, M. A., F. L. S., and Sidney H. Vines, M. A. D. Sc., F. L. S., with a preface by W. T. Thiselton Dyer. Macmillan & Co., London, 1885. 12°. 226 pp.

Ten years ago Huxley and Martin's Elementary Biology was published. It was the first laboratory manual of the kind, and the excellency of its conception is well attested in the numerous works after the same pattern which have since appeared. Up to the present these have been confined to zoölogy, although the model included botany also. The work before us belongs to this class of text-books, and, as we learn from the preface, its inception reaches back to Professor Huxley's own laboratory and methods, and even antedates his work. Mr. Thiselton Dyer was at that time giving instruction at what is now the Normal School of Science at South Kensington, and assisted in the preparation of the botanical part of Huxley and Martin's book. The methods which he found so valuable have been adopted by his successor, Mr. F. O. Bower, to whom, with the assistance of Dr. Vines, of Christ's College, we are indebted for the present work. Of the great value to both teacher and pupil of such a handbook, when well prepared, there can be but one opinion.

The work opens with sixteen pages on methods of preparing the material, followed by seven pages on reagents and twenty pages on the structure and properties of the cell. The remainder of the work, one hundred and eighty pages, is devoted to the study of types of phanerogams and pteridophytes. The student takes up the sunflower as illustrating in its seeds the dicotyledonous embryo, and in its stem the herbaceous type of structure, followed by the elm for the arboreous type, and the mare's-tail (*Hippurus vulgaris*) for the aquatic type. Sieve tubes are then examined in *Cucurbita* and *Tilia*, laticiferous vessels in the dandelion and *Euphorbia splendens*, followed by a study of leaves and roots. Corn is next used to illustrate the embryo and germination in monocotyledons and also for the herbaceous type of stem, yucca being used for the arboreous type, and is followed up by a study of roots and leaves. This brings us to the consideration of the reproductive organs of both classes, together with the development of the embryo. Beside the plants enumerated, some ten others are used in this part of the work to illustrate special features, or as preferable for certain parts; some of these are natives, some exotics. Passing to the gymnosperms, *Pinus sylvestris* is taken to show different phases of structure and development. In pteridophytes the following plants are used: *Selaginella Martensii, Lycopodium clavatum, Aspidium felix-mas* and *Equisetum arvense*. This closes the volume, which is but the first part of the projected work; the second part proposes to complete the types of the lower forms, and it is to be hoped will also supply an index.

The free use of unexplained technical terms, the skill required for some of the manipulations, and the use of the most complex types at the outset, indicate that the work is not intended for beginners. For those who have sufficient knowledge of the science to intelligently follow the directions, however, it will prove a great boon.

The method of paragraphing adopted permits of an easy handling of the subject. The student is directed to look at certain parts and is told some characteristic by which they may be recognized, while at the same time much information of a theoretical nature, points in homology, special methods of demonstrating a difficult feature, the suggestion of comparative studies, and various other helpful matters are interspersed. Reagents and the latest processes of staining are freely used. The interpretation of structure according to the most recent investigations, and a corresponding nomenclature, are items that will be highly appreciated by the progressive student.

This publication will enable English students to obtain a practical knowledge of the fundamental features of plant structure in accordance with latest views, and it is therefore a much needed work. But while the execution of the work as it stands is of the highest order, some doubt may be expressed regarding the desirability of starting out with the highest type of the vegetable kingdom, instead of progressing from the simpler forms upward. For advanced students, however, this is of little moment.

BOTANICAL GAZETTE.

VOL. X. JUNE, 1885. No. 6.

An Autobiography and Some Reminiscences of the Late August Fendler. I.

EDITED BY WM. M. CANBY.

Brief notices of the late August Fendler have appeared in several scientific periodicals, but scarcely such as so excellent a man and one so useful to science deserved. Feeling this, a fuller account, consisting of extracts from his correspondence and some personal reminiscences, was prepared by the writer. After this had been done, it was found that, at Prof. Eaton's suggestion, Mr. Fendler had written and sent to him the autobiography which has been kindly furnished, and is here given. The former account, revised and enriched with further extracts from his letters to Professors Gray and Eaton, is appended.

AUTOBIOGRAPHY.

August Fendler, the only child of Mathias Fendler, was born on the 10th day of January, 1813, at the town of Gumbinnen, in the most eastern part of Prussia. When he was about six months old his father, who by trade was a turner in wood and ivory, died. Two years later his mother married again. Little August's parents being possessed of but scanty means, could not do much for the boy in the way of education. Hence it happened that his school training was for a number of years confined to the most rudimental establishment, scarcely deserving the name of a school. When about twelve years old he was sent to the "Gymnasium," a kind of preparatory school for the University. Here he showed more aptitude for mathematics than for Greek and Latin, and after a term of four years his parents, becoming financially embarrassed, were obliged to take him from school. Being apprenticed to the town clerk's office, he soon found that the kind of writing to be done here was to him but a time and spirit-killing employment, during which the longing for a visit to foreign countries grew daily stronger.

At the end of his apprenticeship his first chance for traveling presented itself. He received an offer from a distinguished physician to accompany him in the capacity of clerk during a journey of inspection to be made with regard to the quarantine stations along the Russian frontier of Prussia, which the much dreaded cholera was then, for the first time, fast approaching in its westward course through Europe. F. accepted the offer most readily, and as the time of starting on this little trip was fixed upon for the next morning, he could not sleep an hour all night for excitement and joy. They had not been long on their journey when the physician received the alarming news that the cholera had already made its appearance in a large Prussian village on the frontier. To this point they hastened immediately. The cholera made sad havoc among the population of the village, and F. was soon surrounded by cholera patients, an unusually great percentage of whom died. The ravages of the cholera in this place finally abated, and F. went home.

He was now troubling his mind more than ever with the question what trade or occupation to choose that would give him a good chance for traveling. If he had but known that there was such an occupation as that of a collector of plants, and that from the sale of them he could clear his traveling expenses, how happy would he have been to prepare himself for it, the more so as he was fond of objects of vegetation. But no such information had ever reached him; he had seen no books describing the species of plants of any locality, and the schools had been silent on the subject.

Having a preference for a trade based upon chemistry, and having been assured that the tanning and currying trade was *the* one that would take him safely through all Europe and America, he became an apprentice to it, and during two years of steady hard work learned practically most of the various manipulations, disgusting though some of them are to most persons, and trying as they were to his rather slender and light frame of body. He got over all the objections in a most cheerful manner, looking constantly to the future chances for travel offered by his trade.

Meanwhile F. found out that there existed in Berlin a kind of Polytechnic school, the Royal *Gewerbe schule;* in which young artisans, who showed an ability for readily acquiring the physical sciences, were to receive not only free instruction, but likewise an annual stipend of three hundred thalers for three years. The candidates for these favors to be selected, after due examination, two or three from each province of the kingdom. Arrived at this school, the pupils found soon that the vigorous and rapid course of instruction tasked all their mental powers. A small proportion of their number only were able to avail themselves of the whole three years' instruction, all the rest being dismissed as unfit, either at the end of the first or second year.

In the fall of 1834 F. was admitted a pupil to the Royal *Gewerbe schule*, but the continued sedentary life, combined with the strain of mind in studying till late at night, told plainly that this mode of life did not agree with his health. Advised by his physician to desist from any further exertions at this school, he, at the end of the first year, asked for his dismission, which was granted, accompanied by a testimonial certifying to his "good and very good progress in all the various branches of instruction."

In the autumn of 1835 F., with knapsack on his back, started from Berlin in the capacity of a traveling artisan (*Handwerksbursche*), passing through parts of Silesia, Saxony to Frankfort, and down the river Rhine, working in several places at his trade, and finally going to Bremen. Thence early in the spring of 1836 he embarked for Baltimore, Maryland, where he arrived with only a couple of dollars in his pocket. In Philadelphia he worked in a tanyard for a few months, but found the work too hard, and after having visited the coal districts of Pennsylvania, he went to New York late in the fall and without money, friends, or employment at his trade, was obliged to go to work in a lamp factory and learn a variety of handicraft more agreeable to him than those of the tanyard. While at New York he witnessed the arrival of the first ocean steamers, the Sirius and the Great Western. They were side-wheel steamers, and were hailed most enthusiastically by the people of New York. The great money crisis and panic of 1837 depressed the lamp manufacturing business to such an extent that, one after another, all the journeymen of his shop, as well as the apprentices, had to quit. F. was the last one to leave his employer, until finally in the spring of 1838 the shop was shut up altogether.

F. having made up his mind to go to St. Louis, Missouri, the then "Far West," started as early as possible. The best and quickest route he could find at that time was the following: from New York up the Hudson river to Albany by steamer; then to Buffalo by canal, which took seven or eight days; thence by steamer to Cleveland, Ohio; thence by canal to Portsmouth, on the Ohio river; thence down the Ohio and up the Mississippi by steamboat to St. Louis. The whole journey from New York to St. Louis required thirty days, and at the most economical rate, by taking deck-passage on the steamers, could not be made for less than thirty dollars.

At St. Louis, which at that time had but 13,000 inhabitants, F. got employment as lamp maker with a man who had just commenced making spirit-gas for lighting public houses, as the manufacture of coal-gas had not reached so far west. F.'s wages were good, but getting dissatisfied with the poor tools and the cold and open room he had to work in at the approach of winter, he directed his thoughts towards the sunny South, and resolved to leave St. Louis about Christmas time in 1838. As all the river steamers were ice-bound, he took up his staff and knapsack, the same he used to carry in the old country, and crossing the Mississippi, he commenced his solitary walk through the then thinly settled forests of Illinois, the cane-brakes of Kentucky, and part of Tennessee, where he fell in with two other men bound for New Orleans. As no steamboats from northern ports had yet been able to break the great ice barrier below the mouth of the Ohio river, the three wayfarers joined in buying an old skiff, and in it floated down the great river. Towards evening the same day a steamboat, the first to break the ice, was espied by them coming down, was hailed, boarded, and the skiff abandoned.

Arrived at New Orleans, the talk about Texas induced F. to seek adventures still farther west. Embarked in a steamer and arrived at Galveston in January, 1839. Galveston island at that time contained about a dozen poor-looking houses scattered about its low and sandy surface. From Galveston he went to Houston, the capital of Texas. The government of Texas then granting to every immigrant a "headright" of 320 acres of public land, F. applied for one and received it, but in order to have it selected and surveyed he was required, well armed, to join the surveyors, in order to strengthen their party against any premeditated attack from the wild Comanches who, it was feared, might at any time pounce upon them. But having no rifle, he could not join the surveying party, and hence had to leave his grant of land unselected.

His stay of twelve months in Texas was full of exciting incidents. Having roamed, for the most part singly, the country as far as to the then uninhabited spot (soon, however, to be surveyed by order of the government) where now the new capital of Austin stands, and suffering from a severe attack of bilious fever, F. returned to the nearest settlement, and subsequently to Houston, just in time to be an unwilling witness to the dreadful and distressing sights of the unprecedented ravages of the yellow fever during a period of four months in the summer and fall of 1839. At last, dissatisfied with the country, nearly empty in purse, and broken down in health, he left for Illinois, where for some time he was engaged in teaching school.

Autumn in North America, and especially in the Western States, always presented more charms to F.'s mind than any other part of the year. Hence in 1841, when autumn winds began to scatter the falling forest leaves, he was seized with an uncontrollable desire for solitary life in the wild woods, removed from the haunts of man, in short, for the independent life of a hermit. In his search for a proper place, he came upon a little village called Wellington, situated on the banks of the Missouri river, three hundred miles above St. Louis. Here he learned that an uninhabited island, two and a half miles long, called Wolf's Island, not very far below the village, was at his service.

Without delay, F. packed his little baggage, including some bed-clothes and cooking utensils, a rifle, an axe and some books, in a canoe, also taking along some provisions, and started for his new home. This island was densely wooded with gigantic trees. On the lower part of it, farthest removed from the village, was an old, dilapidated log cabin, the former abode of some wood-choppers. The upper part of the chimney was gone, so that a tall man standing on the outside of it could look down inside upon the low fire-place, from the burrows of which wild rabbits popped forth at the approach of man; part of the roof was gone, and the door carried off. There was plenty of game, however, especially wild turkeys. These latter had chosen the island as a roosting place for the night and as a place of safe retreat in daytime when chased on the mainland by hunters. In a so-called "turkey-pen" they were easily entrapped, and thus an abundance of excellent food secured. To return the borrowed canoe to its owner and to make one of his own was his first aim. So he went to work at a big trunk of a prostrate tree, and with an axe shaped part of it into proper form of a light canoe eight feet long.

Removed from the crowd, the hum and strife of men, his pastimes consisted alternately in trapping, hunting, reading, musing and meditating, and on mild and sunny days in paddling up a placid arm of the river, then turning round lean idly back in his canoe, thus floating home again. Occupied in this way F. lived for about six months, enjoying the sweets of solitude with a satisfaction of inward peace of mind and bliss higher than he had expected—contented and happy as ever mortal man, similarly situated, can claim to be. His feelings of content would at times culminate into feelings of thankfulness, which then found vent in words akin to the soliloquy of Faust at his forest cave: "Spirit sublime! Thou unto me gav'st ev'ry thing I pray for."

Only once he met on the island with a human being, namely, with its owner, coming to see him. How long F. would have continued to live here is hard to say, if the great spring rise in the Missouri river, which began to overflow part of the island, had not taken place. When its waters rose to within a short distance of his cabin he thought 'twas time to leave, and entrusting himself and baggage to his frail canoe, was hurried along at no mean speed by the precipitate rush of the foaming and rapidly swelling stream. Dodging floating logs and broken ledges of ice, he expected every moment to be swamped by the high waves caused by a stiff breeze blowing up stream. To land his tiny craft amidst eddies and whirlpools at Lexington, ten miles below the island, was, however, the most perilous part of the venture.

In 1844 F. sailed for Europe on a visit home. At Koenigsberg he got acquainted with Ernst Meyer, Professor of Botany at the University, who first intimated to him that a certain number of sets of dried specimens of plants for the herbarium might be disposed of at a reasonable price, and advised him on his return to the Western United States to collect and send them on, for sale, to the Professor's address.

On his return to America and to St. Louis, F. assiduously began to collect plants, and took the different species to Dr. Engelmann, who furnished him with their scientific names. Different parts of the country, between Chicago and New Orleans, were visited by him for the purpose of collecting. Dr. Engelmann observing the zeal of F. for his new occupation, recommended him to Dr. Asa Gray in 1846, during the war between Mexico and the United States. The latter being about to send troops to Santa Fe, New Mexico, Dr. Gray furnished F. with a letter of recommendation from the Secretary of War, by means of which he got free transportation for himself, his collections and luggage. F. arrived at Santa Fe late in the fall of the year, when vegetation on the most interesting part of his route was already dried up. Collecting during the following spring and summer, he was, to his great sorrow, obliged to return to

St. Louis in the fall of 1847, his means of subsistence having become exhausted.*

In the spring of 1849 F. started on another collecting expedition over the western plains. This time he intended to visit the Great Salt Lake region. To him the year 1849 proved most disastrous, for in crossing the plains he lost, in the Little Blue river, by a flood that came suddenly upon him, all his drying paper, besides many other things needful on his intended tour, as well as his principal means of transportation, so that he was forced to wait at Fort Kearney for a chance to return to St. Louis. Arrived at the latter place, he found that all his worldly goods, all his collections, all his books, and worse still, all the journals of his travels had been destroyed by the great conflagration that, at the same time, laid the best business quarter of St. Louis into ashes during his absence.

At the close of 1849 F. embarked at New Orleans for Chagres, on the Isthmus of Panama, and after having collected for four months at and above the mouth of the Chagres river, went by the way of New Orleans to Arkansas, collecting plants during the summer at Camden, on the Washita river. The fall of 1850 found him settled at Memphis, Tennessee, introducing and carrying on for three years the camphene-light business in that town and collecting for his herbarium as time would permit. As soon as he found that the introduction of coal gas, in the fall of 1854,† made his camphene business unprofitable, he was on the move again and went by way of New York to La Guayra, Venezuela, then up to Caraccas, and after a few months stay in the latter place to Colonia Tovar, situated 6,500 feet above the sea. Here, unattended by any one in his four years' botanical rambles, he scaled the lonely crests and explored the hidden recesses of many a forest-covered mountain range, and through trackless wilds and along the margin of foaming rivulets gathered lots of Phænogamous plants, as well as Ferns, Mosses and Fungi. He also paid attention to meteorological phenomena, parts of his observations being printed in the annual report of the Smithsonian Institution for the year 1857.

Having returned to Missouri F. acquired, in 1864, near Allentown, a tract of land densely wooded, which, with the assistance of his half-brother, he began to clear and cultivate. Toiling here for seven years to improve his new homestead, he finally sold it, in 1871, and left for Europe in the spring following to pay once more a visit to his old home with a view to abide there. America, however, had taken too strong a hold on his affections, the more so as he had been for twenty-four years a naturalized citizen of the United States. He returned to its shores in 1873, and, after looking around for some time, settled at Wilmington, Delaware, which he intended to make his final and permanent home. Yet this was not to be. Fearful attacks of acute rheumatism, endangering his life, forced him, four years after, again to break loose and go in search of a more genial climate in more southern latitudes. In June, 1877, he landed in a feeble state of health at Port-of-Spain, on the Island of Trinidad, where he has been busy ever since in making collections of Ferns and Phænogamous plants, as well as Mosses.

*About this time (July 25, 1848,) we find the earliest letter to Professor Gray which has been preserved. It gives a pitiful account of his privations and losses, stating, among other facts, that his brother had been obliged to enlist in the army on account of poverty. Later in the year he wrote again, proposing, if proper pecuniary encouragement was secured, to make a collecting tour on the Isthmus of Panama and in California. No arrangement was made, however. In a letter dated August 11, 1853, he states that many of the sets of his Santa Fe collections, which had been sent to Europe, were still unsold. Professor Gray's classic *Plantæ Fendlerianæ* has long since made these invaluable, and many botanists would gladly purchase them now.

†This date should be 1853, as we find by his letters that he left Memphis on the 16th of November, 1853, and on December 24, of the same year, sailed from New York for Venezuela. The extracts from his correspondence given hereafter illustrate his life at this and subsequent periods.

His notes and observations on botanical subjects are scattered in letters to his correspondents. Besides Botany, Meteorology is one of F.'s favorite studies, and wherever he resided, since 1849, he made daily observations with regard to it.

While at Wilmington F. published a little work entitled "The Mechanism of the Universe," and also translated Goethe's "Faust" from the German original into the English language. This translation is yet in manuscript form.

The Myxomycetes—their collection and preservation.

BY GEO. A. REX.

In the increasing interest manifested by American botanists in the study of mycology, the curious and anomalous Myxomycetes, or slime moulds, have not received the attention which they merit. The study of this border-land group will amply repay those who undertake it, for not only the wonderfully interesting life history and development, but the exquisite structural beauty also, of the matured sporangia of many of the orders, render them objects of peculiar interest.

The true position of the Myxomycetes is yet a disputed point with biologists, but systematic botanists will probably continue to claim them in the future, as in the past. Until the appearance of the monumental monograph of Rostafinski, the scattered and inaccessible literature, and above all the exceedingly meagre descriptions of the older botanists, rendered the determination of species almost impossible without a reference to the scattered types, which were still more inaccessible. Necessarily there was excessive reduplication of species, which is curiously illustrated in the Monograph, by the pages of synonyms of even some of the commoner species.

This difficult work of determination is now rendered easier by later and more accessible literature, especially by Cooke's translation from Rostafinski, of the British Myxomycetes, of which at least seventy-five species are also found in the United States.

It is not the intention of this paper to discuss the origin and developmental history of the plants or the plasmodium from which they are differentiated, but simply to suggest a study of interest to those whose limited time creates a necessity for specializing their work.

In the proper season in favorable locations, there may be seen ramifying on the surface of moist, decaying logs, for example, patches of a semi-fluid slime or plasmodium, varying in size and in color from white or whitish grey to the deepest orange. If kept under observation, these masses will be found to be mobile, changing their position with a constant, ever varying current, until the conditions are favorable for the differentiation and formation of the mature plants. In some cases this maturation is accomplished with wonderful rapidity. I have seen a network of the rich yellow plasmodium of *Physarella mirabilis* covering a superficial area of two or three square feet of log surface, which developed in a single day its myriads of matured plants. The moist tan bark of the tan pits, masses of decaying leaves and herbage and decaying wood or vegetable material of any description, are the favorite places of development for the plasmodium, whence it flows over adjoining moss, leaves, growing plants and exceptionally even over moist rock and metallic objects. The vagaries of this mobile mass sometimes produce curious results. I recall an instance in which the plasmodium of *Diachea leucopoda* crept up a clump of blackberry stems to a foot in height and thence upon the radiating threads of a spider's web suspended between them, where it matured its exquisite sporangia.

With certain precautions these plants are neither difficult to collect nor preserve.

The question how and where to collect seems a simple one, and yet probably the experience of every mycologist teaches that no season or even collecting tour passes by without the acquisition of new facts in the ways and means of collecting. In this pursuit the "unexpected" is constantly occurring. Our most valued "finds" may occur in places which set our previous experience at defiance. These organisms are emphatically the creatures of warmth and moisture, and they may be found in any suitable locality which furnishes these requisites.

Generally stated, low damp copses, dense shady forests, glens in mountain forest regions, and the banks of brooks and streams are favorable collecting grounds in the proper season.

On account of the fragility of many of the species, the question of transportation and preservation is as important as that of collection. Of course many of the specimens may be wrapped in paper as other fungi, and carefully packed in the field, without destroying their scientific value, although broken by the process, but for other forms other means must be adopted.

The ingenuity of the botanist will readily suggest a safe means of transportation for the tender species, yet I may be pardoned for suggesting a simple method by which even the most fragile Cribrarias which a rude breath will crush, have safely borne the jolting of Adirondack corduroy roads and the manipulations of the railroad baggage fiend.

For transportation I use pasteboard boxes, which may be of any convenient size (mine are $1\frac{1}{2}$ by 3 inches), made with a deep lid and a stiff base, with simply a shoulder or shallow rim around it, high enough merely to serve as a bearing for the lid. The wood or other material bearing the specimens can be placed upon this base, held in position by light rubber bands, and the lid placed over all.

For herbarium preservation the Myxomycetes, after a thorough drying, should be placed in shallow boxes, which can then be arranged in the herbarium according to the general plan adopted by the individual botanist. Neglect of this simple precaution, originally, has caused the total loss by crushing of many of the type specimens in the Schweinitzian collection in the herbarium of the Academy of Natural Science of Philadelphia. It is also of great advantage to have these species boxes so arranged that they may be easily removed if required for study or comparison, to the stage of a microscope, where they may be examined by the aid of a condenser or a parabolic reflector. This simple method of study by reflected light not only facilitates comparison of stages of maturity and phases of variation of this very variable group, but is really essential as an aid to the determination of many species.

Few of the lower orders of plants equal these in beauty as microscopic objects, whether viewed in their entirety with the binocular or in their structural details with high powers. Some genera, as *Diachea* and *Lamproderma*, display a brilliant metallic or iridescent lustre of the sporangia walls. Others, of the *Physaraceæ* are characterized either by snowy crystals or highly-colored granules, orange, scarlet, lilac, or purple, of calcium carbonate. Still others, of the *Trichiaceæ* and *Arcyriaceæ*, by their beautiful spore and thread-markings and sculpturing, are worthy objects for the use of the higher lenses of the microscope.

The limited areas of our country which have been subjected to mycological search have been found rich in Myxomycetes, and our list of American species can and will undoubtedly be yet enriched with both new and rare forms as the large unexplored districts are examined by students.

In Fairmount Park, Philadelphia, eighty species have been found, and each year adds to the number. This result in so comparatively limited an area, simply shows what may be done in other favorable localities with a little faithful and systematic work.

According to Rostafinski (Supplement to Monograph) 229 species in all are known to science. There have been found, up to the present time, about 180 species within the limits of the United States, including a number of yet unrecorded species and omitting the uncertain or duplicated Schweinitzian species.

The physiological literature of this group has been recently enriched by "Die Pilzthiere oder Schleimpilze" of Zopf, which, with De Bary's Mycetozoa, epitomizes the latest knowledge of the subject.

For systematic study the "Monografia Sluzowce" of Rostafinski (in Polish) is exhaustive, but practically inaccessible to students in general. The ground, however, is largely covered for American students by the "Myxomycetes of Great Britain" (Cooke); the "Myxomycetes of United States" (Cooke); a list of all recorded American forms compiled from all published sources to the date of publication (Annals of New York Lyceum of Nat. Hist , 1876); the "New York State Reports" (Peck); and "Grevillea."

Notes on Carex.—IV.

BY L. H. BAILEY, JR.

1. CAREX TRICHOCARPA, Muhl., Gram. 257 (1817). Culms slender, 2 or 3 feet high: leaves narrow (2 to 3 lines wide), long pointed, scabrous, the sheaths smooth: staminate spikes two or three together on a slender peduncle 2 to 5 inches long, their scales appressed, obtuse or nearly so, usually erose: pistillate spikes cylindrical (about 2 inches long and 4 or 5 lines wide), mostly loosely flowered towards the base, the lower on exserted stalks: perigynium setose-hairy, conspicuously marked with ridge-like nerves, broadly ovate at the base, tapering rather abruptly into a cylindrical beak which is tipped by nearly upright teeth a line long, twice or more the length of the ovate scale.—Moist or wet grounds throughout the Northern States east of the Mississippi. A form with nearly lanceolate perigynia and shorter spikes from New York is the var. *turbinata* of Dewey, Sill. Journ. xi. 159 (1876).

Var. IMBERBIS, Gray, Man. 5th ed. 597 (1867). Perigynium smooth, teeth usually shorter, pistillate scales longer and sheaths scabrous.—New York, *Sartwell*, to Illinois, *S. B. Mead*, *E. Hall*.

Var. DEWEYI. Staminate scales very acute, mostly loose:

pistillate spikes rather thick (1 or 2 inches): perigynium very smooth, usually somewhat polished, rather coriaceous, the nerves not conspicuous, ovate-lanceolate and rounded, the teeth mostly short, usually a little rough: scales very acute, about the length of the perigynium.—*C. læviconica*, Dew., Sill. Journ. xxiv. 47 (1857). Big Sioux and Yellowstone rivers, *Hayden*, Bismarck, Dakota, *A. B. Seymour*, 1884, and northward. Very variable; the typical forms are slender with short pistillate spikes and short erect teeth, but they connect themselves in various ways with

Var. ARISTATA. Culm 2 to 4 feet high, mostly stout and often spongy below: leaves broad (4 to 6 lines), their under surface as well as the sheaths loosely hairy: staminate spikes more remote or often numerous and aggregated, their scales awl-pointed and more or less spreading: pistillate spikes usually thick, attenuated below: perigynium smooth, ovate-lanceolate, conspicuously nerved, terminating in very long (2 or 3 lines) awl-like mostly widely spreading teeth: scales awl-pointed, the lower often exceeding the perigynium.—*C. aristata*, R. Br. Narrative Frankl. Exped. Append. 764 (1823); *C. orthostachys*, C. A. Meyer, Fl. Alt. iv. 231 (1833); *C. mirata*, Dew., Wood's Bot. 593 (1848). Generally distributed from New England and Canada to Oregon, and far northward.

The characters of the plants here combined are so inconstant as to invalidate all specific distinctions and even to obliterate any marked varietal limits. Ordinarily the perigynia of *C. trichocarpa* are hairy and the sheaths smooth, while the perigynia of var. *aristata* are smooth and the sheaths hairy. These differences are entirely inconstant, however, so that all degrees and conditions of hairiness are found. The shapes of perigynia vary as widely as the pubescence.

2. C. VERRUCOSA, Muhl., Gram. 261 (1817) (*C. glaucescens*, Ell., and *C. verrucosa*, Ell., Chapm. Fl. 542). Of the species which has gone under the name of *C. glaucescens*, Ell., there are two forms, one characterized by a single and rather long-stalked staminate spike and drooping pistillate spikes, and the other by one to three short-stalked staminate spikes and the upper pistillate spikes erect. The first form was first described by Muhlenberg as *C. verrucosa* in 1817 and in 1824 by Elliott (Sketch Bot. S. C. and Georgia, 553) as *C. glaucescens*. The form with shorter stalks and more erect spikes is described by Elliott (l. c. 555) as "*C. verrucosa*, Muhl.?" The two forms are not sufficiently distinct to merit even a varietal separation. They were united by Dr.

Boott, who used the name *C. glaucescens*, as later writers have done. The priority of Muhlenberg's name does not appear to have been noticed. Var. *androgyna*, Curtiss, Sill. Journ. xliv. 84, is a form with androgynous terminal spike, "flowering in October, quite polymorphous." Var. *polystachya*, Curtiss, Sill. Journ. vii. 410, is a small and polystachyous autumnal form "apparently produced by having been cropped early in the season by cattle." These varieties are merely occasional forms. Otto von Bœckeler in Linnæa, xli. 292 (1877) refers the species to *C. Brasiliensis*, St. Hilaire, a later and apparently distinct species. Margins of ponds, mostly in pine barrens, Virginia to Florida and Texas.

3. C. CRINITA, Lam. This plant grows from Canada to South Carolina and Texas. It is widely variable in the size of all its parts. The only form which appears to possess characters of any permanence is the var. *gynandra*, which is distinguished by rough sheaths, more loosely flowered, pistillate spikes and stouter scales. *C. Mitchelliana*, Curtiss, Chapm. Flora, 536, is a form with an androgynous terminal spike. Olney in his Exsiccatæ quotes *C. Caroliniana*, Schw. An. Tab., as a synonym of one form of *C. gynandra*, but I can trace no resemblance to any form of *C. crinita* in Schweinitz's key which leads to his *C. Caroliniana*. The synonomy of the species, so far as I know it, may be arranged as follows:

C. CRINITA, Lam., Dict. de Bot. iii. 393 (1789).
  Var. *paleacea*, Dew., Sill. Journ. x. 270 (1826).
  C. Mitchelliana, M. A. Curtiss, Sill. Journ. xliv. 84 (1843).
  Var. *minor*, Boott, Ill. i. 18 (1858).
  C. Porteri, Olney, Exsicc. (1871).
Var. GYNANDRA, Schw. & Torr., Monogr. 360 (1825).
  C. gynandra, Schw., An. Tab. (1824).
  C. gynandra, var. *Caroliniana*, Olney, Exsicc. (1871).

4. C. HIRTA, L. Resembles *C. Houghtonii* and *C. trichocarpa*, but differs in its very remote and smaller pistillate spikes and its loosely hairy perigynia, sheaths and leaves.—Introduced from Europe. Ashland, Mass., 1877, *Thos. Morong*; in ballast, Philadelphia, 1880, *F. L. Scribner*; and about Boston, *Wm. Boott*. Mr. Morong writes me as follows in regard to this species: "I have collected it for several years in succession. I first found it by the roadside in rather low lands and afterwards in yards around dwellings, among grass. I presume from these situations that it must have been introduced into this locality."

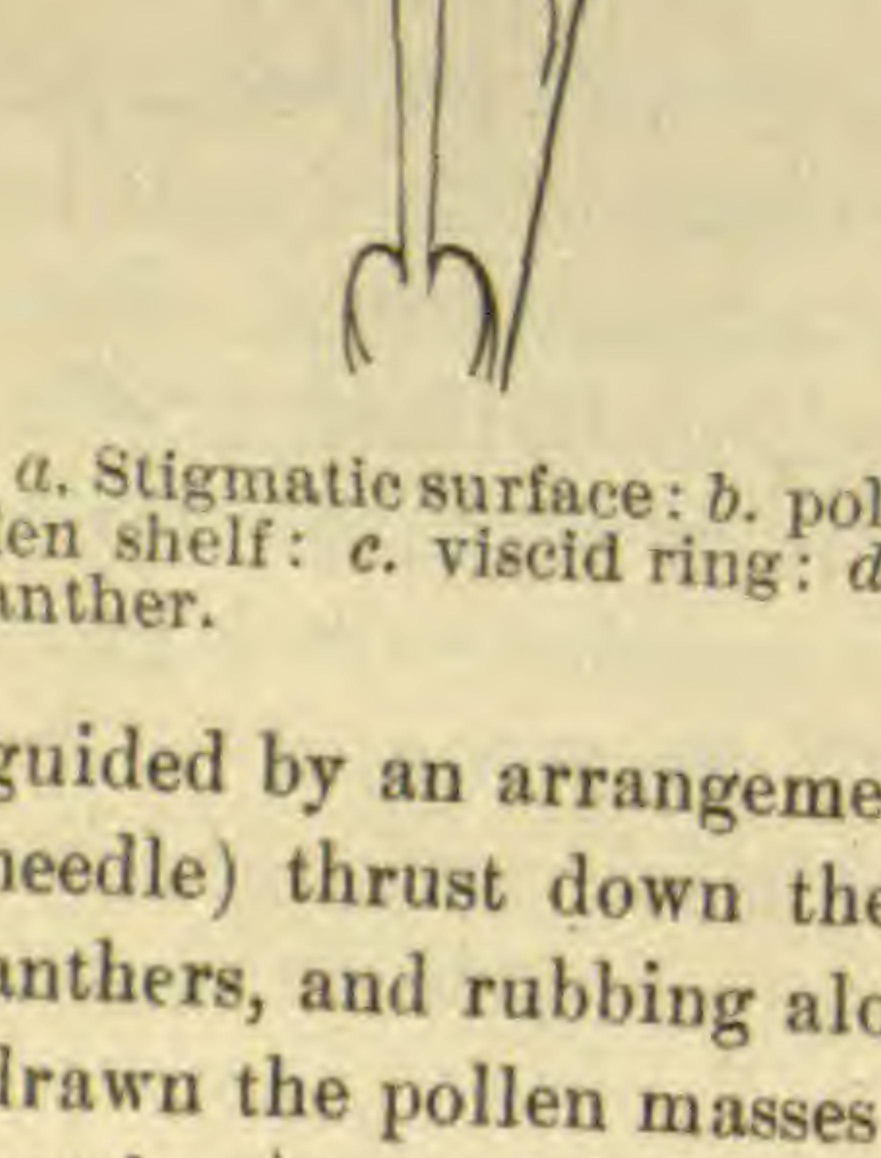
5. C. GRAYI, Carey, is sometimes found with hispid per-

igynia. Specimens from Athens, Ill. (*E. Hall*, 1861), and from Prof. Babcock, Ill., in Herb. Olney, are very sparsely hispid-hairy. Specimens from Greene county, N. Y. (*E. C. Howe*, 1869) are conspicuously so. Dr. Chapman finds similar specimens at Rome, Georgia. The species occurs as far east as New Jersey.

GENERAL NOTES.

Some Abnormal Rudbeckias.—While botanizing in Central Arkansas last summer, my attention was called to a patch of *Rudbeckia hirta*. There were about 50 plants in bloom, and in at least half of the heads more or less of the ray flowers were quilled. Sometimes only one ray in the head was abnormal; in other heads several, and in quite a number of heads all the rays were quilled. Normal and abnormal heads occurred on the same plant. Some of the plants bore several heads, all of which were abnormal. The abnormal flowers were generally shorter than the normal. There was a great difference in the amount of quilling even in the same head, varying from a mere ring at the base to a tube extending nearly to the top. The end of the ray was usually two-toothed, as in the normal form. The plants were normal in height and had faultless stems and leaves. I am unable to account for this general teratological display, or to assign a reason why normal and abnormal plants were growing side by side, much less to account for normal and abnormal heads occurring on the same plant.—F. L. HARVEY, *Fayetteville, Ark.*

Cross-pollination in Vinca minor.—Le Maout and Decaisne say that in *Vinca minor* the "pollen is granular, applied directly to the stigma." From the abundance of well-protected nectar, and the elaborate arrangement of parts in the neighborhood of stigma and anthers, cross-pollination seems at least to be the presumption. The accompanying figure shows the relations of the parts concerned. The pollen falls from the whole anther in a single mass (a habit becoming much more decided in the allied *Asclepiadaceæ*) upon the edge of the pollen shelf (*b*). Often the five masses of pollen are found lying upon this shelf at the same time. The outer face of the shelf (*c*) is very viscid. Although the anthers (*d*) extend well up toward the stigmatic surface (*a*), the pollen masses are guided by an arrangement of hairs down upon the disk below. A proboscis (or needle) thrust down the line of the nectar guides passes between contiguous anthers, and rubbing along the viscid ring becomes so smeared that when withdrawn the pollen masses lying upon the edge of the shelf are also withdrawn, not in a mass, but broken up into a line of pollen grains. Every insertion of a



a. Stigmatic surface: *b*. pollen shelf: *c*. viscid ring: *d*. anther.

needle shows a line of pollen stuck fast to it. By the same thrust any adherent pollen is rubbed off upon the stigmatic hairs above. We have thus a neat arrangement by which the proboscis is smeared with a mucilage just before it reaches the pollen grains.—W. E. HUMPHREY, *Botanical Laboratory, Wabash College.*

A New Grass.—DEYEUXIA MACOUNIANA. Culm 60 to 90cm. high, slender, leafy: sheaths mostly as long as the internodes, smoothish; ligule about 2mm. long, lacerate; leaf-blades narrow, 15 to 25cm. long, attenuated to filiform point: panicle 10 to 12cm. long, narrow, open, 2 to 4cm. in width, branches mostly in fives, approximate, slender, erect: spikelets somewhat crowded on the upper part of the branches, 2mm. long: empty glumes nearly equal, purplish, lanceolate, acute, finely scabrous on the back: flowering glumes 1½mm. long, ovate-oblong, somewhat truncate and 2-lobed at the apex, the lobes finely denticulate; awn above the middle of the glume, straight, reaching to the apex: palet about one-third shorter than its glume, bifid, denticulate at apex: hairs copious, as long as the flowering glume.

The panicle resembles that of *Agrostis vulgaris*, and the flowers are smaller than those of any other of our species.

Collected in the N. W. Territory, British America, by *J. M. Macoun*, for whom it is named.—GEO VASEY.

EDITORIAL NOTES.

PROF. DR. J. ROEPER died at Rostock, Germany, on March 17, aged 84 years.

DR. AND MRS. GRAY have returned in good health and spirits from their western trip.

J. C. DÖLL, author of the Flora of Baden, died at Karlsruhe, Germany, on March 10, at 77 years of age.

PROF. PLANCHON, of Montpellier, has received the De Candolle prize of 500 francs for his memoir on the *Ampelidees.*

DR. JOHAN GRÉSZ, author of a work entitled *De Potentillis Hungariæ*, died on February 19th, at Csáktornya, aged 72.

IT SEEMS THAT holly leaves above the reach of cattle often lose their leaf spines; which is on a par with *Polygonum amphibium* developing pubescence when lacking isolation by water.

A WELL ILLUSTRATED article, by Rev. J. L. Zabriskie, on some Ascomycetous fungi, which grow out from caterpillars, grubs and scale insects, is given in the April number of the *Journal of the N. Y. Microscopial Society.*

PROF. F. L. SCRIBNER, formerly of Girard College, has been appointed assistant botanist to the Department of Agriculture, and will devote his attention chiefly to microscopic fungi, especially those affecting and injuring cultivated plants.

MR. F. O. BOWER, lecturer on botany at the South Kensington Normal School of Science, has been called to the chair of botany in the University of Glasgow, made vacant by the recent resignation of Prof. Bayley Balfour.

DR. GIACOMO BIZZOZERO, of the Botanical Garden of Padua, Italy, and assistant in the Botanical Institute of the same place, died recently. The last volume of his Flora Veneta Crittogamica, for which he had the material prepared, will be issued under the charge of Prof. Saccardo.

MR. JOHN ROBINSON has prepared an extract from Professor Sargent's Forestry Report, showing the distribution, uses, specific gravities, strength, etc., etc., of the native woods of Essex county, Mass. The specimens were furnished by the Peabody Academy of Science, in whose reports this paper is printed.

THE THIRTY-SEVENTH ANNUAL REPORT on the N. Y. State Museum of Natural History for the year 1883 has been issued, but includes the introductory part only of the botanist's report by Mr. C. H. Peck. We learn that it is the intention to issue the full report of the botanist in the form of a separate bulletin.

FASCICLE II of American Medicinal Plants, published by Bœricke & Tafel, of Philadelphia, has appeared. It is as elaborate as the other, with colored plates of plants, drawn from life by Dr. C. F. Millspaugh. This fascicle contains thirty plates, some of which are poor and others good, and ranging from *Hepatica* to *Equisetum*.

THE PROCEEDINGS of the Philadelphia Academy for the first quarter of 1885 contains Dr. Rothrock's paper on the internal cambium ring in *Gelsemium sempervirens*, Prof. Meehan on spicate inflorescence in *Cypripedium insigne*, and Mr. Scribner's revision of North American *Melicæ*, all of which have already been noticed in these pages.

THE ENUMERATION of the North American *cercosporeæ* with descriptions of the species by J. B. Ellis and B. M. Everhart, which has been running through several numbers of the *Journal of Mycology*, is brought to a close in the May number. It comprises 116 species on 122 hosts, and is a valuable contribution to the aids for study of this difficult group of plants. We hope it may be followed by a similar treatment of other genera.

MR. JAMES N. BISHOP, of Plainville, Conn., has published a catalogue of the phænogamous plants of his State, which appears to be the first attempt of the kind. Of course we are all familiar with the excellent Berzelius catalogue of Yale College, and it is somewhat of a surprise that a State catalogue has not before been attempted. Mr. Bishop neither numbers his species nor gives the totals, so that we are unable to contrast the display with that in other States.

IN THE CURRENT NUMBER (April) of the *Nuovo Giornale Botanico Italiano*, Prof. Danielli gives an exhaustive study of *Agave Americana*, L., accompanied by seven plates, chiefly illustrating its histology. The paper is not only interesting in itself, but also as illustrating the multitude of subjects a single species suggests. In this case we have first a bibliography of the species, arranged by centuries, extending from 1533, and referring to 177 works. This is followed by the detailed history, description, synonymy, varieties, etc., and then the biology, morphology, and histology of each organ. At last geographical distribution is given, and uses, the latter subject being, as usual, a surprise to one not acqainted with the facts. Such papers should encourage our younger botanists, who are too apt to think that all important botanical work has been done.

DR. GEO. VASEY has issued a new and revised edition of his "Descriptive Catalogue of the Grasses of the United States." It contains several new genera and about one hundred new species. The synopsis of tribes and generic descriptions have been very much improved. No region of botany contains a more vexed synonymy, or is troubled with a greater diversity of opinions in regard to affinities, but Dr. Vasey and Prof. Scribner have gotten them well in hand and promise eventually to straighten them out.

TERATOLOGY is a great study for those who can find much in it. A certain professor who will read this used to tell us that monstrosity was from *monstro*, meaning something pointed out, demonstrated. We grant the aptness of the definition, for morphological positions are in more cases than one propped up by teratology. But a set of the average "teratological notes" always reminds us of a "side-show museum," containing a three-legged calf, a double-headed rooster, and a man with six fingers.

A NEW COMMISSIONER of Agriculture brings to mind the nature of the work done by that department, generally followed by a thought concerning the work not done. The GAZETTE has been very abstemious in its remarks in this direction, but it imagines that the time for distributing seeds is about over, and the department is to enter upon a higher grade of work. There are many living questions in botany which demand investigation. Of course all physiological experiments find their proper relations in agricultural work, especially those relating to germination, but the crying need just now is for a general and systematic study of parasitic fungi. We have specialists fitted for the work, and it should be undertaken, not by one man, but by a commission resembling the entomological commission. It is to be hoped that the coming Congress will pay some attention to the memorial from the American Association, which should be more vigorously pressed at the Ann Arbor meeting.

THE PROCEEDINGS of the fourth and fifth meetings of the society for the promotion of agricultural science, which have just been issued, form a volume of 95 pages, with a strong botanical coloring. It opens with a paper by Dr. E. L. Sturtevant on Agricultural Botany, advocating the importance of considering the influence exerted by man in controlling variation as the key to the classification of cultivated plants. The value of leaves as an agent in promoting the growth of the plant is discussed by J. J. Thomas. A paper by Dr. W. G. Farlow on the *Peronosporeæ* has already appeared in this journal. The remaining botanical papers are Bearing of Plowright's discovery as to the germination of rust spores upon the problem of wheat growing in the Northwest, by Prof. C. E. Bessey; a tomato disease, by Prof. B. D. Halsted; the vitality of seeds, by Prof. W. J. Beal; agricultural grasses of central Montana, illustrated, by F. Lamson Scribner; a list of cultivated food plants, by Dr. E. L. Sturtevant; and lecture on agricultural investigations, by Dr. J. H. Gilbert.

THE GAZETTE wishes to make an appeal to botanists in behalf of the meeting at Ann Arbor next August. Arrangements for the summer are now being made, and if it is within the bounds of possibility every botanist should lay his plans so as to devote a week to the American Association. A delightful place of meeting and one easy of access will bring a large attendance of the general association, and botanists should be well represented. The vigorous botanical club, now two years old, forms a great attraction, with its informal confabs, fraternal excursions, and general and hearty good fellowship. But for the credit of botany, before the biological section and the general association, we must protest against the customary practice of botanists, which is to have no paper, or something which would be better unsaid. The disjointed twaddle which so often offends the section, if it must be said, should be reserved for the privacy of the botanical club, which will guard its own family secrets. Every botanist should prepare a brief paper, as compact as possible, and to secure exactness and save time, it should be *written and read*. This thing of talking in a maudlin way for half an hour, when the same thing can be said a ten-fold better way in a ten minute paper, is simply an outrage on a long-suffering section. We grant that papers are rather an excuse for getting together in a social way, but object to such a lame excuse.

CURRENT LITERATURE.

A Guide for the Microscopical Investigation of Vegetable Substances; from the German of Dr. Julius Wilhelm Behrens: translated and edited by Rev. A. B. Hervey, A. M., assisted by R. H. Ward, M. D., F. R. M. S. Pp. xv, 466. Boston: S. E. Cassino & Co. 1885.

During the two years in which Behrens's "Hilfsbuch" has been before the German-reading public, its merits have become so well known that there is need in this notice only to say a few words concerning the translation which, so long promised, has at last appeared.

The first glance at the book is very disappointing, because it shows a work elaborately bound, printed on stiff, heavy paper, and therefore utterly unsuited, as far as the publisher's skill can make it, for a "guide," the necessary idea of which is that it is to be always at hand and *convenient* for reference and study. Messrs. Cassino & Co. have published a number of valuable books within a few years, on which an almost universal criticism has been that they were not gotten up in a style suited to the subject matter of the book. This has been notably the case with Brooks's Invertebrate Zoology, Trelease's (Poulsen's) Botanical Microchemistry and Penhallow's Vegetable Histology. The present volume adds another to the list. When will publishers learn to adapt binding and paper to the book and cease to sacrifice the book to binding and paper?

The work of the translator has been well done: the only criticism that is to be offered is that there has been unnecessarily close adherence to the German idioms—a fault, however, which interferes only with the smoothness of the English and for which the translator begs pardon in advance.

The work of editing has been too thoroughly done: indeed so many have been the interpolations and changes that were it retranslated Dr. Behrens would hardly recognize his own book. In some instances the additions have been valuable; in others they have been unnecessary, and injudicious in so far as they increase the cost and size of the book without correspondingly increasing its value.

To those not familiar with the work, it may be said that the most valuable part of the book to botanists is the last three chapters, which treat respectively of the preparation of microscopic objects, microscopical reagents, and the microscopical investigation of vegetable substances. Of these three, the last is especially important, not only because of the text itself, but by reason of the very complete bibliography which accompanies it.

Notwithstanding the sins of omission and commission on the part of the publishers and the high price of the book, it is one which every botanist engaged in histological work ought to have at his hand.

Catalogue of the Flora of Noble County, Indiana. By W. B. Van Gorder. Pp. 52. The author, Rome City, Ind., 1885.

We have in this catalogue the first attempt to get together a list of the flora of Noble county, and though necessarily incomplete, is a move in the right direction. No State east of the Mississippi river has had so little published in regard to its flora; a condition of things that sadly hampered the authors of the catalogue of the flora of the State when getting together their list in 1881. Mr. Van Gorder has been an assiduous collector, and in three years has added nearly thirty species to the list of the State, all from two or three of the northeastern counties. The present catalogue is creditable to his energy and zeal.

ROSE ON SPIROGYRA.

BOTANICAL GAZETTE.

VOL. X. JULY, 1885. No. 7.

An Autobiography and Some Reminiscences of the Late August Fendler. II.

EDITED BY WM. M. CANBY.

Let us now give, by extracts from his letters, a fuller account of his life in Venezuela. In a letter written to Dr. Gray, in December, 1854, he says: "On my arrival * * * * (at Colonia Tovar), I found a chance to buy a small farm, with the produce that was on it and a small cottage, for $47." One can not help wishing for more definite information regarding the size of the "farm," the amount of produce, and the style of cottage, all of which could be purchased for $47! And the place seems like a veritable Garden of Eden, when farther on he discourses thus: "A visitor who never before lived in a valley like this, finds here many peculiarities of vegetation, surface and climate, which make him feel that he is not far off the land of perpetual peace; for he has entered the happy region of the ferns, the 'tierra templada de los helechos.' There is no scorching summer's heat, no fearful winter's cold, neither tornadoes to devastate the country, nor gales to blind the inhabitants with sand or dust, or penetrate their clothes and flesh with piercing frost. Lightnings are rare and rather harmless, thunders merely grumbling. * * * * The mean temperature of April was 63.3°; May, 63.9°; June, 63°; July, 62.4°; August, 63.62°; September, 63.5°; October, 63.44°; November, 62.52°. Very seldom the temperature gets as low as 50°, and yet more rarely it rises to 78°. These two degrees (50 and 78 F.), seem to be the limits which are never exceeded in these months. The common temperature ranges between 56° and 70°. I am told that in January and February the temperature may be a few degrees lower in the morning, but otherwise about the same as in all the other months. The temperature of this valley therefore is that of a perpetual spring. Yet there is some variety in the climate with regard to moisture, viz.: the dry and rainy seasons. * * * * In the dry season if there is at any time moisture enough in the atmosphere to be condensed the mountainous districts are sure to get it. The judicious farmer is therefore enabled to plant and reap at any time the whole year round, for if the rain should fail abundance of spring water, which rushes and leaps down from all sides in numerous rivulets to every man's field, can be made to restore moisture to the soil. In fact, my brother, who is with me, plants small patches of potatoes once every fortnight, month after month. * * * * My cottage stands on a small hill which is projecting from the sloping side of a mountain overlooking the greater part of the colony. On the slopes of this little hill we have made terraces, planted with Musa sapientum, with apple trees, palms (Conocarpus utilis) and a stately tree fern fourteen feet high. Near the brown polished stem of the palm the clear arch of a fountain glitters in the tropical sun, sending up unceasingly its sparkling little stream to the top of the young palm." He then speaks of having already collected about 255 species of ferns as well as other plants. "The fine dry weather, which is now approaching, urges me again to renewed activity in the field. The woods here are very dense, and impenetrable without a sabre. The neighboring country is much diversified. In two or three hours' walk I can be in a region where the tropical fruits in all their luxuriance grow, while the products of the colony are rye, barley, oats, wheat, potatoes, beans, flaxseed, etc. The apple tree here is more shrub than tree-like, blossoms at all times of the year, and bears apples without seeds. * * * * The finest strawberries can be gathered a few steps from my door in great abundance during eight months of the year; blackberries are equally abundant. Of palms I have collected six species, of which five grow in the colony; tree ferns nine or ten species. Cruciferæ and Umbelliferæ are represented only by two or three species."

In a letter to Dr. Gray, under date of Nov. 25, 1855, he informs him that he had already collected 314 species of ferns, "of which at least 290 were collected at the colony, or from four to eight miles around it." He had also collected 1,850 species of flowering plants, and thought he might get 800 or 1,000 more of these, and perhaps eighty or a hundred more of ferns.

Late in 1855 or early in 1856 he returned to this country. About May 1 of the latter year he again sailed for Venezuela, and by July of 1857 had increased his fern numbers to 489 and of flowering plants to ,541. He busied himself also with Fungi for Dr. Curtis, Lichens for Prof. Tuckerman, and Mosses for Mr. Sullivant. He speaks of there being heavy white frosts in the high mountain regions, "and yet the stately wax palm on the neighboring heights, with its polished shaft of seventy or eighty feet, rears uninjured its slender form and its leaf-adorned head high above all other trees." Two statements taken from his journal will complete the extracts from his Venezuelan correspondence.

"In traveling from Victoria towards Valencia we find, about three miles west of Turmero, right in the middle of the road, the famous 'Zamang,' an enormous tree so well described by Alexander von Humboldt. Its head, formed by enormous horizontal branches, is the most remarkable part of this giant of trees. * * * I measured its head in its greatest diameter * * * most carefully, and found it to be 206 feet 11 inches English. Fifty-seven years ago it was found by Humboldt to measure in its greatest diameter 192 feet French measure, which would be equal to 204.48 feet English. Hence it follows that this tree, within the last fifty-seven years, has increased the horizontal diameter of its head only by 2 feet 5 inches English. The branches are loaded with a wonderful mass of epiphytes and parasites, and it seems surprising that branches of nearly one hundred feet in length, standing horizontally out from the trunk, can support for centuries, besides their own astonishing weight, such an extra load of heavy plants as Bromeliaceæ, Orchideæ, Cacteæ, Loranthaceæ, Piperaceæ, etc." The next relates to the celebrated "Cow-trees." "The space over which they were distributed was but very limited. * * * Their external appearance, the shape of the trunk and leaves, agree exactly with the description given by A. von Humboldt. Most of them were trees of 1 to 1½ feet in diameter, but very tall. In seven or eight of these trees, of different age and dimensions, I made incisions to see the milk flow. Although it was about the same season of the year when Humboldt saw the cow-tree between Valencia and Puerto Carbello, I never could elicit from them more than one or two drops in a second of time. There was not much difference in the flow of milk between the larger and smaller trees, and if ever I was disappointed in my expectation, it certainly was on this occasion as to the quantity of the milk. The milk has an agreeable, mild, rather rich taste, and becomes somewhat sticky between the fingers. People who live not far off, and have tried these cow-trees, do not praise much their milk-yielding qualities. I have neither seen the fruit nor the flower of these trees, but in comparing its leaves with those of plants in my herbarium I find the closest resemblance in shape, structure and venation with some species of fig trees. The wood is white and of considerable hardness.*

Fendler returned to this country and settled again at St. Louis sometime in 1858. It is not necessary to recount his various occupations between this date and the time of his removal to Wilmington.

About the year 1873 the writer received a note from the late Dr. Engelmann, giving information that Fendler had settled at Seaford, Delaware, and requesting that some attention should be paid to him. After a short correspondence with the writer he determined to remove to Wilmington in the same State, where he purchased a small house and garden. In the latter he and his brother (who required some care) took great delight. At this time Fendler was about 60 years of age, rather tall and spare, dignified and pleasant in address, but very modest and often painfully diffident. The writer frequently took botanical excursions with him, and found him to be a devoted lover of nature and a most intelligent and faithful assistant in preparing and arranging specimens for the herbarium. The enthusiasm with which he spoke of the wonderful and curious vegetation of the tropics will always be remembered by those who heard him; and his long and arduous journeys gave him much matter for entertaining conversation.

He was scrupulously honest and exact in every duty and business transaction, and it is within the writer's knowledge that he at one time suffered what his friends thought a most unjust loss, because of his determination to avoid a quarrel with any one.

He was now much engaged in getting ready for publication his "Mechanism of the Universe," in which he had given his ideas of cosmical phenomena. Nothing would persuade him that this book was not to bring him lasting fame, and no reasoning could discourage him from undertaking the expense of publication. All that could be done was to save him as much as possible. The expense proved to be comparatively small, but, in this respect, was much more than matched by the small sale of the work. The few commendatory letters which he received were treasured and re-read with the greatest pleasure by the gentle and guileless man.

As he says in his autobiography, it had been his intention to make Wilmington his permanent home; but a year or two after he settled there he was attacked by some rheumatic ailments, which not only caused the most acute suffering, but at one time seemed likely to end his career. Finally, when he had somewhat regained his health, he determined to seek a warmer climate, choosing, after some deliberation, the island of Trinidad. He and his brother sailed from New York on the 11th of May, 1877, and arrived at Port of Spain on the 3d day of June following. In a short time he bought a little property at Belmont, a suburb of this city, and at once commenced to plant the ground and otherwise improve his new home. He was more than ever delighted with the tropical flora, and thus wrote his impressions: "The gardens of some of the wealthy men here are of a splendor which, with regard to magnificence of vegetation, excels everything I have seen. Such beauty in form, such gorgeous colors portioned out among such an abundance of racemes, bunches, and scattered masses of flowers, is indescribable. * * * All efforts of the most able

*The "Cow-tree" (Palo de Vaca of the Spaniards) was described by Humboldt, Bonpland and Kunth as a genus under the name of Galactodendron utile. It is now considered as identical with the older genus Brosimum of Swartz, of which Bentham and Hooker recognize eight species, all tropical American trees with lactescent sap. As Fendler suspected they are nearly allied to the fig trees (Ficus), but it is possible, as his trees were such "poor milkers," that some species have a smaller flow of the milky sap than others.

writer can not but fail to give the reader an adequate conception of the brilliancy of such garden scenery and of the astonishing luxuriance of vegetation. Men and their habitations sink into insignificance beside the enormous trunks and heads of giant trees, and the busy town itself, looked at from the neighboring hills, lies hidden beneath their branches. * * * * Bananas and mangoes are plenty, and sell two for one cent. The mango, which when ripe is a delicious fruit, will be in its perfection in about a week, and will then sell much cheaper."

Again, in a letter to Dr. Gray, he writes: "Here, also, as in North America, June seems to be the month of flowers, at least as regards the cultivated ornamental shrubs and trees in Port of Spain. At present Poinsettia takes the lead, and shows off in great splendor. Think of specimens of this beautiful shrub 15 feet high, head 10 to 15 feet in diameter, with such an abundance of crimson leaves (4 to 7 inches long) as to hide nearly all the green leaves. The season for mangoes came to a close about the first of August, to be succeeded by what is here called 'Governor's Plums.' Next came the season for bread-fruit, ending about the 24th of October, and now we are entering the season for oranges."

Very soon he commenced collecting specimens for the herbarium, the ferns, as usual, being the first to demand attention. Within five miles of his residence he found, within a few weeks, "about 70 species." His aim was to make 50 sets for sale, and in the course of two months he had prepared more than 2,800 specimens. Those botanists who are so fortunate as to have these specimens can well allow his claim, that "as regards completeness, freshness of color and expression of characteristics" they were "all that could reasonably be desired and expected." As a demand arose he collected many specimens of mosses, lichens and phanerogamous plants.

Notes on the Conjugation of Spirogyra.

BY JOE N. ROSE.

During nearly two years study of the various species of *Spirogyra*, conducted in the botanical laboratory of Wabash College, my attention was repeatedly drawn to exceptional features in their conjugation. At Professor Coulter's request I have collected my notes upon this subject and figured the more striking cases. In explanation of the accompanying plate it should be said that it is entirely diagrammatic, with a view of bringing out the salient points, although most of the original drawings were made with a camera. This text is intended to be little more than an explanation of the figures, and but little interpretation of the facts is attempted.

Figure 1. In this case (*Sp. longata*) a single well matured zygospore fills most of the larger (*a*) and part of the smaller (*b*) cell. No evidence of conjugation other than through the partition between the two cells could be discovered. The old cell wall remaining somewhat firm accounts for the neck of the zygo-

spore. In the vegetative cell (c) is seen a constant result of the formation of a zygospore in a contiguous cell. In the fertilized cell (a) pressure seems to have been removed sufficiently to allow the pressure in the vegetative cell (c) to push outward the intervening partition, just as happens to a partition when a contiguous cell has been ruptured.

Figure 2. Occasionally two zygospores are found in the same cell, formed by the one act of fertilization, but usually somewhat smaller than those in adjoining cells.

Figure 3. Between the cells a and a' the usual conjugating tube has developed, and doubtless there has been a certain union of the contents, yet in each cell there is a perfect zygospore. They are not quite so large as those of adjoining cells. This condition of things was found as often as three times in the same pair of filaments. The bulging of the cell c into a', owing to a relief of pressure in the latter, is apparent, but becomes very noticable in the next figure.

Figure 4. When a filament has broken up into unusually short cells and then conjugates with a large-celled filament, there is not always room for the zygospore in the female cell, and such distorted forms as those shown in the figure are the result. In this case the bulging walls of the vegetative cells have still further diminished the space.

Figure 5. The dumb-bell zygospore of this figure could not be explained, unless some such condition as in Fig. 1 shaped it until it became rigid. But of this there was not the slightest indication.

Figure 6. While in general terms in the case of conjugating filaments one may be called fertile and the other sterile, as expressing the usual direction of flow, yet zygospores are repeatedly found in the latter. In this figure there are four contiguous filaments. The first cell of b has been provided for by a, hence the first cell of c is compelled to send out a very long tube towards d. But the contents of c have already assumed the zygospore form while d still has its spiral band, as though the latter was too long in being reached.

Figure 7. In the two filaments represented conjugation has already taken place between some cells, and is being prepared for between a and b, yet a is a single banded cell, while in b there are two bands. So far as could be determined these two filaments represent two species, based upon the number of spiral bands.

Figure 8 shows an unusually great difference in the size of conjugating cells.

Figure 9. In this filament no conjugation was discovered in any part of it, but the cells *a* and *b* have each sent out a tube at their adjoining ends, as *c* and *d* are also beginning to do, while *e* has sent out an additional tube at the other end.

Figure 10 is doubtless a later stage of the last, the two tubes together conjugating with a third and lower cell.

Figure 11 is another phase of polygamous conjugation, while *Figure 12* shows strong inclinations in that direction.

GENERAL NOTES.

Acer pseudo-platanus is a common shade-tree about our streets. The fruit is now forming and in every raceme I find one or more of the samaras composed of three or four carpels, instead of the normal number, two.

Catalogue of New Brunswick Plants.—We are indebted to Mr. George U. Hay, of Carleton, N. B., for the Bulletin of the Natural History Society New Brunswick, No. IV. This contains "A preliminary list of the plants of New Brunswick," by Prof. James Fowler, M. A. The Rev. Mr. Fowler was for a long time a resident of New Brunswick, and has been the most active collector of the region. He now resides at Kingston, Ontario. We are surprised to find how recently botanical observation began in this province, and feel as if we could almost rank ourselves among the early collectors. The earliest published information dates back only to 1862, and in 1864 the writer collected largely about Fredericton, St. Stephen, and Campo Bello, continuing his work in the years 1866, 1868 and 1872. Unfortunately he has preserved very little material from those explorations. To return to Mr. Fowler's list, it is an extremely interesting one in many ways; its author was indefatigable in his researches. He has found some curious cases of extra-limital distribution. For instance at Eel River, Restigouche County, *Collomia linearis* occurs. "If it is not native, it is at least thoroughly naturalized." Mr. G. F. Mathew, of St. John, has elsewhere pointed out how the river St. John affects the distribution of plants. Indeed, the whole district is well worth further study. There are rich collecting grounds already familiar, like the marshes of the Kennebeckosis, but the flora of much the larger part of the province remains practically unknown. The members of the geological survey record what they find, but their attention is too much engaged upon other work to allow careful exploration. Not the least interesting part of the list is the appended catalogue of ballast plants gathered around St. John, Portland, etc. The list is well edited and printed, and will repay careful perusal.

Utricularia cornuta.—On Decoration Day it has been my habit for a long time to take an excursion in the woods. This year I was rewarded by seeing a most magnificent display of *Utricularia cornuta*, a mass of yellow literally covering one side of a secluded pond, and quite out of reach. Is this not an early date for it?—W. W. BAILEY.

The Torsion of Leaves.—The following is the substance in tabular form of a paper read before Section F of the Am. Ass. Ad. Sci. at its Philadelphia meeting, by Prof. W. J. Beal, of the Agricultural College, Michigan. In the case of plants whose leaves are not erect they are supposed to be erect when the direction of twist is given.

NAMES OF PLANTS.	Number of Plants examined.	Number of leaves examined.	Direction of Twist.	Number of revolutions.	REMARKS.
Chenopodium album..	....	....	Indifferent..............	½	Structure of both surfaces alike: ¼ more stomata on lower. Keep same position during dry nights.
Typha latifolia...........	....	Sev'l 1000	All with the sun......	1½—2	Structure alike.
Typha augustifolia......	....	300	All with the sun......	....	Structure alike.
Sparganium—sp?.........	....	75	All with the sun......	1 or less.	Plants shaded.
Acorus calamus...........	A few	....	Most with the sun....	½	Young leaves most twist'd
Fritillaria imperialis...	....	....	All with the sun......	....	
Allium carinatum......	....	....	Most with the sun....	½	
" porrum............	104	....	All with the sun......	1	
" cernuum.........	....	....	Indifferent...............	½-1½	
Iris speciosa..................	....	....	Most with the sun....	1 or less	
" three other species	....	....	Indifferent...............	....	
Gladiolus, cult. vars....	350	....	All against the sun....	½	Structure alike. Twist greatest near tips.
Liatris scariosa............	2	192	179 with the sun.... 13 against the sun.	......	Structure alike: stomata 18 on lower to 12 on upper. Twist greatest near base.
Phleum pratense.........	50	....	All with the sun......	....	Seedlings.
" "	29	121	117 with the sun ... 4 against the sun	....	
Lolium Italicum.........	40	....	All with the sun......	....	Seedlings.
Holcus lanatus...........	30	....	All with the sun......	....	Seedlings.
Bromus secalinus........	100	....	All with the sun......	....	Young plants.
" Shraderi..........	50	....	All with the sun......	....	
Hulless barley............	50	....	All with the sun......	....	
Clawson wheat...........	100	....	All with the sun......	½	
Triticum repens..........	....	300	All with the sun......	¼—½	
Seedling oats...............	....	....	All against the sun...	....	

The author concludes that the conflicting facts observed do not furnish any satisfactory clue to the cause of torsion. Similar variation has been observed in the direction of twining *Calystegia sepium*. The twisting of the leaves may be of advantage to the plant in rendering the leaf more rigid and in allowing both sides to be exposed through part of the length to direct sunlight.

Zopf's Classification of the Bacteria.—The following arrangement of the bacteria by Zopf is probably the most satisfactory one yet proposed. The genera are distributed into four groups, as follows:

1. Coccaceæ. Possessing (as far as our present knowledge reaches), only

the coccus form, and in some species thread forms which are produced by the adhesion of the cocci. Spore formation as yet undemonstrated.

Genera: *Streptococcus, Micrococcus, Ascococcus, Merismopedia, Sarcina.*

2. Bacteriaceæ. Possessing mostly cocci, rods (straight or curved), and thread forms (straight or spiral). The first may be wanting; the latter have no distinction of base and apex. Division, so far as known, in one direction only. Spore formation existing, or wanting, or unknown.

Genera: *Bacterium, Spirillum, Vibrio, Leuconostoc, Bacillus, Clostridium.*

3. Leptotricheæ. Possessing cocci, rods, and thread forms (which show a distinction of base and apex). The latter straight or spiral. Spore formation not demonstrated.

Genera: *Leptothrix, Beggiatoa, Crenothrix, Phragmidiothrix.*

4. Cladotricheæ. Possessing cocci, rods, thread and spiral forms. The thread form is provided with false branches. Spore formation not yet demonstrated.

Genus: *Cladothrix.*—From *Die Spaltpilze.*

Stopper for Bacteria Culture Vessel.—In recent numbers of *La Nature* Dr. H. Fol, of Geneva, Switzerland, described, among other things pertaining to bacteria, a permeable stopper for culture vessels that has proved so valuable upon trial that we give an illustration and description of it. In most forms of culture vessels it is impossible to introduce or remove any substance without at the same time exposing the contents of the vessel in some degree to contamination from the germs of the air. In this form a small glass test tube an inch or so long, having a hole in the bottom, is wrapped with cotton and fitted into the mouth of the vessel. It is then half filled with glass wool or asbestos and protected by a mass of cotton (Fig. 1). The contents of the vessel are easily reached by removing the plug of cotton and introducing a capillary glass tube (Fig. 2), glass wool offering little resistance to such a tube while cotton can not be pierced. A translation of part of Dr. Fol's article has appeared in the *Scientific American Supplement*, and since the above was written the larger part of it has been given in *Science.*—J. C. A.

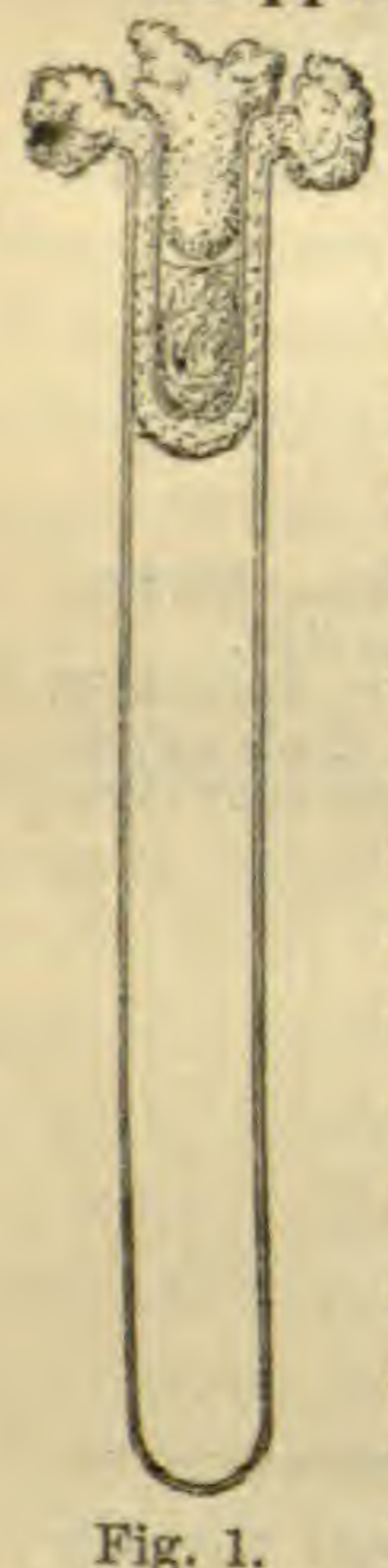


Fig. 1.

Fig. 2.

Bacteria as Vegetable Parasites.—The only genuine instance of parasitic bacteria in plants yet mentioned by the books (DeBary, Zopf, etc.) is that of the yellow sickness of hyacinths, first described by Dr. Wakker, of Amsterdam, in 1882. This bacterium winters in the bulb scales, and increases in the spring to slimy yellow masses which destroy the tissues and eventually kill the plant. The priority of demonstrating parasitic bacteria in plants belongs, however, to an American. In 1880, two years before Dr. Wakker's announcement of bacteria in hyacinths, Professor T. J. Burrill, of Illinois, presented a paper before the American Association for the Advancement of Science demonstrating the invariable presence of characteristic bacteria in the disease known as pear blight, which attacks pomaceous trees, and that the disease may be transmitted from tree to tree by inoculation. Since then the bacteria have been isolated and cultivated in artificial media, and the statements of the original paper fully confirmed. Americans should have credit for what little original work they do accomplish in bacteriology.—J. C. A.

The Cladophylls of Myrsiphyllum.—Gray's Structural Botany is quite wrong in stating (at least by implication) that the apparent leaves of Myrsiphyllum are vertically expanded, that is, are inserted edgewise on the branch. They are really and most obviously horizontally expanded, in the manner of true leaves. The vertical position which they soon assume is the result of a half twist, differing in this respect from Ruscus, in which the cladodia are vertical from the first. Professor Dickson calls attention to this, in an interesting paper in the Transactions of the Botanical Society of Edinburgh, vol. xvi. But, although the fibro-vascular bundles are arranged in one plane (as also in some species of Ruscus), yet he still regards the organ as a cladophyll. And the two elements of these bundles are disposed in the reverse order to that of the leaf.

In this connection it should be noticed that Van Tieghem (in Bull. Soc. Bot. France, xxxi., 81, 1884), maintains that this organ even in Ruscus is a leaf, the first and only leaf of an axillary branch, or when floriferous, is a leaf with a connate branch.—A. GRAY.

Flowers of the Wild Strawberry.—In this locality, and in other portions of the state where I have been this spring, the flowers of *Fragaria Virginiana* var. *Illinoense* are as constantly polygamous as they are in cultivated varieties. Flowers are either perfect or pistillate. The pistillate appear rather the more numerous. These flowers are commonly small, sometimes not exceeding one-fourth inch in diameter. There is seldom anything more than the merest indications of stamens in these flowers. The perfect flowers are larger, brighter in color, and the numerous yellow stamens render them conspicuous. I can now tell almost invariably the sex of a flower at a distance of two rods.—L. H. BAILEY, JR., *Agricultural College, Mich.*

Addenda et Errata.—In Dr. Koehne's article on the Lythraceæ of the United States, vol. x, pp. 269–277, the following corrections are to be made:

Page 269, line 7 from bottom, for unsymmetrical read symmetrical.

Page 273, line 31, for 1½ to 6½ mm. read, 4½–6½ mm.

Page 274, to *L. lineare* add New York, New Jersey, Delaware, Florida and Texas; Cuba; Guanajuato and Vera Cruz, Mexico; Virginia, *fide* Elliott.

EDITORIAL NOTES.

DR. C. BERG has been called to the chair of botany in the University of Buenos Ayres.

A CHAIR OF BACTERIOLOGY is to be established at the college of the Sarbonne at Paris.

A LIFE-SIZE statue of Charles Darwin has just been placed in the great hall of the British Museum.

THE FIRST BACTERIA ever seen were observed by Leeuwenhoek in 1683 in the white substance adhering to his teeth.

THE SPANISH GOVERNMENT has prohibited inoculation for cholera in districts where the disease has not yet appeared.

PROFESSOR V. M. SPALDING, of the University of Michigan, has leave of absence for a year's study in the botanical laboratories of Germany.

DR. GEORGE M. STERNBERG has gone to Europe at the request of the Department of State to attend the meeting of the Sanitary Council at Rome, held during June.

PROFESSOR A. N. PRENTISS, of Cornell University, sailed for Europe on June 20, to recuperate and make some botanical observations during the summer vacation.

RECENT NUMBERS of the *Gardeners' Chronicle* have been almost entirely devoted to orchids. A supplement gives the geographical distribution of all known genera, with a map.

A SMALL BOOK has been published in Germany by Johne on the details of the cultivation of Koch's cholera bacillus, and the very similar bacillus of Finkler, and has already reached a second edition.

AT THE RECENT cholera conference at Berlin there was much discussion regarding the bacteria connected with the disease, but each disputant appeared to hold the same views at the close as at the beginning.

THE BEST WORK on the germs in the air with methods of investigation is Miquel's *Des organismes vivants de l'atmosphère*, published in 1883. The author carries on his researches at the Montsouris Observatory near Paris.

THE OBSERVATIONS of Professor Trelease on the relations of some cecidomyid larvæ to parasitic fungi, published last year in *Psyche*, have been confirmed and extended by Dr. Fr. Thomas, of Thüringia, as we learn from *Irmischia*.

AN ITALIAN investigator, C. Comes, considers that the gummosis of mulberry trees is due to the alteration of the starch and young tissues by a specific form of bacteria, identical, however, with what he believes to be the cause of gumming in the peach, cherry, etc.

S. KORSCHINSKY has observed, according to the *Botaniches Centralblatt*, that the leaves of *Lactuca Scariola* only assume the meridianal position when growing exposed to strong sunlight, and that *Tanacetum vulgare* in the same situations directs its leaves toward the source of light, but without taking the meridian. He thinks the difference is due to the more flexible tissues in *Tanacetum* which permit the leaves to constantly change position, while in *Lactuca* the firmer tissues hold them rigid.

TELL Messrs. J. U. and C. G. Lloyd, of Cincinnati, Ohio, whether the following plants grow in your locality, and how abundantly: Coptis trifolia, Xanthorrhiza apiifolia, Aconitum uncinatum, Actæa alba, Actæa rubra, var. spicata, Cimicifuga Americana, Cimicifuga racemosa.

THE VERY EXTENSIVE library and herbarium of Mr. I. C. Martindale, of Camden, N. J., are for sale. The editors' opinion of their value and completeness has already been expressed. (See vol. ix., p. 163.) Any individual or institution that secures them will indeed secure a treasure.

A CATALOGUE of the fungi of Italy by P. A. Saccardo and A. N. Berlese, issued not long since, enumerates 6403 species distributed in seventeen orders. The smallest order is the *Entomophthoreæ* containing only the one species, *E. Muscæ*, and the largest the *Pyrenomyceteæ* with 1515 species. Other interesting orders are the *Uredineæ* with 340, *Myxomyceteæ* with 91, and *Schizomyceteæ*, or bacteria, with 64 species. Although this is a large list the authors yet regret that, owing to parts of the country being unexplored, it is still quite incomplete.

AN INTERNATIONAL Botanical and Horticultural Congress is to be held in Anvers, Belgium, August 1–10. The subject which will take the most prominent place in the discussion will be the botanical exploration of the Congo, which means the interior of Africa. Belgium is wide awake in these matters, and supported by an intelligent and interested sovereign the work can be well done. A liberal invitation is extended to foreign botanists, but while papers will be presented in six of the principal languages, of course the discussion will be conducted entirely in French.

THE ILLUSTRATION of the action on gelatine of the real and pseudo "comma bacillus" of cholera, given in a recent number of *Science*, with the cuts of the bacilli themselves by Dr. Sternberg in an earlier number of the same journal, brings this strange controversy graphically before American readers; a bitter partisan controversy, in which non-investigators have poor chance to form a correct opinion. It will doubtless be settled after the manner of the famous spontaneous generation controversy—by refined practical experience after due lapse of time.

PROBABLY FEW SUBJECTS have advanced so rapidly and to such important proportions as that of bacteriology. Ten years ago we had scarcely heard of it, to-day many of the first universities of Europe have established chairs devoted to the subject, while a number of institutions have been created for its exclusive consideration; there are besides several government commissions and hundreds of private investigators. On the other hand it has revolutionized some of the departments of medicine and surgery, is a constant theme in sanitary science, and has become an important factor in the daily life of every individual.

An Orchid Exhibition, under direction of the Royal Horticultural Society, was held in the conservatory at South Kensington, London, on the 12th and 13th of May. Sixty-one genera were represented. There were many specimens shown in fruit and numerous hybrids. Some of these hybrids were bi-generic. Three such have been raised and borne flowers, and others have been propagated, but have not yet flowered. How these bi-generic crosses will affect the stability of genera as at present circumscribed, is a conundrum which was propounded but not answered at the Orchid Conference with which the exhibition was connected.

Bryn Mawr College, a new institution for the higher education of women, situated near Philadelphia, is to be opened in September. No pains have been spared to place the college on a firm foundation, and it promises to be a specially notable institution. Miss Emily L. Gregory, a graduate of Cornell University, has been appointed to the chair of botany. Immediately upon graduating in 1881 Miss Gregory went abroad, and studied under Prof. Wigand at Marburg, Prof. Reinke at Göttingen and Prof. Schwendener at Berlin. Returning to this country in 1883 she studied in Prof. Goodale's laboratory at Harvard, also taking charge of the laboratory work of the Harvard Annex. In 1884 she was appointed teacher of botany in Smith College, and shortly after received her present appointment at Bryn Mawr. She at once sailed for Europe to continue her studies under Prof. Schwendener, and will shortly go to Zürich to remain until the opening of the college in September. The curriculum of the College is in many respects modeled after that of the Johns Hopkins University. The course drawn up for botany reflects the thought and thorough preparation which Miss Gregory has given her subject.

The prospects for an interesting gathering of botanists at Ann Arbor in August are excellent. Western botanists may be specially expected in force. The city of Ann Arbor is a delightful place in which to spend a week, even in the hottest weather, and at the worst no such discomfort can be experienced as was felt at Philadelphia last year. The meetings will not be disturbed by the rumbling of vehicles over the pavements, the distances will be short and through shady avenues, and altogether the outlook for the physical comforts is entirely satisfactory. The programme for the special entertainment of the Botanical Club is not yet definitely arranged, but as heretofore there will be short excursions for collecting, an evening reception, and similar social privileges to besugar the dry crusts of science, and promote that most valuable feature of these gatherings—personal acquaintance and the interchange of ideas. Neither the scenery nor flora immediately about Ann Arbor are striking. It is largely "oak openings," woodland interrupted with open ground, yielding only about 850 species of flowering plants and ferns within a radius of four miles. There are, however, several of the Michigan "catholes" within reach, in which one finds *Arethusa*, *Sarracenia*, *Andromeda*, *Menyanthes*, *Drosera* and other swamp plants. The Huron river runs through the lower part of the city and furnishes the usual supply of water plants. An examination of this part of the flora from a sanitary point of view will have a special local interest as water works are soon to be established with the water supply from this source. The free excursion to the Saginaw valley will give the botanists a favorable opportunity to see the characteristic flora of Michigan. The steamer excursion, after adjournment, to Mackinac island and Sault Ste. Marie promises to be one of the most delightful ever offered the association. Every botanist who can command the time should certainly go, as the flora of that region is characteristic and specially interesting, the trip inexpensive, and the social and physical pleasures all that can be desired. The trip may be made in three or four days, but more time can be profitably spent. With such a favorable prospect it is safe to predict a most enjoyable and successful meeting, with a fair probability that the botanists will hold their recently gained vantage of ten per cent. of the total attendance.

CURRENT LITERATURE.

Louis Pasteur, His Life and Labors. By his son-in-law. Translated from the French by Lady Claud Hamilton. D. Appleton & Co., New York, 1885. 8°. Pp. xlii, 300.

Every reader must be charmed with this work. Its enthusiastic portraiture of the successes of a remarkable man, a man who does not tolerate failure, the glowing account of his devotion to the work of his life, the pertinacity with which he defends his views against all opponents, and the great pecuniary and commercial value of his discoveries, invest the work with more than usual interest. The chapter on the silkworm disease reads like a romance, ending with that sad stroke of paralysis which so nearly cost the hero his life. The silkworm disease had gradually reduced the silk industry of France till it yielded barely one-fifth the usual revenue, and, as many districts were largely dependent upon this source of maintenance, its failure entailed the greatest poverty and suffering upon the inhabitants. It was at the close of the famous controversy on spontaneous generation, in which Pasteur was so signally triumphant, that he undertook to solve the problem of this mysterious disease. We can not follow him through the successive steps of the difficult investigation to the final restoration of wealth and prosperity to the silkworm districts, but can assure the reader that the story is so fascinatingly told that whoever begins it is not likely to lay the book down before its completion.

The other great subjects of Pasteur's studies—fermentation, studies of wine and beer, splenic fever, fowl cholera, hydrophobia—are almost equally interesting. But it is only possible in this notice to call attention to the general nature of the work. The casual reader will find few technicalities to detract from the smoothness of the narrative, while to the student of bacteriology it is suggestive and stimulating. The value of the work is much enhanced by the admirable introduction by Professor Tyndall.

Micro-organisms and Disease, an Introduction into the Study of Specific Micro-organisms. By E. Klein, M. D., F. R. S. 2d ed. Macmillan & Co., London, 1885. Small 12°. Pp. 201. Illustrated.

Among the numerous works on pathogenic bacteria, which are being so rapidly turned out, this small book deserves an important position. The author is an experienced investigator who knows of what he writes, having been employed by the English government for many years to conduct such studies. The work opens with several concise but well written chapters on the examination of bacteria, the materials, apparatus and methods of artificial cultures, and the means of inoculation and observation. These are ample to direct the investigator into the right course, and to give the reader a just appreciation of the difficulties which beset this kind of work.

The body of the book is given to the discussion of the various pathogenic species of bacteria and the more common, closely-related non-pathogenic forms, arranged upon the basis of Cohn's classification. Some space is also given to certain higher fungi having more or less relation to the health of the higher animals and man, such as yeast, *Oidium lactis*, *Aspergillus*, *Actinomyces* and *Saprolegnia*. The systematic part of the work is profusely and admirably illustrated with cuts that are well drawn, clear and finely printed.

The latter part of the book is devoted to a discussion of the rôle of septic and pathogenic forms, and will be found an excellent resumé of the present knowledge of the subject. The grounds of Buchner's belief, that septic organisms may, by attention to certain conditions of culture, be changed into pathogenic forms, as, for example, the harmless hay bacillus into the malignant anthrax bacillus, are reviewed and shown to be untenable, a conclusion already reached by DeBary and quite generally accepted by botanists, even by Zopf in the last edition of his *Spaltpilze*, contrary to the author's statement. After the examination of several other supposed cases of transformation of harmless into harmful bacteria, Dr. Klein very sensibly concludes that "some definite micro-organisms have the power, when finding access into the body of a suitable animal, to grow and thrive and to induce a definite pathological condition. But this power they have *ab initio*. Those that do not possess it can not acquire it by any means whatever."

In conclusion we can most heartily commend the work to those who desire to become acquainted with the principal forms of pathogenic bacteria.

Die Spaltpilze, nach dem Neuestem Standpunkte Bearbeitet. Von Dr. W. Zopf. 3d ed. Eduard Trewendt. Breslau, 1885. Roy. 8°. Pp. 127. Illustrated.

This work was primarily written for the *Encyklopaedie der Naturwissenschaften*, and separately published in March, 1883. It met with such ready sale that in a few months the edition of 1,000 copies was exhausted, making it necessary to issue a second edition in January, 1884.

This was as eagerly sought for as the first, and but a year had passed when a third edition was demanded. Each successive issue has been improved and enlarged, especially the last, which contains one-fourth more pages and seven more wood cuts.

The work is devoted to the general treatment of the bacteria. It opens with the consideration of their position in the plant system and their occurrence in nature. The main portion is divided into four parts—morphology, physiology, methods of investigation, and descriptive classification.

The author takes up Cohn's theory of the constancy of bacteria forms, and his classification into coccus, rod, thread and spiral groups (monomorphism), and points out that they have now only historic value, as any two or more of these groups may have genetic relationship (pleomorphism). The author, however, disavows any intention to adopt ultra-pleomorphistic views, believing that for certain bacteria pleomorphism is surely proven while for certain other bacteria it can not at present be demonstrated. Yet in the latter case it may possibly be found, upon further investigation, that a similar variability does really occur. This possibility has its advantages, for, while it does not alter the facts, it does give an incentive to more exhaustive stndy. The classification which the author adopts, founded upon the structure and degree of development, is given elsewhere in this journal.

Under morphology the author treats of the forms and their metamorphoses, vegetative multiplication, growth, color, contents, and structure of the cells, organs of movement, formation of spores, and zooglœa condition. Under phyiology is given the nourishment of bacteria, their influence upon the medium in which they grow, their relation to temperature, gases, light, electricity, chemical substances and moisture. Under methods of investigation is a careful statement of the principal methods of work and observation. The part devoted to the description of species is far more satisfactory to the systematist than the usual treatment in pathological works. Each species has been studied from the botanist's standpoint, and has been assigned its proper place in the system, so far as present facts admit.

An important part of the work is the biliography of bacteria, including a list of nearly 350 authors. An excellent index completes the volume.

The Technology of Bacteria Investigation; explicit directions for the study of bacteria, their culture, staining, mounting, etc., according to the methods employed by the most eminent investigators. By Charles S. Dolley, M. D. S. E. Cassino & Co., Boston, 1885. 12°. Pp. 263.

The author says in the preface that the work has been written with the hope that it will stimulate careful study of the schizomycetes by American investigators. There can be no reasonable doubt that such manuals will have this tendency. The subject of bacteriology is exciting such universal attention that even in America we must ere long catch the general enthusiasm, and lend ourselves to the fascinating but difficult study of the "infinitely little." A few Americans have already done excellent work in this field, although one does not often find them mentioned by foreign authors. Let us see what help Dr. Dolley offers the student.

The work is divided into three parts: (*a*) General and (*b*) special methods of investigation, and (*c*) formulary. Under the first we have the study of microscopic preparations, both living and stained, and also by means of photography, followed by culture experiments, inoculation and biological analysis. Following each topic is the literature pertaining to it. The second part treats of the special methods used by different investigators in studying anthrax, cholera, glanders, hydrophobia, leprosy, malaria, tuberculosis, typhoid fever, diphtheria, erysipelas, yellow fever, etc., etc., each being followed by the literature of the subject. The third part contains about fifty formulæ for the preparation of stains, reagents, culture media, etc.

The value of such a work naturally turns upon the fullness and perspicuity with which the methods and apparatus are described, and upon their proper selection. The present work is excellent, so far as it goes, and will prove of great value to many investigators, but it still leaves much to be desired. The descriptions are short and sometimes quite inadequate; there are no illustrations, which in many instances would be as valuable as the descriptions; the work is evidently compiled from literature alone, and lacks that fullness of detail which the author could only give from personal knowledge of the manipulations; there is no index. The bibliography occupies one-third of the volume; a wholly unnecessary amount, as it is printed in full-size type, which, besides taking up extra room, obscures the clearness of the page.

Yet, whatever the defects are, this is a timely and welcome volume, one that will prove of service to the investigator, especially the beginner, and one that will foster the study of the subject.

BAILEY ON CAREX.

BOTANICAL GAZETTE.

VOL. X. AUGUST, 1885. No. 8.

Notes on Carex—V.

BY L. H. BAILEY, JR.

1. To sustain the disposition which I made in the June GAZETTE of *CC. trichocarpa, aristata*, and *læviconica*, I submit drawings of perigynia and pistillate scales from various specimens in my collection. I have little confidence in the pubescence of the perigynium as a specific character. It is generally very variable in different individuals of a species, and, in some cases, *e. g., CC. triceps* and *cinnamomea*, it disappears with age. In *CC. trichocarpa* and *aristata* it is entirely inconstant. Nevertheless, in the perigynium are to be found the most constant characters to separate these plants. Typical variety *aristata* differs from typical *C. trichocarpa*, as follows: Culm stouter; sheaths hairy; staminate scales awl-pointed and lax; pistillate spikes heavier; pistillate scales awl-pointed, narrow at base, equaling or exceeding the perigynium; perigynia smooth, somewhat coriaceous, rather narrow and abrupt at the base, long and gradually beaked, teeth setaceous and spreading. The size of the plants is wholly unreliable as a specific character; the hairiness or smoothness of leaf-sheaths is by no means constant; there are very numerous and complete gradations from the one to the other in shape and disposition of staminate scales. There is every gradation in size of spikes. The perigynia present the only characters worth especial consideration. I have in my possession every gradation of size, shape, texture and hairiness of perigynia from one extreme to the other. *C. trichocarpa* should have hairy perigynia and smooth sheaths, while *aristata* should have smooth perigynia and hairy sheaths. I often find specimens with both perigynia and sheaths smooth, and conversely, specimens sometimes occur with both perigynia and sheaths hairy.

The figures illustrate a few of the variations of the perigynia and pistillate scales. Fig. 1 represents a perigynium, and Fig. 2, a scale of typical *C. trichocarpa* from Illinois. The perigynium is very broad, short-beaked, and densely setose-hairy. Fig. 3 shows *C. trichocarpa* with only a trace of hairiness and the long scales (Fig. 4) approach var. *aristata.* The shape and appearance of the perigynium is decidedly like var. *aristata.* This plant is robust, and has much more the appearance of the variety than of the species. It might with equal propriety be referred to either. The sheaths are smooth, or nearly so. The specimen figured is from Nebraska, but a similar form is common here at Lansing. Fig. 5 is the typical var. *imberbis* from Illinois. It has the scale of *C. trichocarpa* and the perigynium also, with the exception of the smoothness; sheaths scabrous. Fig. 6 is also var. *imberbis* from Illinois. Both perigynium and scale (Fig. 7) are nearer var. *aristata* than the species. Fig. 8, from Michigan, is nearly like the last only that the sheaths of the plant are hairy. This hairiness throws it into *aristata,* but the scale is nearly that of *C. trichocarpa.* Fig. 10 represents Dewey's old var. *turbinata* from New York. If the sheaths were hairy it would make a better *aristata.* Fig. 12 pictures C. A. Meyer's *C. orthostachya* from Russia. The smooth perigynium and hairy sheaths throw it into var. *aristata,* but the form of the perigynium is nearer the species. Fig. 13 is the var. *Deweyi* (*C. læviconica,* Dew.), which is smooth throughout. This variety is distinguished from both *C. trichocarpa* and var. *aristata* by its hard, polished, and almost nerveless perigynium, and by general habit. It passes by all gradations into both the species and the variety, however. Fig. 15 is from a plant of *aristata* with the typical robust habit, hairy sheaths, long spikes (4 in. long!), very loose and long staminate scales and awl-toothed perigynia, but the perigynia are hairy. This specimen is from Oregon. Fig. 17 represents pretty good *aristata,* but the whole plant is smooth!

2. Carex compacta R. Br., Sill. Journ., 1835, p. 39. Prof. John Macoun sends me this interesting arctic species from Nottingham Island, Hudson's Straits. (Fig 19.) The species is closely allied to *C. saxatilis* L., but differs in habit and especially in the *closely packed, conspicuously squarrose and much inflated perigynia.* From a study of authentic specimens in Herb. Gray, I am prepared to say that this species and *C. membranacea* Hook., are the same. My friend, Arthur Bennett, of Croyden, Eng., sends this note:

"*C. compacta* R. Br., is
C. hymenocarpa Drej.
C. membranacea Hook.
C. ampullacea var. *borealis* Lange.

Fide Herb. Hooker and Boott at Kew."

Carex compacta inhabits arctic America, and it is apparently rare.

EXPLANATION OF PLATE VIII.—1–18, *C. trichocarpa* and *vars.* 19, 20, *C. compacta*. 1, Perigynium of typical form, Illinois. 2, Pistillate scale of same. 3, With smooth perigynium and long scale, 4. 5, Perigynium of typical var. imberbis, Illinois. 6, Same of var. imberbis approaching var. aristata. 7, Scale of same. 8, Perigynium of var. imberbis, Michigan. 9, Scale of same. 10, Perigynium of var. turbinata, New York. 11, Scale of same. 12, "C. orthostachya" (C. A. Meyer), Russia. 13, Perigynium of var. Deweyi. 14, Scale of same. 15, Hairy perigynium of var. aristata, Oregon. 16, Scale of same. 17, Perigynium of smooth var. aristata. 18, Scale of same. 19, Entire plant of C. compacta. 20. Pistillate scale of same.

An Autobiography and Some Reminiscences of the Late August Fendler. III.

EDITED BY WM. M. CANBY.

His old habit of meteorological observation was kept up with unfailing regularity. He writes: "The evenings, mornings and nights are delightfully cool—the thermometer standing at 73°–80°, and generally clear. The heat of the day attains its maximum at noon, when the mercury usually rises to 94° or 96°. We make five thermometric observations every day at 5:30 and 7 A. M., 12 M. and 2 and 8:30 P. M." This industry and exactness, traits of character so unusual among the population of Trinidad, combined with the daily drying in the sun of botanical papers, an occupation which, as many botanists know, excites the wonder and amusement of people claiming a more enlightened civilization, soon rendered the brothers liable to a suspicion that they were engaged in counterfeiting or some other illicit business. In consequence their house was taken possession of and searched by the not over-gentle police, who even dug over their garden. It was a severe trial to the scrupulously honest man. "That this little affair weighed heavily upon my mind and gnawed deep into my immoderately sensitive feelings, you may well imagine," he wrote soon after. After some time he again wrote: "Not minding more than I can help the people around me, I go on improving my little property, setting out lots of Yams, Tanias and Bananas, and putting in cuttings of different ornamental shrubs and roses, also a weeping willow; raising from seeds Rondeletia, Coxcomb, Zinnias, Pinks, Petunias, etc., etc., to remind me of my former more northern home."

The promiscuous population of Trinidad afforded Fendler much interest and amusement. He contrasted the large Coolie population with the New Mexican Indians he had formerly known, finding many points of resemblance in character and habits. Among the latter he notes particularly the well known one of taking a whiff or two from a pipe and passing it on from one to another. But to one so honorable there was much also to cause pain. A short extract will throw some light on his habit of thought. "The observer of mankind finds in this Island much to interest him, but to me it is a source of pain to see the dense swarms of humanity full of tricks and deception * * * * with indecent haste trying to cheat and undermine each other. It is only when getting among 'the high woods,' in places where the single individual finds himself almost lost between the boughs and leaves of nature's fairest objects, that I feel happy again and forget the folly and rancor of the surging multitudes not far off." His garden prospered under his loving care, and he wrote enthusiastically of his flower beds and noted accurately the yield of his fruit trees. "A few days ago our Mango tree yielded the last of its fruit, giving us in all 426 mangoes of about half a pound each." At another time he says: "The Mango tree gave 438 mangoes up to August 11, and more to ripen soon. One orange tree furnished 1,006 sweet oranges. Fewer in number were the Plantains and Breadfruits, of which we have become quite fond."

Much of his time was given to botanical excursions and collections, often giving him much pleasure.

He writes to Dr. Gray: "Let me give you an account of one of these excursions. As the railroad train which is to take me to St. Josephs (six miles east of Port of Spain) does not start before 7 A. M., I need not rise earlier than 4 o'clock. Then preparing breakfast, and getting things all right, I start from home at six, walking one and one-half miles to the railroad depot, and arrive at St. Josephs at half-past seven. From St. Josephs I have to walk six miles up Maraccas valley in a northern direction, the road crossing the unbridged river nine times and rising gradually all the way to the foot of the mountains (where I get by about ten o'clock), and for three miles farther the road passes through small cacao plantations where nothing is to be collected in my line of business. Where the steep declivities begin the plantations cease and the primeval forests are entered. Searching for specimens to the right and left I reach at length, three miles farther on, the place that leads over the mountain ridge and down the other side towards the Caribbean Sea. By the time I get to the top of the ridge it is about two or three o'clock in the afternoon. By this time the most interesting region has been reached and the search for specimens is redoubled. During the excitement of searching and gathering, the flight of time is not heeded, and before, in scrambling downward, I have made three miles headway, I am reminded by the lengthening shadows, that it were best soon to look for a resting place for the night near some suitable tree or rock. In the dry season, when the sky promises to be serene for the coming night, I make a heap of dry, or nearly dry leaves close to the base of the tree against which I am going to lean. The tree ought not to be far off from a running stream, so that I may not lack a supply of water which, with a few biscuits steeped in it and a piece of cold meat, makes up my supper. This barely finished, the shades of night settle fast around me, the transition from day to night and from night to day, being so sudden in these latitudes that the darkness of night is upon one before he is aware of it. Horse-flies and mosquitoes are very eager for attack towards evening, but as soon as it has turned dark they are gone. Nevertheless I do not fail to hang a piece of mosquito-netting over my head and face, to protect myself against the attacks of a species of big bats called 'vampires,' and now, with no one to talk to, commences the long, lone watch of the night, for sleep it can not be called. Over head in the tree tops the stars twinkle through a few open places, but all else around is hid in shade and darkness; even the moon's softening rays are not allowed to enter the dark recess. At times, when the wind rises, the boughs of the higher trees utter a doleful whisper, and from afar comes up the hollow, dull, yet angry moan of the distant surf from some of the coves of the coast, which but a few hours ago glittered so lovely in the glare of the setting sun. But with the night wind dying away all is hushed again, save the low gurgling sound from the rolling waters of the rivulet near by and the never-ceasing notes of the cricket. In this way one long hour is passed after another, and the question suggests itself more than once—what time of the night? Whenever for the second time the subdued voice of the owl is heard answering one another, then there is reason to hope that dawn of day is not far off. * * * * As soon as daylight peeps through the branches, I rise from my heap of leaves, the dry splinters brought with me from home are kindled, and, in addition to a few grains of quinine, a good cup of strong coffee without sugar soon revives my chilly frame. Having packed up my things, I again scramble along river and ravine gathering ferns and flowering plants. Thus occupied I turn gradually homeward in a round-about way. * * * * This is all very well in dry weather. But in the rainy season it is not quite so pleasant. * * *"

But these excursions were sometimes not unattended with risk if the following is to be believed: "It is well known that in Trinidad there is no scarcity of serpents, but I was not prepared for the following which I read the other day, and which happened in a remote district near a cacao plantation, hidden and isolated in the midst of extensive, low and level primeval forests, where shade and dampness reign forever, and where, at times, I roamed about and had the pleasure of gathering many a rare fern: 'On the 9th of December some men, at work in a cacao plantation, on the river Manco, belonging to Mr. Augustine, heard cries of alarm. On reaching the spot from whence the cries had come, they saw a man enveloped in the folds of a monstrous serpent. They were not sufficiently armed, but presently returned in larger numbers, and with cutlasses chopping the snake through at several of the folds, killed it and disengaged the man's body. The man was dead and was stretched by the enormous pressure of the serpent's embrace to the length of seven feet.'" Whether Fendler thought this a mere "snake story" or not, he prudently concluded, "Now, however, if I go to these and similar woods again, I shall take along a more effective knife than the one I usually carry."

Here is the relation of another event which may serve to illustrate the character of the people by whom he was surrounded: "Having ascended one of the highest ridges of the Saut d'eau mountains, about ten miles from town, I took occasion to visit a man known all about as Popo Fernand (though his real name is Joseph Isodore), in order to inquire of him about a piece of land that was offered for sale in his neighborhood. On my way thither I was astonished to find that in and beyond the village of Maraval every man, woman and child knew where the man lived, though his cabin was miles away in the mountains in an out-of-the-way place. When I at last reached his premises I found no one there, but noticed, as something unusual, a great number of beehives stuck all around his cabin and outhouses, the first beehives I have seen in Trinidad. After a while a woman came up and called aloud Fernand's name. He soon made his appearance. Neither he nor any of his neighbors could speak English and I could not speak their language. * * * * The man seemed, however, to be courteously disposed. In order to see how the land lay, I exposed my little pocket compass in his presence, when at once he seemed to become alarmed, and made me understand that he thought the instrument was intended to show the spot where money was hid in the ground. Of this notion I tried to disabuse him. Soon after he invited me into his room and, as is customary here, he asked me * * * to help myself to the contents of a small bottle he set before me. Not to show any signs of distrust, I poured out about two thimblefuls of the liquor, mixing it with plenty of water, but became somewhat suspicious after drinking it on noticing that Fernand himself had not taken any of the bottle's contents. About ten minutes later, on my way back, I experienced a strange state of mind such as never before I had happened to be in. There were neither dizziness, stupefaction nor exhilarating symptoms. Visions and strange incoherent thoughts flashed across my mind continually and vanished at once as quickly as they came. Any theme I made an effort to think upon slipped from my memory, and instead thereof quite a different theme presented itself with the same futile result, until I became frightened at my own thoughts and terrified at my condition of mind. After a two hours brisk and steady walk this unpleasant irritation of mind gradually subsided. * * * * What would have been the result had I taken a little more of that liquor?"

Sufficient has been written to show what manner of man Fendler was. It has been more than eighteen months since the writer heard directly from him, and now only the bare fact of his death is known, letters of inquiry directed to persons in authority at Port of Spain remaining unanswered. Those who have been privileged to become well acquainted with him will not soon forget this kindly, simple, honest-hearted man, nor cease to regret that they can no longer enjoy his friendship and correspondence.

On the Perforation of Cells and the Continuity of Protoplasm in Vegetables.

[A note by M. L. Olivier, presented to the French Academy of Sciences by M. Duchartre (*Comptes Rendus*, Tome C, No. 18, May 4, 1885).]

TRANSLATED BY ERWIN F. SMITH.

I. Three years ago I stated* that photography applied to microscopy was capable of showing details of structure which do not impress themselves upon the retina. In support of this assertion, I published† a description of a negative in which may be seen on the cell walls a system of markings and perforations inappreciable with the microscope.

In seeking to perfect this new method of investigation, I have confirmed the existence in vegetable cellular membranes of a system of canals to which I desire to invite the attention of the Academy.

In examining the living tissues of plants, whatever be the magnifying power used, we generally perceive no communication of one cell with another.‡ The small protoplasmic masses which constitute the living matter of each cell have also been considered, up to a recent date, to be absolutely independent and entirely isolated from each other; each one of these little masses appears in fact to be completely enclosed in an alveolus.§ From this view arises the impossibility of attributing to two neighboring protoplasmic masses any other relation than that of osmotic exchange through the solid walls which separate them. Such has been the general conception of the vegetable organization as depicted in the most recent standard works.

My researches have led me to an entirely different result. In

---

* *Revue Sci.*, April 8, 1882, 3d series, vol. iii, p. 433.
† *Ibid.* p. 434, and note on p. 435.
‡ Except in the case of sieve tissue of which the wholly special structure and localization in the plant are to-day well understood.
§ The walls of this prison are composed of a ternary substance; cellulose, lignine, cutine, etc.

the substance of the membranous walls I have observed numerous canals and have ascertained that they insure the continuity of the protoplasm through the cell walls.*

II. The existence of these extremely tenuous canals, which traverse the cell walls through and through, escapes detection by the ordinary methods of investigation, but may be shown by the employment of the following methods:

1. *Photography.* Thin cross sections are made of living tissues, after growth has ceased. The sections are then photographed *direct* with a magnification of about 300 to 700 diameters. By using for this operation the method I have already described †, we obtain negatives of a peculiar interest. On these negatives, when examined with a lens, the cell membranes appear to have an extremely complex structure‡; they are seen to be variously perforated by canals, transverse or longitudinal, which establish a communication between the contents of the cells.§ It seems impossible to ascribe this appearance of canals on the photographic film to any phenomenon of diffraction.

2. *Direct observation.* After having shown this structure upon my negatives, even upon old negatives which had not been made with reference to the study of cell membranes, I have tried to see it directly. To this end I have examined my preparations, with powers of from 700 to 900 diameters, in a dark chamber into which the microscope projected in such a way that my eye was influenced only by the light proceeding from the instrument. Under these conditions I have succeeded in seeing clearly the interruptions of the cell walls in several plants.‖ Nevertheless, for the most part, this method is wholly insufficient.

3. *Staining sections.* I have obtained a better result by staining in an exclusive way, by means of appropriate reagents, either the cell membranes, or the protoplasmic elements after fixing, turgescence, or contraction. In the first case the cell walls, when

* In 1880, M. Tangl described perforations in the cell membrane of the endosperm of *Strichnios, Phoenix, Areca.* In 1881, in my "*Recherches sur l'appareil tégumentaire des racines,*" I noted monocotyledonous tissues in which the cells communicate with each other by means of narrow canals. M. Strasburger, M. Russow (1882), M. Gardner (1882-3), M. Schaarschmidt (1884), have observed in various tissues, and especially in the albumen of a large number of grains, a similar arrangement, and have demonstrated it by means of staining materials.

† *Recherches sur l' appareil tégumentaire des racines*, Appendix; and *Revue Sci.*, vol. iii, p. 429 *et seq.*

‡ *Lappa communis*, var. *major*, *Ruyschia Souroubea*, *Clusia Liboniana*, *Buxus sempervirens*, *Ruscus aculeatus*, etc.

§ These canals therefore differ totally from the *culs de-sac* in thick membranes which are often described under the defective name of canaliculi.

‖ *Triticum vulgare*, *Scindaspus pertusus*, *Tornelia fragrans*, *Raphidophora pinnata*, *Ficus elastica*, *F. carica*, *Buxus sempervirens*, *Amorpha glabra*, *Cytisus alpinus*, *Robinia viscosa*, *Lunaria annua*, *Jasminum humile*, *Anthurium nitidum*, *Smilax excelsa*, *S. rotundifolia*, *Agave glauca.*

observed under the conditions just indicated, present here and there colorless lacunæ, at least in certain species of plants. In the second case, the walls of the cells are seen to stand out white upon a colored ground; the canals which traverse these walls are then visible because they are colored the same as the fundamental protoplasm itself.*

4. *Injection into organs.* I also tried to inject (slowly under pressure) into the organs to be studied a liquid capable of coloring the protoplasm; I then made cross sections of these organs. The injection rarely succeeded, but when it took place in a sufficiently uniform manner, this process led to a result identical with the preceding.†

IV. This unity (*ensemble*) of facts shows at least that in a great number of cases the cell walls permit the passage of protoplasm through narrow openings; so that in the tissues of a given plant, where up to a recent date we have only observed a multitude of small protoplasmic masses entirely isolated, there is in reality a single enormous protoplasmic mass.

It has seemed to me especially interesting to prove the existence of this structure in various parts of the same plant. For this purpose I have employed the box (*Buxus sempervirens*). Applying the methods 1, 2, 3, above mentioned, I have proved a continuity of the protoplasm in the stem and in the leaves of this shrub. From my investigations I am led to believe that in this species the protoplasm pursues, through incomplete cell walls, an uninterrupted course from the roots to the extremities of the leaves. *Ficus elastica* shows an analogous structure. The bearing of these facts on vegetable physiology and on natural philosophy will be considered in the near future.

[NOTE.—An English rendering of Dr. Schaarschmidt's paper "On the *Continuity of Protop.asm*," etc., may be found in *Nature*, Jan. 29, 1885, pp. 290–292. See also, *Nature*, Feb. 12, 1885, p. 337; Feb. 26, p. 290; and March 19, p. 459.—TR.]

GENERAL NOTES.

Esculent Plants of the Aborigines.—We are apprised that M. Paillieux, one of the Councillors of the French Society of Acclimatation, aided by M. Bois of the Museum of the Jardin des Plantes, are publishing a work on rare and curious esculent plants, and are anxious to bring as many of these as possible into cultivation in France. A request has reached us for seeds, bulbs or tubers, according to the species, of certain of our Western plants which the Indians use, or have used. By circulating the request in the BOTANICAL GAZETTE

* I have colored especially: *Triticum vulgare, Ficus elastica, Buxus sempervirens, Robinia viscosa, Cytisus alpinus, Amorpha glabra.*

† *Cytisus alpinus.*

we may hope that it may meet with botanists or amateurs who will cheerfully contribute what they may. The list leads off with *Asclepias tuberosa*, the roots or shoots of which are said to have been eaten by the Sioux at the Upper Platte. One need not go so far for this, and, indeed, it should be obtained through *the trade*. Nor should it be difficult to get the fleshy roots of the common American Arrow-head, *Sagittaria variabilis*, though it might not so readily be had under its Chippewa name, *Wah-es-i-pinig*. Among those asked for are the *Lewisia rediviva*, *Valeriana edulis*, the various species of *Peucedanum* of the Idaho region, which the Indians eat the roots of, as also those of *Edosmia* (now *Carum*), those of *Balsamorrhiza incana* and *helianthoides*, of *Callirrhöe*, *Scorzonella* (section of *Microseris*) and of *Calochortus luteus*, also the seeds of *Œnanthe sarmentosa* (we fancy a poor substitute for celery), and of *Rumex hymenosepalus* (probably a poor pie plant), which abounds throughout southern California. The address of A. Paillieux is 21 Rue du faubourg Poissonnière, Paris.—A. G.

The Investigation of Plant Diseases.—At the convention of influential agriculturists convened at Washington on the 8th and 9th of July by Commissioner of Agriculture Colman, the subject of plant diseases received considerable attention. There is manifestly a strong feeling throughout the country among the more thoughtful cultivators that the subject is one of immediate importance, and that its study should be encouraged to a greater extent than at present. No man stands in a better position to give a decided and substantial impetus to this movement than the head of the Agricultural Department at Washington.

It is, therefore, very gratifying to those who have the subject at heart to find that Mr. Colman has responded cordially to the memorial of the committee of the American Association appointed last year to encourage investigations into the health and diseases of plants, and that he has already secured Prof. Scribner to take charge of this work in the Department. That the commissioner is in earnest in his efforts is further evident from the considerable space given the subject in his address at the convention. We make room for the following extracts:

"Observations and conclusions published upon the origin and causes of diseases in plants are valuable or otherwise, according to the knowledge of vegetable economy possessed by those who favor us with their opinions.

"I am aware that in studying plant ailments it is extremely difficult in many cases to decide between a cause and a consequence. This has led to serious mistakes, as, for instance, a recent recommendation to cut down, "stamp out" peach trees, otherwise the fungus growth known as leaf blister, which is seen on peach trees occasionally during the period of leafing, would spread and destroy all the peach trees in the country. This, like most other destructive fungi on plants, being a consequence of diseased leaves caused by unfavorable climatic conditions, could not be "stamped out" permanently unless peach culture should be abandoned.

"It is well known that the profitable culture of some of our best fruits is rendered very problematical on account of their liability to fatal diseases. The pear blight is an example. Many apparently conflicting opinions have been published from time to time in regard to the cause of this malady, some attributing it to fungi, and others to bacteria, but withal, no remedy is suggested by microscopists so far as I am aware.

"Then again we have the serious question of grape mildew, which is really the cause of so much perplexity in the culture of this fruit, and gives rise to many conflicting opinions regarding the value of varieties in different sections and localities. Only the kinds most resistant of mildew can be cultivated profitably over a large portion of the country.

"Millions upon millions of dollars are lost annually by the ravages of blights, molds, rusts, smuts, and other vegetable diseases, and agricultural colleges can do a noble work in determining their causes and prescribing remedies."

In the discussion of the subject by the convention Dr. Phares, of Mississippi, offered a resolution to petition Congress to fully equip the Department for the more effective investigation of the fungous diseases of plants. A resolution was subsequently offered to have the seeds of the department subjected to the critical inspection of an expert on their quality, purity and vitality, and Major Alvord, of New York, deemed it best to have the two resolutions united, which was done. We think, this, however, an unfortunate disposition of the matter, but yet hope something may be accomplished.

What is now needed, as it appears to us, is a well equipped laboratory with a corps of trained specialists, who shall also be permitted to study the diseases in those parts of the country which offer the most favorable conditions for their investigation in the field. To make the work entirely successful it should constitute a separate division or bureau of the Department on an equal footing with that of botany, entomology, animal diseases, etc., and might very appropriately be called the *bureau of plant diseases*. The co-operation of the agricultural colleges, experiment stations and private investigators could be secured, and great scientific and economic service be rendered the country.—EDS.

EDITORIAL NOTES.

THE UNIVERSITY OF NEBRASKA has established a botanic garden.

DR. KLEIN's work on micro-organisms has been translated into French.

A WORK of 300 pages has just been published in Berlin on J. J. Rousseau as a botanist.

PROF. V. M. SPALDING has been detained from going abroad to study by the illness of his wife.

PROF. J. M. COULTER is engaged during the summer on geodetic work in the southern part of the state, near New Albany.

DR. O. J. OLSEN has received a grant of $250 from the Norwegian government with which to continue his studies on native edible mushrooms.

THE VACANT PAGE of the last number was due to a misunderstanding of the printers. The GAZETTE can ill afford to leave blank any of its much needed space.

A SMUT on cultivated violets, *Urocystis Violæ*, attacking the leaves and flower stems, has made its appearance in France, as we learn from the *Revue Mycologique*, and has proved very destructive.

PROF. CHARLES R. BARNES, of Purdue University, has been granted a year's leave of absence, and will spend the time at the Botanic Garden, Cambridge, Mass., in the prosecution of some special researches.

DR. WARMING, of the University of Stockholm, has received a call as professor of botany in the University and director of the botanic gardens of Copenhagen, Denmark, and will begin his labors on November 1.

WE TAKE PLEASURE in directing the attention of our readers to our advertising columns, which have never been better filled with what is needed in all departments of botanical research, and especially that of bacteria.

WE HAVE HAD the pleasure of examining slides prepared at Marpmann's Microscopical Institute, for which Dr. Theodore Hinrichs, of Baltimore, is agent, and find them thoroughly satisfactory, although not so elegantly mounted as those of some American preparers.

THE JUNE NUMBER of *Drugs and Medicines of N. A.* completes the account of Hydrastis, and has excellent illustrations of *Trollius laxus, Coptis trifolia, occidentalis* and *asplenifolia*. A map showing the distribution of *C. trifolia* and the illustrations of its histology are specially commendable.

A STATUE to Linnaeus was recently placed, with much ceremony, in the Humlegarden park at Stockholm, Sweden. It represents him at sixty, meditating, holding the *Systema Naturæ* and a bunch of flowers. He is surrounded by allegorical female figures representing botany, zoology, medicine and mineralogy.

PROF. W. W. BAILEY, of Brown University, is to deliver four lectures at Narragansett Pier on botanical subjects. The topics announced are "Laurels and kindred shrubs," "Ferns and their allies," "Insect relations to plants," "The South county flora." The first is to be given July 21 and the last August 11.

PROF. WM. TRELEASE, of the University of Wisconsin, will, in September, take charge of the new school of botany, founded by Mr. Shaw, in connection with Washington University at St. Louis. A laboratory is to be equipped at once, and we understand an assistant is also to be appointed. It is probable that the laboratory will, before long, be removed to the splendid gardens which have made Mr. Shaw and the city of St. Louis so well known. These magnificent gardens, together with the extensive arboretum and greenhouses, will offer almost unrivalled facilities for students when a laboratory, library and herbarium are placed in their midst. We do not doubt that Prof. Trelease will make the school as worthy as its founder's intentions are commendable.

AS THE TIME approaches for the meeting of the American Association at Ann Arbor, Mich., the promise of a full attendance of botanists grows better. In answer to a circular every western botanist who usually attends the meetings has signified his intention of being present, as well as many others, and also quite a number from the eastern States. A thoroughly interesting meeting is already assured.

Among the subjects that will be brought up at this meeting will be that of plant diseases. Papers upon any phase of the subject will be especially welcome.

All botanists are expected to register immediately after registering for the Association, and receive the badge of the Club, which entitles them to its privileges.

An excursion is to be given some afternoon by carriage, to members of the

Botanical Club only, to one of the most interesting collecting grounds of the region, giving an opportunity to see the country and to botanize throughout the trip. The long excursion for Saturday has not been definitely decided upon as we go to press, but whether it be to the Saginaw valley or along the Detroit river an opportunity will be afforded the botanists to make a detour for examining the vegetation and collecting. The excursion after adjournment to Mackinac island and Sault Ste. Marie will give a rare opportunity to see a new flora and enjoy a delightful trip.

The meetings of the Club will be held during the week, beginning on Thursday (and not on Tuesday, the 25th, as erroneously announced in the Permanent Secretary's circular). The time and place will be given in the daily programme, as well as all other announcements for the Club.

It will doubtless not be superfluous to say a little regarding the organization and purpose of the Club. It had its inception at the Minneapolis meeting in a desire to secure a larger attendance of botanists at the meetings of the Association and to promote more ready and cordial intercourse between those who did attend. It was expected that accomplishing this much would lead the way to the consideration of questions and measures of scientific and practical importance. The Club is not encumbered with constitution, by-laws or formalities. Only members of the Association who express an interest in botany are eligible to membership, and the only other requirement is registration. The meetings are held at such times as will not interfere with those of the Association, usually at 9 to 10 a. m., on Thursday, Friday, and the succeeding Monday and Tuesday.

It is earnestly suggested that only botanical papers of considerable weight and importance be submitted to the general Association, and that all others be read before the Club, which will give them quite as good a hearing and the certainty of a more earnest discussion.

CURRENT LITERATURE.

Neue Untersuchungen über den Befruchtungsvorgang bei den Phanerogamen als Grundlage für eine Theorie der Zeugung. Von Dr. Eduard Strasburger. 8 vo. pp. xii, 176. 2 plates. Jena: Gustav Fischer. 1884.

The improvement in the processes of staining has made it necessary to re-examine some of the more recondite points in the process of fertilization of the Phanerogams, and Dr. Strasburger has gone over the whole ground thoroughly for the purpose of following the nuclei of the pollen grain thence to the oosphere. This has led him to the revision of the theory of fertilization.

The work before us is divided into five parts, the first treating of the structure and development of pollen grains and tubes; the second of the modes of penetration of the tubes into the stigma and the style; the third of the fertilization in the Coniferæ; the fourth of fertilization in the Angiospermæ; the last and largest part is devoted to a statement of a theory of fertilization. The following are some of the salient points of his work:

I. Doubt is cast on the generally accepted homology of the vegetative cell or cell-complex in the pollen grain of the Coniferæ and Cycadeæ with a rudimentary prothallium, because the vegetative cells (when more than one) are cut off successively from the progamous cell. The proposition is then laid down that of the two cells formed by division in the pollen grain shortly before anthesis, the larger one is the vegetative and the smaller the generative cell, contrary to present nomenclature. It is found that there is in most cases a difference between the nuclei of these two cells in their capacity for taking up stains. Although in previous researches the nuclei had been thought to be sometimes absent in mature pollen grains, improved processes have demonstrated their presence in every plant examined. In ripe pollen grains the generative nucleus remains enclosed in the cell until the formation of the tube. In some cases the whole cell separates itself from the wall of the pollen grain, elongates and passes into the tube where it persists for some time. In other cases the generative nucleus divides while in the pollen grain, and this early division is characteristic of whole families, among which are mentioned the Gramineæ, Cyperaceæ, Juncaceæ, Caryophyllaceæ, Umbelliferæ, etc. The vegetative nucleus never divides, notwithstanding such division has been claimed be Elfving to occur in Cyperaceæ. When the pollen tubes are formed a strong streaming movement of the protoplasm carries the nuclei into the tube. The protoplasm keeps near the end of the tube and is prevented more or less completely from returning to the empty part by plugs of cellulose, except in a few cases Usually the vegetative nucleus goes ahead, yet in many cases the generative one (or two) is first, and in other species sometimes one and sometimes the other. The generative nucleus in Angiosperms always divides once at least, and usually so in Gymnosperms. Both of the nuclei thus produced do not become destroyed, earlier negative results being due to imperfections in methods of research. The vegetative nucleus can be followed in monocotyledons to the ovule, although it frequently undergoes a surprising reduction in size. It is otherwise in dicotyledons. The vegetative nucleus disappears earlier or later in the pollen tube and only the two generative nuclei reach the ovule. This point is an important one; it strongly supports the claim that the smaller cell is the generative one; we must therefore consider the larger cell as the rudimentary prothallium in Angiosperms, a conclusion which increases the doubt as to the small cell or cell-complex of Gymnosperms being a prothallium. The author is somewhat inclined to consider the whole pollen grain of Phanerogams and the microspores of vascular Cryptogams as the homologues of the antheridia.

II. In studying the entrance of pollen tubes into the stigma several distinct modes were observed. The first case is that in which (in species of *Lilium*) the pollen tube grows downward on the one-celled club-shaped papillæ of the stigma, forces its way between their bases and enters one of the three narrow slits in which the canal in the style ends above. Through this canal, adhering to its walls in the mucilage formed by degeneration of the outer layer of the wall of the lining cells, they descend to the cavity of the ovary. In another case (*Atropa Belladonna*) the pollen grains drive their tubes between the cell-rows of the stigma and into the conducting tissue of the style which is arranged in several strands through it. In *Cereus speciosissimus* the conducting tissue surrounds a canal and the pollen tubes penetrate this and do not pass down the canal. In *Agrostemma Githago* the pollen tubes dissolve the walls of the elongated single-celled papillæ at the point of contact enter these cells and grow downward (though they sometimes make a mistake and have to turn on themselves) penetrate the bases of the papillæ cells and pass thereafter *between* the cells of the conducting tissue. The Malvaceæ behave in the same way as *Agrostemma*, though none of the rest of the Caryophyllaceæ agree with it. In *Anoda hastata* the pollen tubes penetrate the epidermal cells of the stigma (which are not at all prolonged, hardly even swollen) though the outer wall of these cells is somewhat cutinized! "[The pollen tubes] show in their behavior the same modifications as have been recognized for the penetration of the hyphæ of parasitic fungi into their hosts. The entrance of the pollen tubes *between* the cells of the stigmatic surface is most commonly observed and only in relatively few cases is their growth *into* the cell to be seen."

III. In the fertilization of the Coniferæ the most important morphological facts are clear. Differing from Goroschankin, Strasburger states that though he has seen numerous cases of copulation in *Picea vulgaris*, he has never observed more than *one* male pronucleus in this copulation. The second one is finally dissolved. The development of the oosphere of Abietineæ has been the subject of much controversy. The numerous nuclei of Goroschankin resolve themselves into vacuoles, according to our author. The nucleus of the central cell of the archegonium undergoes one division with which the formation of the canal-cell is connected. In Cupressineæ, as in all Gymnosperms, the male pronuclei enter the oosphere. They have previously been seen in the oosphere at various distances from the neck of the archegonium; lately they have been found at the extreme outer end of the oosphere, so that there is hardly a doubt that they have passed from the pollen tube between the neck-cells of the archegonium. The nucleus of the fertilized oosphere *clothes itself* with a layer of very large starch grains which disappear during its movement to the lower end of the oosphere or shortly thereafter. These starch grains were formerly thought to be inside the nucleus of the oosphere.

IV. In the fertilization of Angiosperms there remains only one step to be observed, viz., the passage of the nucleus of the male cell of the pollen grain into the oosphere. In many monocotyledons, especially Orchideæ and Liliaceæ, the transparency of the ovules and the comparatively large size of the nuclei in the pollen tubes renders the process much more easily observed than in dicotyledons, in which these two conditions seldom co-exist. The processes are, however, essentially alike in both. In the pollen tube the generative nuclei can be recognized even to the time when the tube enters the ovule. In those cases when the vegetative nucleus goes first (some monocotyledons), it is probable that it can and does copulate with the oosphere, though it has never been seen inside the integument of the ovule. When the pollen tube reaches the micropyle it penetrates to the embryo sac and inserts its apex between the caps of the synergidæ. One or both of the synergidæ then become disorganized, thus making way for the plasma of the pollen tube to reach the oosphere. The generative nuclei can then be seen between the synergidæ; one of them, the male pronucleus, penetrates the oosphere and fuses with its nucleus, the female pronucleus. The other soon becomes absorbed. The nucleoli of the male and female pronuclei likewise fuse, and a delicate cellulose wall is formed on the fertilized oosphere.

V. The author states his new theory of fertilization in three propositions which he considers well established.

1. The process of fertilization consists in the union of the male pronucleus with the nucleus of the oosphere, a statement which was first definitely formulated by O. Hartig.

2. The cytoplasm is not concerned in the process of fertilization.

3. The male pronucleus, like that belonging to the oosphere, is a genuine nucleus.

In confirmation of the last proposition it has been established by direct observation that, although usually the male pronucleus undergoes more or less important changes in its course to the embryo, thus casting doubt upon its nuclear nature, yet in some cases it proceeds without such changes even up to the time of copulation. When the nucleus meets with resistance on its way to the oosphere, there are coincident changes especially when surrounded by but little cytoplasm. The more the enveloping cytoplasm, the less change in the nucleus, the changes being reduced to their minimum in phanerogams.

The second proposition, which makes the protoplasm surrounding the pronuclei only incidental in the process of fructification, has given rise to much controversy. It is undoubtedly necessary to look to the angiosperms to clear up this important point. In the division of the progamous pollen cell the cytoplasm of the resulting generative cell, even when in the smallest quantity, is seen to be strongly defined. It is evident that this cytoplasm might possess procreative qualities if it retained its identity up to the time of copulation. But we find on the one hand that it is as good as consumed by the generative nucleus and so often quite disappears, and then on the other hand that the boundary of the cell may entirely vanish sooner or later. Just here a difference exists between gymnosperms and angiosperms in that the nucleus of the generative cell of the former only uses up a part of the cytoplasm of its cell, while the latter may consume it all. From this and other arguments it is concluded that the procreative power can not reside in the cytoplasm. The cytoplasm of the generative cell in gymnosperms and of the vegetative cell in angiosperms serves in part as a vehicle to transport the nucleus, and therefore performs the same office as the cilia of the antherozoids in the vascular cryptogams.

The first proposition naturally follows from what has been said, for if the cytoplasm is not concerned in fructification, the pronuclei—male and female—must necessarily be the agents. The author does not, however, rest the question upon this *reductio ad absurdum* proof, but proceeds to give with the greatest detail every item of the process of fructification with the accompanying changes. He then discusses many recondite questions connected with the physics and physiology of the process, bringing to bear the latest investigations of the similar processes in zoology, such as those of Balfour,* Nussbaum,† and Ed. van Beneden and Ch. Julin.‡ Over eighty pages are devoted to this theme, so packed with new and important matter that it is entirely impossible to give a profitable abstract in the space at command.

Die Pilzthiere oder Schleimpilze, nach dem neuesten Standpunkte bearbeitet. Von Dr. W. Zopf. Eduard Trewendt. Breslau, 1885. Roy. 8°., pp. 174. Illustrated.

In this exceedingly interesting work the author has given the results of his own earnest and patient labor and also quoted freely from the writings of De Bary, Cienkowski, Klein, Brefeld, VanTieghem and other investigators in the same field.

In his opening chapter he makes a comparison of the morphology of the Monadines with the morphology of the Eumycetozoa, and is led to the conclusion that the representatives of both groups are substantially similar in their early development, and that between them bonds of union exist.

In regard to the place of this combined group of Mycetozoa in the system of organic life, it occupies, without doubt, a peculiar position, a borderland between the animal and vegetable kingdoms, a view which the author has expressed in the words of the title. He also prefers on this account DeBary's term, Mycetozoa, to Myxomycetes, as being more literally correct.

The first division of the book is devoted to morphology and life history, giving in detail the development of individual members of the group from the germination of the spore through the successive stages of zoospores, amœbæ and plasmodium, and finally the matured zoocysts and sporocysts.

---

* Handbook of Comparative Embryology.
† Arch. f. mikr. Anat., Bd. xxiii.
‡ On the spermatozoids of *Ascaris megalocephala*, in Bull. de l' Acad. roy. de Belgique, ser. 3, vii.

In the second division is given the physiology of the group, which includes detailed accounts of the behavior of the plasmodium under light, electricity and various temperatures, and also when subjected to the influence of different gases and chemical re-agents. A chemical analysis of plasmodium of *Fuligo varians* (after Reinke and Rodewald), furnishes a large and curious list of component parts.

In the third division is the systematic classification with descriptions of one or more species of each genus represented. The heads of the author's classification are as follows:

A. Monadineæ.
  I. *M. azoosporeæ* Z.
    1. Vampyrelleæ. 2. Bursullineæ. 3. Monocystaceæ.
  II. *M. zoosporeæ* Cienk.
    1. Pseudosporeæ. 2. Gymnococcaceæ. 3. Plasmodiophoreæ.
B. Eumycetozoa.
  I. Sorophoreæ.
    1. Guttulineæ. 2. Dictyosteliaceæ Bref.
  II. Endosporeæ.
    a. Peritricheæ.
      1. Clathroptychiaceæ Rost. 2. Cribrariaceæ Rost.
    b. Endotricheæ.
      a. Stereonemeæ.
        1. Calcariaceæ Rost. 2. Amaurochætaceæ Rost.
      b. Coelonemeæ.
        1. Trichiaceæ Rost. 2. Arcyriaceæ Rost. 3. Reticulariaceæ Rost. 4. Liceaceæ Rost. 5. Perichænaceæ.
  III. Exosporeæ Rost.

As Rostafinski's classification of the Myxomycetes or Eumycetozoa was perhaps universally adopted after the appearance of his monograph, botanists will probably be interested in noting the changes suggested by Dr. Zopf.

As a result of some recent investigations, he deems it necessary to make changes in some of the groups founded upon the color of the spores. The orders and sub-orders, with some omissions, are otherwise substantially the same except the order Heterodermeæ, which is replaced by Peritricheæ, the sub-order Clathroptychiaceæ, being also included.

The following Rostafinskian genera are omitted: Protoderma, Cienkowskia Crateriachea, Chondrioderma, Echinostelium, Brefeldia, Heterodictyon, Siphostychium, Dermodium, Oligonema and Prototrichia.

While botanists may not question the wisdom of the abandonment of some of the above genera, it seems to be a rather vigorous use of the pruning knife to merge Chondrioderma with Didymium on the ground of similarity of capillitium, especially as Lepidoderma with the same character of capillitium is retained.

Two new genera are created, Æthaliopsis and Tubulifera, each with a single species.

The work is well illustrated with fifty-two wood cuts, mostly by the author, and is a welcome addition to the literature of the subject. GEO. A. REX.

BOTANICAL GAZETTE.

VOL. X. SEPTEMBER AND OCTOBER, 1885. Nos. 9 & 10.

Botanical Papers before the American Association.

The following is a full list of the botanical papers read befor- Section F at the Ann Arbor meeting of the American Associae tion:

J. C. ARTHUR, Proof that Bacteria are the direct cause of the disease in trees known as pear-blight.

CHARLES R. BARNES, The process of fertilization in Campanula Americana.

CHARLES E. BESSEY, The question of bisexuality in the pond-scums (Zygnemaceæ); also, Further observations on the adventitious inflorescence of Cuscuta glomerata.

T. J. BURRILL, The mechanical injury to trees by cold.

D. H. CAMPBELL, The development of the prothallia of ferns.

JOHN M. COULTER, On the appearance of the relation of ovary and perianth in the development of dicotyledons.

W. G. FARLOW, Notes on some injurious fungi of California.

E. LEWIS STURTEVANT, An observation on the hybridization and cross-fertilization of plants; also, Germination studies.

Mr. Arthur's paper, published in full in this number, excited a good deal of interest, dealing as it did with a subject coming into greater and well-deserved prominence. Prof. Burrill, who had been the first to announce bacteria as the cause of pear-blight, expressed very great satisfaction in Mr. Arthur's results, which proved so directly a view for which he had been for some time contending.

The paper by Professor Barnes, also printed in this number, brought up some recondite facts in the process of fertilization which it would be well for all teachers, at least, to know. The wonderful results of the methods of the German laboratories are in no place better seen than in this whole subject of reproduction. Not the least valuable part of Professor Barnes' paper is his explanation of methods used in obtaining such delicate results.

Professor Bessey, by means of a series of observed forms, showed conclusively that filaments of *Spirogyra* can not be called male or female, as the two functions seem to reside indifferently in the conjugating filaments. The so-called "lateral," or better, "endwise," conjugation, also prevents any thought of a male or female filament. The subject seemed to be of great interest, as touching upon the beginnings of bisexuality. It was suggested by some, in the discussion that followed, that, inasmuch as it is far more common to find in conjugating filaments one entirely empty and the other containing all the zygospores, while the cases observed by Professor Bessey are really exceptional, the plant might be one in which bisexuality is attempted but not yet completely worked out. To others it seemed preferable to consider not the filaments, but the cells as individuals which are perfectly bisexual; while an intermediate view was held, which regarded both the former as right, for *Spirogyra* is a plant which marks not only a first attempt at bisexuality, but in addition to this, bisexuality in groups of individual cells, thus approaching the higher composite individual.

Professor Bessey's second paper was the result of a further study of the adventitious inflorescence of *Cuscuta glomerata*, announced at the Philadelphia meeting. It seems that the flower branch develops from the stem endogenously, while the hold-fasts begin exogenously. These adventitious buds occur only at points of root connection with the host, and a section shows that the plant axis is changing in the direction of the new buds, the old stem presently dying off below. Not only is a new plant axis formed, but for a time at this transition stage the leaf scales contain chlorophyll.

Professor Burrill spoke of two mechanical effects of cold upon trees; the radial splitting of wood and bark, and the separation of bark or wood layers in a concentric way. The first was explained by water freezing in plates parallel to the surface of an organ, and then additions being made to the base, crystals perpendicular to the surface would be formed. Thus the wood contracting, and the ice expanding tangentially and longitudinally (chiefly the former), radial bursting is the result. The south side of a tree is the weakest, as more water exists there, and ice is first formed. Direct observation shows that the specific gravity of sap is greater on the north side of a tree.

Concentric splitting, usually called "wind-shake," was explained by minute ice crystals forming with axis perpendicular to the wood cylinder, thus causing radial tension. Want of ripeness of tissues, in the sense of the relation of water to other constituents, is the chief predisposing cause.

Mr. D. H. Campbell, whose paper appears in this number, in addition to his interesting anatomical study, is to be commended for pointing out the ease with which fern prothallia may be cultivated. These, too often considered material to be obtained with great difficulty, can be cultivated with no trouble. Suggestion was made that such culture afforded a good opportunity for experimenting upon the hybridization of ferns.

Professor Coulter's paper, published in this number, was more in the form of an announcement than a formal paper following completed work. It was readily agreed to by all, in the discussion that followed, that any attempted natural classification of Dicotyledons was better than the artificial one so long in use, and that organogeny might prove as successful in plant classification as embryology among animals.

Following Dr. Farlow's paper, also published in this number, Mr. J. C. Arthur remarked that the hollyhock disease was one of great importance. It was introduced into Europe in 1869, and its progress has been carefully mapped. It has spread rapidly and surely over almost the whole continent. Statements to the effect that this disease had appeared in the United States have been made in various places, but the true hollyhock disease does not exist in this country; the fungus mistaken for it being the same form found by Dr. Farlow, which also occurs in Kansas and New Mexico. The disease is interesting in view of its possible relation to our cotton crop. By Mr. Arthur's suggestion and aid Mr. C. B. Plowright has made various attempts to communicate the disease to cotton plants, but without success. Prof. C. E. Bessey reported the same *Puccinia*, found by Dr. Farlow, on specimens of *Malvastrum* and *Callirrhoe* from Dakota.

Dr. Sturtevant, in his observation on the hybridization and cross-fertilization of plants, used beans and corn as examples, also barley, peppers, squash, etc., and showed that where pure forms are crossed intermediate forms rarely occur. Prof. E. D. Cope, in commenting favorably upon the paper, confirmed the statements, to some extent, from his own experience.

In Dr. Sturtevant's germination studes, Christiana melon seed and Danvers yellow onion were germinated, showing considerable variation in percentage of duplicates; also the germination at low temperature. Prof. Beal spoke of the germination of seeds that had been buried below frost for some time.

It was very evident that botanists were bestirring themselves to take a more prominent place in Section F. At Buffalo we expect to see still further evidence of this awakening, not only in the number of papers presented, but chiefly in the care shown in their preparation.

The Botanical Club of the A. A. A. S.

The attendance at Ann Arbor was much larger than its most sanguine friends had anticipated, there being eighty-five names entered upon the register. This gave the club twenty-three and one-third per cent. of the total attendance of the association, more than twice as great a proportion as heretofore. Thirty-seven of the members recorded the department of botany in which they are the most interested. These were entered under twenty different headings, but may be reduced to four, as follows: flowering plants and ferns, nineteen; cryptogams, fourteen; physiology, four; and paleophytology, two.

Six sessions were held in all—four in the morning and two in the afternoon—each an hour long, all in the room of the biological section, with the exception of the one on Friday evening, which, by invitation, was changed to Professor Spalding's botanical laboratory. The numbers present at the sessions exceeded seventy-five for several and dropped the lowest at the laboratory gathering, when there were only twenty-eight.

The papers, notes and discussions were of just the kind for which the club was specially founded. Those who heard them can not but have received much valuable information applicable to personal work, as well as having the pleasure of listening to the results of recent studies. The resumé which follows is necessarily very brief, and often omits the items which the listener may have found the most directly serviceable for his own needs.

THURSDAY, August 27, 9 A. M. The chairman made several suggestions of topics for the consideration of the club, which he had already formulated in the last number of the *American Naturalist*: 1. The necessity of uniformity in the use of English names of plant diseases and of the fungi producing them. 2. The advantage of uniform pronunciation of the Latin names of plants. 3. The distribution of botanical literature among the several journals so that each shall represent only certain departments of the science. 4. The relations of the botanists of the country to the National Herbarium at Washington.

In the discussion which followed it was clearly brought out that at present great confusion exists in the use of English names of plant diseases, *e. g.*, the term *blight* is given to the most diverse forms of fungi, as well as to many kinds of disease either partially or wholly killing the plant. To some extent this confusion occurs in most of the English names now in use. It was also shown that the supply of English names was not adequate to the present needs of the subject. Mr. Arthur suggested that it might be possible to prepare a list of English names of fungous parasites and the diseases which they cause, which should be taken as the standard for this country, something in the same way as the American Pomological Society exercises authority over the naming of fruits. After considerable discussion favorable to the suggestion, a committee was appointed to take the matter in charge and report at the meeting next year. The committee are J. C. Arthur, of Geneva, N. Y.; W. G. Farlow, of Cambridge, Mass.; W. Trelease, of St. Louis, Mo., who are to act in conjunction with F. L. Scribner, of Washington, D. C., who is investigating plant diseases for the government.

The second topic was only partially discussed, but the prevalent opinion seemed to be that, although there was much annoyance from the variety of pronunciations, nothing could at present be done to secure uniformity.

The third topic was urged by the chairman, who represents the botanical department of the *American Naturalist*. The representatives of the BOTANICAL GAZETTE preferred to select their material from the whole range of botanical literature. No representatives of the other journals wholly or partially devoted to botany were present, and no result was reached.

The fourth topic was taken up by Mr. Scribner, who spoke of several ways in which the national herbarium might be of direct service to the botanists of the country, and on the other hand of the duty which the botanists owe to the herbarium in the way of contributions of new material. It was brought out in the discussion that few present had any knowledge of the herbarium, or of the facilities for consultation. It was therefore urged that the first requirement was a full statement of the contents and condition of the national herbarium, in order that botanists may know what facilities it offers for present study, and what is desired to make it more complete. The club then appointed J. M. Coulter and W. J. Beal a committee to take the matter under advisement and report at a later session.

THURSDAY, August 27, 5 P. M. Professor Beal gave some notes on teaching botany. He had found the movement of protoplasm to show well in the hairs on the young buds of many species of plants. The stem of *Smilax rotundifolia* served excellently for histological study. He was of opinion that usually too much time is occupied by lectures, and not enough by laboratory work. He had had students work in various ways, but obtained the best results when considerable time was given to each plant and fewer plants used. Professor Burrill finds difficulty in getting sufficient time for laboratory work. Professor Coulter would have the laboratory open from morning till 4 P. M., and permit students to come and go as convenient to them. Professor Bessey called attention to the scientific course in the University of Nebraska, which is arranged on a plan of alternation. Botany comes but twice a week, which gives plenty of opportunity for laboratory work. The same is true of zoology, physics, chemistry, etc. This arrangement works well when the several professors act harmoniously.

The subject of reagent bottles was then taken up and various devices illustrated and described, followed by a discussion of the several phases and methods of section cutting.

FRIDAY, August 28, 9 A. M. The club received the announcement that two of its former members, Dr. N. L. Britton and Miss Elizabeth G. Knight, both of New York City, had matrimonially united their fortunes on the preceding day, which accounted for their absence from the present meeting. The hearty congratulations of the club were forwarded to them by telegram.

The committee on the relations of the botanists to the national herbarium reported as follows, and its report was adopted by the club:

It is the desire of the Botanical Club of the American Association for the Advancement of Science to assist in making the national herbarium worthy of its name, that it may offer every facility for consultation and study. They would therefore recommend that as a step in this direction the Department of Agriculture make known to botanists

1. The contents of the herbarium.
2. The number of its types.
3. The completeness of its preservation.
4. Its convenience for consultation.

Committee { J. M. COULTER. W. J. BEAL.

Dr. Halsted exhibited specimens of Peronospora and Æcidium from Spirit Lake, Iowa. The former, *P. viticola*, was on wild grapes and so luxuriant as to cover the whole plant with a white velvet and prevented its reaching more than a foot or so in height. The latter was on Euphorbia, giving the host a peculiar upright growth.

Professor Coulter gave some notes on plants collected by the Greeley expedition to the Arctic regions.

Professor Barnes called attention to the peculiar mode of dehiscence of *Campanula Americana*, by means of a pair of circular trap doors on the sides of the capsule.

Professor Lazenby gave some additions to the published lists of the flowering plants of Ohio.

FRIDAY, August 28, 7 P. M. This meeting was held in the botanical laboratory of the University of Michigan. Professor Spalding first pointed out the facilities of his laboratory. A general discussion ensued on instruments, books of reference, laboratory methods, drawing, courses of study, etc., participated in by Professors Spalding, Bessey, Burrill, Halsted, Campbell, Barnes, Beal and Coulter. This was a specially delightful and profitable meeting to those who were present.

MONDAY, August 31, 9 A. M. The election of officers for the coming year resulted in the selection of J. M. Coulter as chairman and J. C. Arthur as secretary.

The subject of the work at Washington on the diseases of plants was then introduced. The following address was presented, and after some discussion upon the best wording of the last clause, was adopted as the unanimous expression of the club:

To the Honorable Commissioner of Agriculture:

The members of the Botanical Club of the A. A. A. S., recognizing the importance of the movement so happily inaugurated by you, whereby provision has been made for the investigation of plant diseases, would hereby assure you of their hearty support in all your efforts to procure the necessary means for carrying out the work proposed. Inasmuch as researches of this nature will require a considerable expenditure of money, the members of the club hereby pledge themselves to use their influence in inducing their representatives in Congress to make a liberal appropriation therefor in accordance with your estimates.

Mrs. Walcott, of Boston, suggested that a copy of the address be furnished each member of the club, to be presented to his representative in Congress, a suggestion which met with approval.

Professor Burrill spoke of a form of grape rot which had only been recently recognized in this country as a distinct disease, although well known in Europe. It has usually been referred to *Phoma*, but does not have its spores in minute cavities or perithecia as in that genus. It is *Sphaceloma ampelina* DeBy. The spores are unable to germinate on a dry surface, so that sheltering the grape clusters prevents its attack. He also exhibited grape leaves bearing *Phoma uvicola*, a mode of occurrence which had been denied.

Mrs. Walcott gave an account of a Campanula, probably *C. Americana*, which made its appearance in some unaccountable way in a row of wild flowers raised from seeds from other localities. These seeds were sown in 1880, and the plants moved to another spot last season. This year there appeared two stalks of the species referred to, apparently, but having some of the flower buds two inches long, the calyx bristly and the flower in eights throughout. She had also observed seedlings of *Yucca filamentosa* near a plant of that species in the garden.

Considerable discussion followed. Mr. Campbell had known of *Yucca* fruiting in Michigan. E. F. Smith recited a case in which weed seeds had appeared to lie dormant for fifteen years or more. It was suggested that in this case there might have been a succession of very depauperate individuals, as some large weeds can fruit and so perpetuate themselves without reaching more than an inch or so in height, and thus escape observation.

Professor Barnes called attention to the erroneous figures of the stomata of Marchantia in all English works on botany. They are shown with six cells in circumference, whereas they have only four. The shapes of the innermost cells, the true guard-cells, and of the outermost cells of the chimney-like stoma are not correctly drawn.

F. L. Scribner exhibited some fine drawings of grasses from which photo-engravings had already been taken, and explained how they were made.

TUESDAY, September 1, 9 A. M. A paper from George U. Hays of St. Johns, N. B., on botanical features of New Brunswick was read, which is published in full in the GAZETTE.

D. H. Campbell gave some hints on growing the spores of *Botrychium ternatum*. The spores are devoid of chlorophyll, both before and after germination, which suggests that they should be grown in rich earth or humus. When prothallia of similar plants have been found they have been below the surface of the ground, and he had devised a plan for sowing the spores under the soil yet so as to be kept under constant observation. The spores of most ferns were germinated in water at ordinary room temperature, and when desiring to carry the growth very far were transferred to some solid substance and kept moist under a bell-jar.

The same speaker had found tabular crystals in the base of the petioles of *Onoclea Struthiopteris*, which the usual micro-chemical tests proved to be oxalate of lime.

Professor Bessey explained a convenient form of herbarium doors.

J. C. Arthur exhibited specimens of barley, the so-called *Hordeum trifurcatum*, in which the awn of the flowering glume is jointed and bears more or less perfect flowers.

Dr. Walker of New Orleans spoke of the dwarfing of corn grown in a flower pot in his window. Others mentioned similar phenomena.

Mr. Arthur called attention to the erroneous use of the word fungoid by nearly all English speaking botanists. It is properly applied to growths whose origin is not known or which bear some resemblance to a fungus. It can not, however, be properly applied to a fungus or its product. The word almost always intended is either the noun *fungus* or the adjective *fungous*. As a spheroid can not be a sphere, so a fungoid growth can not be a fungus or a fungous growth.

Entertainment of the Botanists at Ann Arbor.

Whatever good feeling and sociability may exist, it can not be disputed that the enjoyment and satisfaction to be derived from large conventions, in which the majority are strangers to each other, are greatly enhanced by social gatherings arranged to bring those of like tastes together. It is on this account that the receptions, excursions, etc., for the Botanical Club may be considered of not much less importance than the other features of the meetings, especially in view of the fact that through contact and personal acquaintance the general elevation of the standard of botanical thought among the members is largely affected.

The only gathering at Ann Arbor specially for the botanists was the excursion by carriage to tamarack swamp. The success of this delightful and thoroughly profitable trip was due to the efforts of Professor Spalding, to whom the club is under many obligations.

As it approached 3 o'clock, Monday afternoon, there was a noticeable exodus from the biological and other sections of the association, and the members of the club and some of their friends were soon seated in the various vehicles waiting outside ready for the start. The excursion was restricted to members of the club, and to such others as provided their own conveyances, or for which there was room after the club was seated; yet with these restrictions nearly one hundred participated.

The way lay along a straight, quite level, but pleasant road, for two miles and a half, when the whole company left the vehicles and stepped at once into as fine collecting grounds as the general botanist often sees. We passed first through a thick growth of deciduous trees, then in among the tamaracks. The soil was peaty and damp and the vegetation rank. Nearly all sorts of plants were represented; there were some with showy flowers and more yet of the weedy kinds with inconspicuous flowers that botanists usually prize; ferns, mosses and liverworts made luxuriant growth; the parasitic and microscopic fungi were fairly abundant; the parasitic fungus on scale insects attracted much attention; several interesting species of myxomycetes were found; the pileated fungi, such as toadstools, etc., were specially profuse and of lovely colors and shapes; aerial algæ were taken from the bark of trees, and diatoms and desmids could undoubtedly have been found in the running and standing water had anyone looked for them. In short, there was something to interest the specialist of almost any group of plants, as well as the general botanist. After returning to the carriages another halt was called a half mile beyond and an exploration of a less inviting spot was made, yielding Coptis, Circæa alpina, Drosera, Bartonia, and many parasitic fungi. The party then started on the return by another road, and reached the city in time for tea, having been gone about three hours and half, and traveled seven miles.

This excursion was in every way thoroughly enjoyable and profitable, and one of the most interesting botanical features of the meeting.

The arrangements for registration of the members of the Botanical Club were generously taken in charge by the local committee of the association. They provided the necessary registry blanks, silk badges and attendants. Although greatly indebted for the good intentions of the committee, yet it is to be deplored that the execution was so imperfect that only thirty-seven out of the eighty-five who registered fully complied with the requirements. This was because the blanks and badges were not on hand promptly at the beginning of the meeting. Only half enough blanks were furnished, and the attendants did not give close enough oversight to the registering.

The local committee also promised, as was fully announced, that the botanists would be given an opportunity for collecting on the long excursion of Saturday, whether it went to the Saginaw valley or the Detroit river. When it was learned that no such arrangements had been made, several botanists gave up the trip entirely and collected in the vicinity of Ann Arbor, while those who did go would gladly have left the boat at any one of several points, had it been possible, and been picked up on the return.

We can only assume that this apparent slight of the botanists was due to a supposition on the part of the local committee that the botanists were an insignificant part of the Association, not meriting much trouble or attention. If this is the proper explanation, the registration of over a fifth of the total attendance as members of the Botanical Club must have brought about a change of opinion before the meeting was over.

Proof that Bacteria are the Direct Cause of the Disease in Trees Known as Pear Blight.[1]

BY J. C. ARTHUR.

It has now been five years since Professor Burrill brought the subject of pear blight before this Association and announced that it was due to bacteria. Previous to that time no instance of bacteria acting the rôle of vegetable parasites had been known, and the discovery was therefore a very important one, opening the way to a new and promising field of research.

The experiments of Professor Burrill showed that the disease alluded to was invariably accompanied by a specific form of bacteria (since named *Micrococcus amylovorus* Burrill), and that as the disease progressed a colorless or yellowish viscid substance was formed, apparently by the action of the bacteria upon the starch and other substances of the plant. The disease results in the complete death of all those parts of the tree that are attacked.

Although from these and subsequent investigations the theory has been quite generally accepted that the bacteria are the cause of the disease, no rigid proof of it has yet been brought forward. It was with a view to either absolutely prove or disprove the theory that a course of experiments was begun last March, and continued to the present time.

It has been incontestibly shown that the disease may be readily transmitted to healthy tissues by introducing a drop of an infusion made by putting some thin slices of the diseased tissues

[1] Read before the American Association for the Advancement of Science, August, 1885.

in water,[2] or by simply transferring a minute portion of the exudation from the diseased to the healthy shoot.[3] The problem was consequently narrowed down to one of two alternatives, either the bacteria were the cause of the disease, or the juices which accompanied them were the cause of it.

The first attempt was to secure some inoculating material in which the bacteria were entirely freed from the juices of the disease. This was done by means of a succession of artificial cultures in a sterilized infusion of corn (maize) meal.

Two series were successfully carried through, extending over about four months, and an inoculation from the sixth culture of each introduced into the green fruit of a Bartlett pear.

The accompanying tables will show the kind of culture vessels used, the amount of culture fluid they contained, and the date at which each one. was started. The first culture of the

No. of Culture.	Date of Infection.	Kind of Culture Vessel.	Amount of Fluid.
301	March 27	Salmon culture tube	20 cc.
302	April 1	Salmon culture tube	20 cc.
307	April 21	Sternberg culture flask	½ cc.
309	April 24	Sternberg culture flask	½ cc.
314	May 22	Sternberg culture flask	½ cc.
322	June 5	Test tube with Fol stopper	25 cc.
364	July 13	Bartlett pear on tree	

series was infected with a very small fragment of wood taken from the inner portion of a diseased limb of Flemish Beauty pear, in which the disease had been slowly advancing during the winter, from an inoculation made July 26, 1884, with an infusion of blighted twig from an apple tree. The infection of each of

No. of Culture.	Date of Infection.	Kind of Culture Vessel.	Amount of Fluid.
301	March 27	Salmon culture tube	20 cc.
302	April 1	Salmon culture tube	20 cc.
307	April 21	Sternberg culture flask	½ cc.
309	April 24	Sternberg culture flask	½ cc.
310	April 27	Sternberg culture flask	½ cc.
320	June 5	Test tube with Fol stopper	25 cc.
362	July 13	Bartlett pear on tree	

[2] Arthur, Bull. N. Y. Agric. Exper. Station, xcii: 3d Ann. Rep. N. Y. Agric. Exper. Station, p. 358.

[3] Burrill, Amer. Ass. Adv. Sci., xxix, p. 589; *Amer. Naturalist*, xv. 529. Arthur, l. c.

the other cultures of the series was successively made with a small drop of the one preceding. From the last culture a drop was transferred to a puncture in a ripe Bartlett pear. In both cases the pears were soon filled with the disease. They did not turn brown about the wound, as is the more usual way, but first indicated the presence of the disease by beginning to shrivel, which occurred in one case in nine days after inoculation, and in the other in ten days. Upon cutting the pears open the softer tissues were found broken down and liquefied, and a milky viscid juice ran out, showing that the disease had taken thorough possession.

By this means of fractional culture the juices accompanying the bacteria first introduced were so much diluted in the transfers to succeeding cultures that the final drop used to inoculate the pear was practically free of them, and to the bacteria only, supplied by continued growth and multiplication, can be ascribed the last result.

Having shown that the bacteria when isolated from their juices are able to cause the disease, it still remains to show what action the juices would have when separated from the bacteria. On July 18 a strong infusion of blighted pear was filtered through a porous earthenware vessel, such as used for small electric batteries, and an unripe Bartlett pear inoculated with the filtrate and another pear with the infusion used for filtering. In a week the latter was thoroughly blighted, while the former showed no signs of injury except the slight wound, which finally healed. On July 24 another strong infusion of pear blight was filtered through a second battery cell. Both of these cells were new and had never before been used for any purpose. In this case two unripe Bartlett pears were inoculated with the unfiltered infusion and two others on the same tree with the resulting filtrate. Both the former showed strong evidences of the disease within three days, while the latter soon healed up the small wounds made by the inoculation, and have continued their normal growth.

The evidence is thoroughly satisfactory and conclusive. The bacteria accompanying the disease of trees known as pear blight when fully isolated will produce the disease, while the juices in which they live will not. They are therefore the direct cause of the disease.

Notes on Some Injurious Fungi of California.[1]

BY W. G. FARLOW.

During a recent trip to California I had an opportunity of observing some injurious fungi which attack the native plants, and as they may hereafter be the cause of disease in cultivated plants, it may be well to call the attention of the members of the Association to a few facts with regard to them.

In traveling in Mexico the attention of the botanist is attracted by the pleasing foliage and graceful habit of *Nicotiana glauca* Grah., which is abundant along the railroads and highways, where it often attains a height of ten feet or more. This shrub or small tree is a native of Buenos Ayres, but is thoroughly acclimated in Mexico, and is occasionally cultivated in the greenhouses of our Northern States. Within a few years it has escaped from cultivation in California and is now a common roadside plant from San Diego to Los Angeles and Santa Barbara, and also occurs, but less commonly, still further to the north. While in San Diego I noticed that the leaves of the *Nicotiana* were badly attacked by a fungus which formed large grayish-black spots on both sides of the leaves. The spots were often two inches in diameter, and sometimes even larger, and the circumference was irregular but sharply limited, so that the transition from the healthy to the diseased leaf tissue was sudden.

A microscopical examination shows that the fungus in question is *Peronospora Hyoscyami* De By., which was first found on *Hyoscyamus niger* L., in Europe, where it does not appear to be at all common. Both in Europe and California the spots formed on the leaves are large, and the surface is densely covered with a luxuriant growth of conidia, but, so far as I know, no oospores have yet been found in this species.

Since it is well known that the species of *Peronospora* attack different species of flowering plants which belong, botanically speaking, to the same natural order, it is much to be feared that the disease which now attacks *Nicotiana glauca* may sooner or later extend to the cultivated tobacco, which belongs to the same genus. If this happens, the injury to the tobacco would be very great, since by causing large spots on the leaves to rot they would become worthless for manufacturing purposes. We must at least consider the probabilities with regard to the spreading of the disease. The fungus was only observed by me at San Diego, but it was abundant there. Whether it occurs in Mexico or not I can

[1] Read before the American Association for the Advancement of Science, August, 1885.

not say, but my opportunity for observing in that country was so limited that the fungus might have been very abundant there and still escape my notice. At Santa Barbara, however, I was able to make a pretty careful search, and as far as I could ascertain, the disease has not yet made its appearance there, but from what we know of the history of the spreading of diseases caused by other species of *Peronospora*, there is every reason to suppose that the disease which we are now considering will soon reach Santa Barbara. As tobacco is not an important crop in California, we are less interested in the spreading of the disease in that State than in its extension to the southern states. The *Nicotiana glauca* may perhaps spread northward and eastward until it reaches the gulf states, carrying with it the *Peronospora*, but it is too tender to stand the winters further north without protection. What is also to be feared is that in advancing eastward the fungus may be communicated to some species related to the *Nicotiana glauca*, as for instance *Hyoscyamus niger*, and thus be transported north of the limit where the *Nicotiana glauca* might grow, but where *N. Tabaccum*, the tobacco plant, is cultivated. But this supposition is almost superfluous, because if *Nicotiana glauca* and its parasite are once introduced into the gulf states the parasite might attack the tobacco grown there, and then pass on to Virginia and other states where tobacco is the most important crop.

At the Minneapolis meeting I stated in a paper read before the Association that *Peronospora Halstedii*, although one of the commonest species on Compositæ in the eastern and central states, had not yet been found either in the extreme south or on the Pacific coast. I am indebted to Dr. H. W. Harkness for specimens of a *Peronospora* growing on *Madia sativa*, near San Francisco, which is identical with *P. Halstedii*, so that this typically American species extends quite across the continent. *Peronospora leptosperma* of De Bary, known in Europe and the Mississippi valley, I also found to be common at Santa Barbara and Santa Cruz, on *Artemisia Ludoviciana*.

The hollyhock disease, *Puccinia Malvacearum* Mont., which was originally noticed in Chili, has in recent years spread over Europe, and its progress has been more carefully watched by botanists than that of any other plant disease, the potato-rot and grape-mildew perhaps excepted. But while the two diseases last named extended to Europe by way of North America, the hollyhock disease, apparently, was conveyed directly from South America to Europe, and did not pass through the United States.

The only reference[2] to the existence of the hollyhock fungus in this country is in the catalogue of Pacific coast fungi by Harkness and Moore, where it is said to have been found on *Malva*, near San Francisco. A fungus related to the hollyhock fungus has been observed on species of *Malvastrum* in the western states and California. It was first seen by Mr. D. Cleveland, near San Diego, in 1875, and has been seen several times since. By some the fungus on *Malvastrum* has been considered distinct, and even those who have considered it a variety of *P. Malvacearum* have regarded it as distinctly unlike the form found on hollyhocks. When in California I examined with care the different Malvaceæ, to which order the hollyhock belongs, to see whether the true hollyhock fungus did not occur in that state. During a visit to the garden of Mrs. Elwood Cooper, near Santa Barbara, I found the hollyhock covered with a *Puccinia*, and in a canyon near the garden I also found a few leaves of *Malva borealis* L., on which was the same fungus. I at first supposed that what I had found was the hollyhock disease of Europe and South America, but closer examination and a careful comparison with European specimens showed that the form found at Santa Barbara was not the European form, but, on the contrary, precisely the form already known on *Malvastrum* in this country. This is to me rather surprising, for if the fungus on *Malvastrum* is only a variety of the hollyhock fungus, when the disease appears on hollyhocks in this country it should appear in its typical form; and, on the other hand, if the Malvastrum fungus is really a distinct species then the hollyhock disease of Europe is not the hollyhock disease of this country, although both are caused by nearly related *Pucciniæ* of the sub-genus *Leptopuccinia*. A detailed account of the differences recognized in the two forms mentioned is only of interest to mycologists, and a discussion of the subject will come up more appropriately in another connection. In case of the fungus in question, one should consider the possibility that it may attack the cotton plant[3] at some future date, although Cesati states that *Puccinia Malvacearum* has not attacked the cotton in Italy. As far as our own cotton is concerned, danger is rather to be apprehended from *Puccinia heterospora* B. & C., which in its different forms is widely distributed on different Malvaceæ in the southern states.

[2] The mention by Burrill in *Bull. Ill. Lab. Nat. Hist.*, and the several items in the *Gardeners' Monthly*, at different dates, all refer to some other disease.—EDS.

[3] Plowright found by direct experiments that the true *P. Malvacearum* will not grow upon the cotton plant. See *Science*, V. p. 2.—EDS.

BARNES ON CAMPANULA.

The Process of Fertilization in Campanula Americana L.[1]

BY CHARLES R. BARNES.

(WITH PLATE X.)

I have undertaken to investigate some of the more recondite facts in the process of fertilization of *Campanula Americana* in order to increase the number of dicotyledons that have been so studied and to bring to light any peculiar adaptations which might exist.

The investigation of dicotyledonous plants is much more difficult than that of monocotyledons, because the transparence of the ovules and the usually large size of the nuclei which are so common among the latter seldom coexist in any dicot. *Campanula Americana* presents peculiar difficulties in the remarkable opacity of the ovules, though the nuclei are of moderate size.

As preliminary to an account of the study of fertilization, I proceed to give a brief account of the arrangement for cross-pollination which exist in this species.

The plant furnishes a marked example of proterandry, the anthers ripening and discharging their pollen in the unopened bud. The style at this time is not as long as the anthers, and that part in contact with the bursted thecæ is thickly clothed with stiff hairs pointing upward (*fig.* 1). The rapid growth of the style pushes these hairs, like the bristles of a bottle brush, through the thecæ and clears them of all the pollen, which adheres to the style of the now open flower (*fig.* 2). At this time the three lobes of the stigma are not manifest. They do not separate for some time afterward (*fig.* 3). The flowers are visited by wasps and bumblebees, the latter of which in crawling around the almost rotate corolla bring some part of the body, most commonly the hairy thorax or the legs, in contact with the pollen-laden styles of lately-opened flowers or the stigmatic surfaces of older ones. The nectar is secreted in abundance by a series of glands arranged in a circle on the flattened top of the ovary, to reach which the bee has to thrust his tongue between the style and the connivent, broadened bases of the filaments.[2] There is in these plants hardly a possibility of close-fertilization, the pollen being always brushed or blown off the style before the stigmas are at all exposed.

[1] Read before the American Association for the Advancement of Science, August, 1885.
[2] Cf. Gray, Struct. Bot. p. 222, on proterandry of *C. rapunculoides*.

The essential points in regard to fertilization are as follows:

The development of the pollen is quite normal. There appear in each transverse section of the anther from six to eight mother-cells, which have somewhat thickened walls but do not float in liquid. The tapetal cells are unusually large and the three outer rows, particularly the inner, much smaller.

The stigmatic surfaces of the style are covered with nipple-shaped papillæ, the uppermost of which develop sooner than the lower. Those on any lobe interlock with those on the other two and thus prevent the premature separation of the lobes (*fig.* 4). As the growth of the outer surfaces of the style-lobes produces an increasing tension, the lobes finally separate. This separation begins at the base and the tips hold till the stigma is completely mature.

The hairs which brush out the pollen from the anthers (*fig.* 5) have their bases, *b*, deeply sunk in the tissues of the style. They are single-celled. Their tips, *t*, become quite thick and extensively cutinized, and the inner thickening layer is highly refractive. Just at the point of emergence the wall is thinner than at any other place. After these hairs, which are at first rigid, have served their purpose, they become softened and are in some way—I suppose by the contact of insects with the style—telescoped[3], so that the tip is left slightly projecting at the entrance of the pit thus formed (*fig.* 6). The result is as though one grasped the tip of a glove-finger and thrust it in upon itself until only the tip appeared projecting from the hand of the glove. This introversion of the hairs frees the pollen so that it is readily brushed off and carried away. Sometimes a pollen-spore drops into one of the pits and remains as a stopper for it. In the young hairs a beautiful streaming of the protoplasm is easily demonstrated[4].

The style has a small canal in the center, around which the conducting tissue is disposed in a variable number of strands of different sizes (*fig.* 7). Midway between the canal and the periphery are (usually) six fibro-vascular bundles. The conducting tissue, *ct*, is quite small in amount and sharply distinguished from the remaining tissue of the style (*fig.* 8).

The ovules are small, flattened and anatropous, with a *very short* funiculus, so that the micropyle is brought close against the placenta. The embryo-sac is straight and lies in the axis of the ovule (*fig.* 9). It is sharp-pointed at its micropylar end, somewhat larger in its upper fourth than elsewhere, and ends at the

[3] Müller, Fertilization of Flowers, p. 366–7, states that in the genus *Campanula* the hairs shrivel. This is not true for this species, nor *C. rapunculoides*, *fide* Strasburger, Bot. Practicum, p. 103.

[4] Cf. Strasburger's account of similar hairs in *C. rapunculoides*, l. c.

base in a considerable and abrupt enlargement. The tapetal cells, *t*, are unusually large and appear, in longitudinal section, columnar. In each lies a nucleus which is almost as wide as the cell. At both ends of the embryo-sac the tapetal cells become like the other cells of the nucellus. In the basal enlargement of the embryo-sac lie the three antipodal cells, *a*, one of which is usually a short distance above the other two. There are frequently two nuclei, *en*, en^1, belonging to the embryo-sac, near its middle. The pointed apex of the sac is occupied by the synergidæ, *s*, s^1, which are correspondingly long, nucleated near their upper ends and vacuolated near their lower. A little below the lower ends of the synergidæ lies the oosphere, *o*. It is noticeably more granular than the synergidæ and its nucleus is somewhat larger. A layer of protoplasm lines the embryo-sac and bridles extend in various directions between the egg-apparatus, the nuclei of the embryo-sac and the antipodal cells.

The mature pollen-spore is marked externally with numerous minute elevations (*fig.* 10), hardly more than thickenings of the cuticle, and 3–12 thin spots for the exit of the pollen tubes. At each thin spot in the extine there is a corresponding thickening of the intine.

The mature pollen-spore possesses two nuclei, the larger round one, the vegetative[5] nucleus (*vn*, *fig.* 11), occupying the center of the cell, while the spindle-form, generative nucleus lies to one side. I have been able to demonstrate both of these nuclei in only one case, when, after staining with borax-carmine, I crushed the cells (*fig.* 12). In several cases I have found the vegetative nucleus after treatment with acetic-methyl-green, and in other cases I have seen the generative nucleus in the pollen tubes (*fig.* 13). The difficulty of distinguishing the nuclei in this species is greatly enhanced by the markings on the walls, which simulate a nucleus and nucleolus. Strasburger states[6] that in *C. rotundifolia* the generative nucleus is easily demonstrated after staining with acetic-iodine-green, but it is not so in this species.

I have germinated the pollen-spores in ten per cent. sugar solution, and have obtained tubes of considerable length. In these cultivated tubes I have demonstrated both the vegetative and generative nuclei. The vegetative nucleus is therefore not destroyed in the spore, but passes early into the tube, where it

[5] In this nomenclature I follow Strasburger (*Neue Untersuchungen*, p. 5), which is exactly the reverse of that generally used and even the reverse of that given by Strasburger in *Bot. Practicum*, p. 495.

[6] *Neue Unters.* p. 34.

soon undergoes disorganization. I have seen this nucleus in various stages of destruction. The generative nucleus passes later into tube; indeed it is usually among the last of the contents to leave the spore. I am not able to say whether or not it divides; presumably it does,[7] though I have seen but one such nucleus.

When the pollen tubes are emitted on the stigma they sometimes pass straight and sometimes after turning upon themselves downwards *between*, and not *into*, the bases of the papillæ (*fig.* 14). The conducting tissue runs close beneath the stigmatic surfaces. In this tissue I have traced the tubes for several millimeters. The pollen tubes penetrate the strands of conducting tissue and do not enter the canal of the style. A short distance behind the apex of the tubes cellulose plugs are successively formed (*fig.* 15). These plugs, which have sometimes considerable length, are very prominent objects in longitudinal sections of the style or when the conducting tissue is teased with needles. The latter method permits one to trace the tubes for long distances. The pollen tubes pass down the style and follow the placentæ. When they emerge from a placenta they either enter the nearest micropyle at once or pass further, adhering *very closely* to the surface of the placenta.

I have detected the pollen tubes in a number of micropyles. The difficulty of tracing their further course is greatly enhanced by the opacity of the ovules and the consequent necessity of adopting the section method, as hereafter explained. I have been fortunate enough to find one specimen in which the pollen tube had entered the micropyle and penetrated to the synergidæ (*fig.* 16). In this specimen fertilization had taken place. One of the synergidæ at least (I could not see the other) had become disorganized and there were two nuclei in the oosphere. I am not certain that these were the male and female pronuclei, though they may have been. I am rather inclined to think from the considerable elongation of the oosphere that the embryonal nucleus had just divided preparatory to the formation of the first two cells of the suspensor. After fertilization the embryo-sac enlarges greatly, particularly in its middle third, and the formation of endosperm proceeds at once and rapidly.

The main points established regarding the fertilization of *Campanula Americana* are these:

The tapetal cells of the anther and ovule are unusually large.

[7] Strasburger, l. c., p. 15, states that such division is the rule. I have not yet assured myself that it takes place in this species.

The pollen-spore possesses two nuclei, one of which, the smaller, persists and either with or without division copulates with the female pronucleus.

The pollen tube penetrates between the cells of the stigma and passes down the conducting tissue and not in the canal of the style.

There is the usual generative and vegetative apparatus in the embryo-sac.

METHODS.—For the study of the development of the pollen-spores I used alcohol-fixed buds, which had been twenty-four hours in alcohol-glycerine[8], commencing with those 2mm. in length. The sections of the entire bud were stained with methyl-blue.[9] The plant is an admirable one for the use of students in this respect.

For the study of the pollen-spores themselves fresh material is requisite. The best results were obtained by staining with borax-carmine.[10] The spores are placed in a drop of 2 per cent. acetic acid and after a few minutes a drop of borax-carmine added. This is allowed to remain an hour, the slide being protected from evaporation meanwhile. The stain is then washed out with acidulated alcohol[11] and a drop of dilute glycerine placed on the specimens.[12] The demonstration of the nuclei is extremely difficult.

The spores were germinated in a hanging drop of 3-12 per cent. sugar solution in the usual moist chamber. After three hours they were examined, the cover-glass with the drop being lifted off and allowed to fall on (1) a drop of acetic-iodine-green[13] or (2) a drop of picro-carmine.[14] After a few minutes dilute glycerine is run under the cover. Both yield excellent results. The nuclei in the tubes are thus more deeply stained than the cytoplasm.

Longitudinal sections of the stigmas serve for the study of the entrance of the pollen tubes. I used alcoholic material, without any staining, mounted in glycerine.

The pollen tubes in the conducting tissue may be studied either in longitudinal sections of the style or by laying open the style and drawing a needle through the canal, thus dragging out the conducting tissue. In the latter case care must be taken to

---

[8] Equal parts of 95 per cent. alcohol and glycerine.
[9] Aqueous solution.
[10] Grenacher's. See Bot. Pract., p. 630, or Archiv. f. mikr. Anat. xvi, 466.
[11] 70 per cent. alcohol, 100cc. HCl, 5cc.
[12] Strasburger, Neue Untersuchungen, p. 7.
[13] A drop of 1 per cent. acetic acid to which a small drop of iodine-green is added Strasburger, l. c., p. 6.
[14] Bot. Pract., p. 630.

tangle the strands as little as possible and methyl-blue should be used as a stain, otherwise the transparency of the pollen tubes renders them very difficult to follow. The very greatly elongated cells of the conducting tissue are almost exactly the diameter of the pollen tubes and are liable to mislead, were it not for the abundant cellulose plugs which occur only in the tubes.

In the study of the ovules material fixed in strong alcohol, in picric acid[15] and in chrom-acetic acid[16] was used. The contraction of the contents of the embryo-sac is unavoidable. I think the alcoholic material is quite equal to the others and less troublesome. I found it necessary to depend on getting chance sections of the ovules by cutting the whole ovary longitudinally and laying the sections in glycerine. Previous to the cutting the material is placed in alcohol-glycerine for twenty-four hours or more. After being mounted in glycerine the sections become clearer and clearer. I also tried cutting sections in various known directions by imbedding the ovules in colored pith to render them more easily seen. The results, on the whole, are not better than by depending on chance sections, and they are much more troublesome.

[15] Saturated aqueous solution.
[16] Chromic acid, 0.7; acetic acid, 0.3; distilled water, 99. Strasburger, l. c., p. 328.

Explanation of Plate X.—Fig. 1, A bud bisected in the plane of the axis and bract. × 2. Fig. 2, diagram, an open flower bisected in the same plane; the stigmas unopened and the style laden with pollen. Fig. 3, a style with stigmas open. Fig. 4, interlocking papillæ of stigmas. × 195. Fig. 5, section of style from bud, showing hair; near *n* the remains of the nucleus. × 195. Fig. 6, section of style from which the pollen has been removed; *a*, a hair partly turned out of place; *b*, a hair in normal position. × 195. Fig. 7, transverse section of style; *c* lies in the canal; *ct* (shaded) the conducting tissue; *frb*, fibro-vascular bundle. × 37. Fig. 8, transverse section conducting tissue. × 356. Fig. 9, diagram of embryo-sac; *a*, antipodal cells; en, en^1, nuclei of embryo sac; n^1, nucleus of tapetal cell; n^2, nucleus of a parenchyma cell of the nucellus; *o*, oosphere; *on*, nucleus of oosphere; s, s^1, synergidæ; *sn*, nucleus of synergida *s*; *t*, tapetal cells; *v*, vacuole of synergida s^1. Fig. 10, diagram, optical section of wall of pollen-spore through one of the exit spots; *e*, extine; *i*, intine; *t*, stratified local thickening of intine. Fig. 11, a pollen spore, showing vegetative nucleus, *vn*; *p*, a beginning pollen tube. × 356. Fig. 12, part of the contents of a crushed pollen-spore; *gn*, generative nucleus; *vn*, vegetative nucleus. × 356. Fig. 13, a cultivated pollen tube; *gn*, generative nucleus. × 356. Fig. 14, a pollen tube penetrating the stigma; *p*, *p*, papillæ of stigma. × 260. Fig. 15, a cellulose plug in a pollen tube. × 380. Fig. 16, a pollen tube penetrating to the embryo-sac; *p*, pollen tube; *s*, synergida disorganized; kn, kn^1 (male and female pronuclei ?), the germ nucleus after its first division. × 356.

CAMPBELL ON PROTHALLIA.

The Development of the Prothallia of Ferns.[1]

BY DOUGLAS H. CAMPBELL.

(WITH PLATE IX.)

In the following paper an attempt has been made to present in brief form the results of a series of experiments upon the germination of the spores, and the development of the prothallia of some of the common ferns.

This subject was chosen for two reasons: first, because in the course of the experiments attention was called to several facts that do not seem to be generally known; and secondly, if possible, to arouse the interest of students of botany in a line of work that does not appear to receive the attention that it deserves.

The importance of the study of the development for a full understanding of any group of organic bodies is fully admitted, but there seems to be a prevalent idea that such study must necessarily be confined to the experienced and thoroughly trained biologist, whereas frequently many of the most important facts of development can be verified by any student of ordinary ability who knows how to handle a microscope.

The plants under consideration offer perhaps the best illustration of the point in question. Complex as is the structure of the mature fern, it starts from a single cell, the spore, and the earlier steps in the development of the plant from this cell can be traced with little difficulty. Of course the development of the sexual organs and the growth of the fern itself from the fertilized germ-cell is a much more difficult matter, but up to this point no difficulty is experienced.

There is no part of the country where some ferns do not grow, and the spores may either be sown at once or kept for future use, as they retain their vitality for a long time. They germinate quickly, and with a little care can be kept in a healthy condition and the successive steps in the development of the prothallium followed.

The first fern investigated by me was *Onoclea Struthiopteris*. After vain attempts to procure a sufficient number of fern-prothallia from green-houses, for study, and supposing that the germination of the spores was a long and difficult process, I determined to make some experiments. A quantity of the spores were gathered and sown without much hope of success, but in a few days undoubted signs of germination were evident, and soon

[1] Read before the American Association for the Advancement of Science, August, 1885.

a large number of healthy young prothallia was the result. Encouraged by this success, *O. sensibilis* was tried with similar results. Lack of time prevented following out the complete development of the prothallium, but subsequently both forms were grown and produced young plants. Other species, upon which more or less complete observations have been made, are *Asplenium Filix-fœmina*, *Aspidium spinulosum*, *A. acrostichoides*, *Adiantum pedatum*, *Cystopteris fragilis*, and *Woodsia Ilvensis*. Of these *Aspidium spinulosum* is frequently found growing naturally, as is also *Cystopteris*, but whatever observations were made upon the others were from artificial cultures. Spores were sown under various conditions, but the best results were obtained by simply sowing upon fine earth. The earliest stages can be more conveniently observed by sowing in water, but prothallia so grown do not maintain a healthy growth, and so far as my observations go, no sexual organs were developed upon them. Other cultures were made upon rotten wood, upon which they are frequently found naturally, and upon porous pottery, but in neither case was the result as good as when grown upon damp earth. In order to maintain an even degree of moisture, it was found best to keep the prothallia covered with a bell-jar, or some similar contrivance, as evaporation is too rapid when they are exposed to the air. Excess of moisture, especially after the prothallia are at all advanced, must be guarded against, as they will decay if kept too wet. The ground should be kept damp, but *not muddy*. Spores may be started at any time, but the best results are obtained by sowing in warm weather, or at least when they can be kept at a tolerably uniform temperature. In winter, even with artificial heat, growth almost ceases, the deficient light seeming to affect them unfavorably, as well as the lower temperature. Probably in a green-house, where the fluctuations of temperature are less marked, this would be less apparent.

By following the directions given, no trouble should be experienced in growing any of our common ferns.

The spores of ferns are protected by a thick brown exospore, usually marked by prominent thickenings or ridges. In many cases this exospore remains attached to the spore for a long time after germination, but in the genus *Onoclea*, it frequently becomes thrown off, being readily detached even when the spores are not fully mature. In this genus there is in addition to the exospore a second coat, which must be ruptured before the endospore proper can protrude. In ferns of other genera examined the exospore adhered so firmly to the spore as to make it impossible to determine whether this third coat was present or not.

The contents of the spore consist of dense protoplasm containing a nearly central nucleus, and numerous fine granules of chlorophyll. Oil is present, usually uniformly distributed, but sometimes collecting in large drops.

Ordinarily the first step in the active growth is an elongation of the spore, one end becoming nearly transparent. This transparent end elongates still farther and very soon is shut off by a septum approximately at right angles to the longer axis of the spore. Two cells are thus formed, a small transparent one, the first root-hair, and a larger one containing abundant chlorophyll. The root-hair contains only a few very small granules of chlorophyll, and these finally seem to disappear entirely. The walls of the root-hair frequently show a decided brown color, which is sometimes developed very early. This is noticeably the case in *Onoclea sensibilis*; in *Asplenium filix fœmina*, on the contrary, the color is scarcely apparent even in the older root-hairs. Abnormal cases occur where no root-hair is formed. The larger of the two cells first formed also elongates and very soon undergoes further division (Figs. 1–3). In the great majority the first division, and usually several successive septa, are parallel to the primary septum, thus giving rise to a filament, or single row of cells. The prothallium may never pass beyond this condition, especially if it is grown in water, but ordinarily, sooner or later, the terminal cell becomes divided by a septum nearly at right angles to the first ones (Fig. 4). Sometimes, again, the first wall in the body of the spore may be at right angles to the primary septum, and the prothallium never passes through the filamentous stage—this, however, appears to be exceptional (Fig. 4, a).

While the division of the cells is progressing, the chlorophyll granules which were small and crowded at first, become much larger and more widely separated. As the prothallium grows, they enlarge and divide, all of those to be found in the complete prothallium apparently arising from the growth and division of those that occur in the spore before germination.

After a varying number of divisions, one of the terminal cells assumes the lead and becomes a triangular apical cell, dividing by septa directed alternately right and left (Fig. 5–6, a). Occasionally two successive septa will be formed on the same side. As a result of the repeated divisions of this apical cell, the end of the prothallium becomes rapidly broader, but for a time the deep sinus in front, so characteristic of the prothallium, is not present. This arises as follows: each segment is first divided by a septum perpendicular to the long axis of the prothallium; the outer of the two cells thus formed, or marginal cell, becomes next divided by a wall perpendicular to the first formed. These marginal cells lengthen, and the inner cell of the segment divides still further by walls parallel to the first. The segment thus grows faster in length than in breadth, and is rapidly pushed out beyond the apical cell, which thus gradually comes to lie at the bottom of an indentation or sinus in the front of the prothallium, and gives it the heart shape or kidney shape that the larger prothallia usually have. After a time, varying extremely even in the same species, the apical cell is divided into two cells by a vertical wall perpendicular to the long axis of the prothallium; the outer cell is next divided by a wall at right angles to the first, and from this time in the growth can no longer be traced back to one cell.

About this time, or sometimes before the obliteration of the apical cell, the cells in its vicinity, which had hitherto only divided in two planes, so as to form a single layer of cells, are now divided by walls parallel to the surface of the prothallium, forming the beginning of the cushion of tissue that occupies the base of the notch in the front of the prothallium; where this is begun early, the subsequent growth of the prothallium results in the formation of a thickened rib running through the middle for nearly its whole length.

The prothallium is fastened to the ground by numerous root-hairs that arise principally from the cells of the lower part, as small papillæ, that are soon shut off by a septum. Like the first one formed they contain little or no chlorophyll, and in most species soon acquire brown walls. They probably serve to some extent as absorbents as well as to fasten the plant.

In many species, e. g. *Aspidium spinulosum*, *Cystopteris fragilis*, *Onoclea sensibilis*, there are developed small papillæ from the marginal cells (Fig. 6. p.); whether these have any special function is extremely doubtful. They are entirely wanting in *Asplenium filix-fœmina*, and *Onoclea Struthiopteris*.

While the foregoing statements are true for the majority of cases, it must not be inferred that they are without exceptions; indeed, probably none of them are absolutely inflexible, and except in the earlier stages they are true only of the larger prothallia, which are, in most cases observed, female.

The subject of diœcism in ferns is not, apparently generally understood; in fact, as far as I have been able to ascertain, while the formation of prothallia bearing only antheridia has been observed, but apparently regarded as exceptional, the formation of strictly female prothallia has been overlooked. Of the ferns mentioned in this paper, three have been traced out with care, from the spore to the formation of the embryo, viz: *Onoclea Struthiopteris, O. sensibilis*, and *Asplenium filix-fœmina*, and in every case it was exceptional to find both sexual organs on the same prothallium. Asplenium offered the greatest number of exceptions, but even here it was rare. *Aspidium spinulosum*, to judge from naturally grown specimens, is monœcious, no undoubted male prothallia being found, and perfect antheridia occurring on the large prothallia. *Cystopteris fragilis* was found with two forms; small male prothallia, and large hermaphrodite ones. In regard to other forms, observations were too incomplete to warrant any statements on the subject.

The male prothallia of all the forms observed are, as a rule, very much smaller than the female, and frequently of very irregular shapes (Figs. 8, 9, 10). Either no definite apical cell is formed, or it is early lost. Where the spores are sown thickly it is not uncommon to find the prothallium reduced to a single row of cells terminated by an antheridium, other antheridia being formed laterally in some cases, in others not.

The simplest form observed was that of *Asplenium filix-fœmina*, where a number of prothallia were formed whose vegetative portion was reduced to a single cell besides the root-hair (Fig. 7). A single antheridium was formed in each, and perfect antherozoids.

Under favorable circumstances the spores germinate in from three to five days, but in cold weather, or with imperfect spores, the time was indefinitely lengthened. The first antheridia were usually mature in about five weeks from the first signs of germination, but in one case, Asplenium, ripe antheridia were formed in a little more than three weeks from the sowing of the spores. Spores sown August 31 produced ripe antheridia on September 23. The prothallia in this case were reduced to a very few cells. Spores of *Onoclea Struthiopteris*, sown on February 25, 1884, began to grow upon March 3d, produced the first ripe antheridia April 9th, and the first mature archegonium, April 30th.

As an instance of the vitality of the spores, one example will suffice. Specimens of *Woodsia Ilvensis* were collected upon Lake Superior in July, 1883, the fronds were dried for the herbarium, and laid aside. In October, 1884, a number of the spores were placed in water, and in about a week began to grow.

Under proper conditions the prothallia will live for comparatively long time. Cultures were made of *Asplenium* and *Onoclea Struthiopteris* in 1884, from spores sown August 31. They grew rapidly and soon developed quantities of antheridia, but in the case of *Asplenium, no archegonia.* As cold weather came on, although the prothallia were kept in the house, growth ceased almost entirely, but was resumed in the spring, the prothallia appearing perfectly healthy. Large numbers then developed archegonia, and subsequently young plants, but some of them are still (August 14) perfectly vigorous, and growing.

The older male prothallia assume very irregular forms, reminding one somewhat of the prothallia of *Equiseta*, but the female retain nearly the same form as they have when young although they may be slightly irregular.

The sexual organs continue to form as the prothallia grow, so that in the older ones the number is very large. A female prothallium of Asplenium, about one cm. in diameter, examined August 12, had over one hundred and twenty-five archegonia, but no antheridia. One of the archegonia had been recently fertilized, but the remainder were abortive. It sometimes happens that several archegonia will be impregnated, but only one embryo apparently ever develops perfectly.

In the older prothallia of *Onoclea Struthiopteris*, especially early in the spring, large quantities of starch were observed.

Explanation of Plate IX.—Figs. 1–5, successive stages in germination of the spore of *Onoclea sensibilis*. × 150. Fig. 6, an older prothallium of the same, showing the apical cell (a), and marginal papillæ (p). × 80. Fig. 7, very small male prothallia of *Asplenium filix-fœmina* antheridia (a). × 150. Figs. 8-9, large male prothallia of the same. × 150. Fig. 10, a male prothallium, about three months old, of *Onoclea Struthiopteris*. × 60. Fig. 11, mature prothallium of *Cystopteris fragilis*. × 5.

On the Appearance of the Relation of Ovary and Perianth in the Development of Dicotyledons.[1]

BY JOHN M. COULTER.

Two years ago I read before this section a paper upon the "Development of the Dandelion," an organógenic study, in which it incidentally appeared that the first character to show itself was that of the inferior ovary. Since then this hint has been some-

[1] Read before the American Association for the Advancement of Science, August, 1885.

what extensively followed up, and the results form the reason for the present paper.

It is well enough known that botanical classification is in a transition state, that the published systems of classification are even far behind our knowledge, and that our knowledge is very far from what it ought to be. Sooner or later everything artificial must be abandoned and the natural substituted for it. It is a matter of great congratulation among botanists that Bentham & Hooker were permitted to finish their magnificent "Genera Plantarum," but it is also to be regretted that they have rendered still more rigid certain groupings which should plainly have been abandoned.

It is very far from the object of this paper to suggest a new scheme of classification, for an appalling array of facts must first be accumulated, but simply to record some observations which seem to have their bearing upon the solution of this difficult problem.

One of our greatest grievances has been the persistent displacement of Gymnosperms, whose true position both their floral organs and paleontology have long since pointed out, but this paper is chiefly concerned with the group Dicotyledons. Here the artificial grouping into Polypetalæ, Gamopetalæ, and Apetalæ has become threadbare and worn from long use, and in the present state of our knowledge it is worse than useless to attempt to patch it up. Although confessedly artificial it distorts relationships in too plain a way and draws down upon us the criticism of the most superficial. The group Apetalæ, intercalating most intricately with Polypetalæ, is yet separated from them by Gamopetalæ, which are much more highly developed than either.

As embryology has been of such invaluable aid in Zoölogical classification, it is but reasonable to suppose that organogeny may be able to play some such part in botany.

Upon the discovery that the inferior ovary was the first character to appear in the development of the dandelion flower, I began a somewhat extensive examination of the larger dicotyledonous families, to discover how the character was sustained. The fact was recognized that the dicotyledonous character was first to appear in the plant life, and hence it seemed that development shows no more natural grouping of Angiosperms than into Dicotyledons and Monocotyledons.

About one hundred and fifty species were examined, from the very earliest stages of the flower to its full development, belonging to the following eleven orders: Ranunculaceæ, Leguminosæ

Rosaceæ, Saxifragaceæ, Onagraceæ, Rubiaceæ, Umbelliferæ, Compositæ, Borraginaceæ, Scrophulariaceæ, and Labiatæ. The result was that in every case the first recognizable character was that of inferior or superior ovary, and a most simple grouping on that basis was apparent.

The appearance of this character in development can be told in a few words. In the case of an inferior ovary, the protuberance which is to develop into the flower is arrested in its axial development, grows peripherally into a collar, and soon there appears an external constriction, distinguishing the nascent floral envelopes above from the ovary below. The character of an external constriction is always the most readily recognized, and is as sure a mark of an inferior ovary as the harder seen arrest of axial development.

In the case of a superior ovary, the axial development is continued, and there is no external constriction. All this is perfectly clear before there is a possible recognition of any other floral character.

It may be instructive to look at a few of the results of such a basis of classification. Naturally, if organogeny means anything, the plants with inferior ovaries must be regarded as more highly and more recently developed than those whose flower parts are hypogynous. Hence Compositæ, Umbelliferæ, Rubiaceæ, Onagraceæ, and their various appendages would stand together as of highest rank, the first named order for some time having been considered the most highly developed. The resemblances between Compositæ and Umbelliferæ other than that of an inferior ovary are very suggestive.

In all natural classification there is a limbo of intermediate forms whose relationships are not so hard to discover as to arrange, and the cases of ovaries neither decidedly superior nor inferior are very familiar to every botanist. In such an intermediate place would stand the orders Rosaceæ and Saxifragaceæ, whose mutual boundary wall has already broken down.

In the group with superior ovaries there would appear such orders as Leguminosæ, Scrophulariaceæ, Labiatæ, etc., great groups with irregular flowers, and probably representing the highest development of dicotyledons with superior ovaries. Following these, and intergrading with them, appears the polymorphous order Ranunculaceæ, and so on.

In the terms of our present classification, such a grouping would result somewhat as follows:

Ovary inferior.	Some Gamopetalæ and Polypetalæ, such as Compositæ Umbelliferæ, Rubiaceæ, Onagraceæ, etc.
Ovary superior.	Some Gamopetalæ and Polypetalæ, such as Leguminosæ, Scrophulariaceæ, Labiatæ, etc., and Apetalæ.

It must be distinctly understood that the above does not present a proposed classification, but simply traces some of the probable results of organogenic study.

It is of no small consequence in these days to obtain the testimony of paleontology in favor of any system of classification. The order of appearance of Phanerogams is well known; first, Gymnosperms, then Monocotyledons, long afterward Dicotyledons, and the last Dicotyledons were those with inferior ovaries. From such great composite groups as Compositæ, therefore, the flora of the future is to be worked out.

GENERAL NOTES.

Results of the Ann Arbor Meeting.—This meeting gave more than the usual opportunities for becoming acquainted and benefited by the society of the members during the intervals between the regular sessions, owing to the short radius within which the members found entertainment, and the fewer distractions than in the case of large meetings, with their multiplicity of excursions and receptions. This advantage was made good use of by most, and it is safe to say that, so far as the botanists are concerned, no former meeting has yielded such full and satisfactory returns in this regard.

The attendance of botanists was unexpectedly large, and gives assurance of the continued prosperity of the club.

The efforts of the club from the beginning have been directed toward raising the standard of the botanical papers presented to the Association, and it is gratifying to note that this is actually being accomplished. It is certain that as a whole the botanical papers of this year will compare more favorably with those presented in other departments of biology than at any previous time. This is both because the papers are actually better than usual, and because the less weighty ones have been sifted out. These siftings found appropriate presentation before the club, where they met a sympathetic audience ready to turn to good use every morsel of value they contained. The total result is that the Association gets better botanical papers, and the botanists get through the club more items, notes and news than heretofore.

The committee of the Association on the encouragement of researches on the health and diseases of plants reported that the first and very important object in view had been accomplished. This was the recognition from the Commissioner of Agriculture of the need of work of this kind and some provision for its prosecution at Washington. Commissioner Colman, upon receiving the first memorial of the committee, at once appointed Mr. Scribner, of Girard College, well known as an accurate botanist, to devote his whole time to this kind of work. The committee then sent Mr. Scribner the assurance of their cooperation in developing this new feature of the Department. Commissioner Colman has since shown in many ways his belief in the value of the work proposed by the committee, and his determination to prosecute it as fully as circumstances will permit. The committee, which consisted of seven members, was found to be unwieldy, and the desirability of having at least one member a resident of Washington was urged. For these reasons it was reorganized, and the following members selected for the coming year: J. C. Arthur, of Geneva, N. Y.; C. E. Bessey, of Lincoln, Neb.; W. G. Farlow, of Cambridge, Mass.; T. J. Burrill, of Champaign, Ill.; and C. V. Riley, of Washington, D. C.

The Botanical Club adopted a resolution supporting Commissioner Colman in this work, and offering to exert their influence with their respective Congressmen to secure a suitable appropriation.

The committee of the Association on postage for botanical specimens reported that the matter had been suitably presented to the Postmaster-General, who made the desired recommendation to Congress, which may be found on page 15 of his Annual Report for 1883–4, but that owing to the rush of business at the close of the session it was neglected. They think there will be no difficulty, however, in securing its passage at the coming session, thus permitting herbarium specimens, accompanied with the usual label, whether written or printed, to go at fourth class rates of postage. The committee, consisting of L. F. Ward, Geo. Vasey, and J. W. Chickering, was continued.

The action of the club in regard to the relationship of the botanists of the country to the national herbarium is given elsewhere in the account of proceedings of the club.

The discussion of the highly important subject of a uniform nomenclature of English names of plant diseases and of disease producing fungi has also been given in the proceedings of the club. The committee to investigate the subject is composed of J. C. Arthur, W. G. Farlow and W. Trelease.

Plants of the Greely Expedition.[1]—List of plants collected in the summer of 1882 and 1883, by Lieut. A. W. Greely and members of the L. F. B. Expedition, in the vicinity of Fort Conger, Grinnell Land, situated in lat. 81° 44′ N., long. 64° 45′ W.:

1. Ranunculus nivalis R. Br. var. sulphureus Wahl. From the sea level to 1,800 ft. 5 to 7 in. high.
2. R. affinis R. Br. 1,800 ft. alt. 5 in. high.
3. Papaver nudicaule Linn. Sometimes nearly white flowered.
4. Cochlearia officinalis Linn.? 1 to 3 in. high.
5. Braya alpina Sternb. var. glabella. (*B. purpurascens* R. Br.)
6. Vesicaria arctica Rich. Sea coast to 1,000 ft. alt. The largest specimen 4 in. high and spreading 6 to 7 in. wide.
7. Parrya arenicola Hook. f.?
8. Eutrema Edwardsii R. Br.

[1] Read in part before the Botanical Club of the A. A. A. S., at the Ann Arbor meeting, August, 1885.

9. Cheiranthus pygmæus Adams. (*Hesperis pygmæus* Hook.) From 50 to 1,000 alt. The specimens are young and mostly less than 2 in. high, the largest 6 in. A few found with stem and pods of two preceding years' growth.
10. Draba hirta Linn. (*D. arctica* Vahl.) 2 to 3 in. high.
11. D. rupestris R. Br.
12. D. alpina Linn. In flower June 16.
13. Lychnis apetala Linn. From the coast to 1,000 ft. alt. The specimens from 1 to 5 in. high, rarely 2 or 3 flowered.
14. Lychnis triflora R. Br. With the preceding, the stem and leaves more pubescent, mostly 1 flowered, rarely 2 or 3 flowered.
15. Arenaria Grœnlandica Spring.? In leaf only.
16. A. verna Linn. var. hirta. 200 to 1,000 ft. alt.
17. Cerastium alpinum Linn. (*C. lanatum* Lam.)
18. Stellaria longipes Goldie, var. Edwardsii T. & G. From the sea to 1,000 ft. alt. 2 to 4 in. high.
19. Potentilla nivea Linn. Coast to 1,000 ft. alt. 2 to 5 in. high.
20. P. nivea, var. quinata Lange.
21. P. pulchella R. Br.
22. P. maculata Pourr.
23. Dryas octopetala Linn. var. integrifolia. Coast to 1,000 ft. alt. The specimens are 1 to 2 in. high, leaves mostly entire, sometimes minutely toothed. The most common plant found, beds of acres in extent being frequent, especially in the interior. Often with many petals.
24. Saxifraga oppositifolia Linn. Coast to 1,900 ft. alt. Flowers from 4 to 9 petaled, varying from pink to dark purple.
25. S. flagellaris Willd. 1,200 to 1,800 ft. alt., generally 1 flowered.
26. S. tricuspidata Retz. Not found below 800 ft. alt. 2 to 4 in. high.
27. S. cæspitosa Linn.
28. S. nivalis Linn. Found between 800 and 1,200 ft. alt. Specimens mostly 2 to 3 in. high, some found as high as 6 in.
29. S. cernua Linn. From 200 to 1,800 ft. alt. 3 to 8 in. tall.
30. S. rivularis Linn. var. hyperborea Hook.
31. Epilobium latifolium Linn. Coast to 1,200 ft. alt. Found only on rocky soil. Specimens from 2 to 4 in. high.
32. Erigeron uniflorus Linn. Coast to 800 ft. alt., becoming larger at the higher altitudes. Specimens 2 to 5 in. high.
33. E. compositus Pursh, var. trifidus Gr. From 100 to 800 ft. alt. Specimens from 1½ to 3 in. high, generally 1 flowered.
34. Arnica alpina Olin. Coast to 1,500 ft. alt. 2 to 6 in. high.
35. Taraxacum officinale Web. var. lividum Koch. Coast to 200 ft. alt. 2 to 4 in. high, two shades of color, deep yellow and yellowish-white.
36. Cassiope tetragona Linn. From 100 to 500 ft. alt.
37. Androsace septentrionalis Linn. 50 to 500 ft. alt.
38. Pedicularis capitata Adams. From 100 to 700 ft. alt.
39. P. Langsdorffii Fisch. var. lanata Gr. From 50 to 100 ft. above the sea, in company with Dryas.
40. Oxyria digyna Camp. Specimens from 5 to 7 in. high.
41. Polygonum viviparum Linn. From 100 to 800 ft. alt.
42. Salix arctica Pall. Coast to 1,800 ft. alt. From 1 to 1½ ft. in length.
43. Luzula hyperborea R. Br. (*L. confusa* Lindb.)
44. Juncus biglumis Linn. Margin of small ponds. 3 to 6 in. high.
45. Eriophorum angustifolium R. Br. 800 to 1,200 ft. 3 to 8 in. high.
46. Kobresia scirpina Willd.
47. Carex nardina Fries.

48. C. rupestris All.
49. C. ustulata Wahl. var. minor Boott.
50. C. vulgaris Fr. var. hyperborea Boott.
51. Alopecurus alpinus Linn. Specimens from 4 to 18 in. high.
52. Arctagrostis latifolia Gris. Coast to 800 ft. alt. From 5 to 6 in. high.
53. Deschampsia brevifolia R. Br. (*Aira arctica* Spr.) Specimens from 2 to 4 in. high. Not the *Aira arctica* of Rothrock's Flora of Alaska, nor *Aira cæspitosa*, var. *arctica* of authors.
54. Trisetum subspicatum Beauv. Coast to 800 ft. alt. From 3 to 7 in. high.
55. Poa cerisia All. (*P. arctica* R. Br.) From 2 to 5 in. high.
56. P. abbreviata R. Br.?
57. P. alpina Linn. var. vivipara.
58. P. laxa Haenke. Specimens 3 to 8 in. high.
59. P. cæsia Smith, var.
60. Festuca rubra Linn. var. From 3 to 5 in. high.
61. Agropyrum violaceum Hornm. From 2 to 7 in. high.
62. Equisetum variegatum Schl.
63. E. arvense Linn.
64. Cystopteris fragilis Bernh. Coast to 1,300 ft. From 3 to 6 in. high.

"PUCCINIA CHEIRANTHI, Ellis & Everhart (n. sp.) On *Cheiranthus pygmæus*, Grinnell Land.

"III. Sori hemispheric, brown, naked, ½ to ¾ mm. in diam., thickly scattered over both sides of the leaves, but (in the specimen examined) not confluent. Spores oblong or clavate-oblong, light brown, constricted at the septum, $35–53 \times 15–22\mu$, either consisting of two subequal cells or oftener the upper cell broader and shorter (subglobose) and the lower one tapering into the stout, rather persistent pedicel, which is about as long as or a little longer than the spore itself; epispore smooth or faintly but rather coarsely roughened above, thickened and lacerated at the apex so as to resemble somewhat the remains of the calyx on a currant or huckleberry.

"I. and II. not seen. This appears to be sufficiently distinct from the other species on the *Cruciferæ*."

I am indebted to Prof. Watson and Dr. Gray for the determination of some of the species included in the list.—GEO. VASEY.

Botanical Features of New Brunswick.[1]—There are two striking physical features of the Province which affect its flora in a marked degree. Its southern shore is a wall of rock, veiled in cold mists of fogs from the Bay of Fundy. Interspersed here and there between these fog-bound hills are peat bogs and evergreen forests, whose flora is of the most boreal type. The average summer temperature is not more than 58°. In the summer of 1884 I had an opportunity to compare the flora of the hills about St. Johns, in lat. 45°, with an inland mountain peak in the northern part of the Province, in lat. 47°, with an altitude of 2,240 feet. The flora in each case was strikingly alike, with an advantage perhaps in favor of the top of the inland peak. Along the outer face of these cliffs that border on the Bay of Fundy, and filling the clefts of the rocks, are reddish colored tufts of *Sedum Rhodiola*. Chief among the plants of

[1] Read before the Botanical Club of A. A. A. S., at the Ann Arbor meeting, August, 1885.

the peat bogs is the Cloud Berry (*Rubus Chamæmorus*), while the ground is covered in many places with *Empetrum nigrum* and *Vaccinium Vitis-Idæa;* and *Potentilla tridentata* with its bright blossoms makes cheerful many a dull rocky crag. These, with many other boreal types, find a genial home in the low temperature and fog-laden atmosphere of the extreme south of New Brunswick, while hidden away still deeper in the clefts of the limestone rocks and generally on the northern sides, is the pretty little *Asplenium viride*, but with no trace as yet in this Province of its congener, *A. trichomanes*.

But the second physical feature is the great valley of the St. John river and its tributaries, whose flora is far more southerly in character than that above enumerated, although in its northern portions it has many striking boreal forms. In the rich alluvial bottoms of the St. John and its tributaries I have seen *Struthiopteris Germanica* six and seven feet high. Along the Tobique river I saw *Osmunda regalis* growing to the height and profusion to which alders grow on the borders of other streams. I have before me a tuft of *Elymus Canadensis* nine feet in height, collected at Eel river, one hundred miles from the mouth of the St. John. In the rich intervals there are *Sanguinaria Canadensis*, *Asarum Canadensis*, *Caulophyllum thalictroides*, *Adiantum pedatum*, and others whose growth would be impossible were it not that the cold fogs of southern New Brunswick have been dissipated by the sunshine which reigns here day after day, and that the rocky coasts have given place to alluvial meadow and green field. One other feature of this St. John river valley may be referred to. Rising from the famous Aroostook region of Maine, it bears upon its waters the seeds of many plants, which are peculiar to this river so far as American botany is concerned. Among these may be mentioned *Oxytropis campestris*, *Astragalus alpinus*, *Hedysarum boreale*, *Tanacetum Huronense* and others.—GEO. U. HAYS.

Society for the Promotion of Agricultural Science.—The sixth meeting of this society was held at Ann Arbor the day preceding the meeting of the A. A. A. S., and was unusually good, both in point of attendance and character of the papers presented. The first paper was read by Mr. J. J. Thomas, of New York, upon the influence of locality upon the varieties of fruit. The writer opposed the very prevalent view that fruit raised in our own country is on that account better suited to our cultivation. In the discussion Dr. Sturtevant called attention to the fact that any fruits are most highly flavored in their most northern localities, and larger and finer looking toward the south. He suggested the influence of actinism as a possible explanation. The two following papers were by Dr. E. L. Sturtevant, of New York, upon the dandelion and lettuce. It was an attempt to prove that the forms of cultivated plants are selected wild types rather than forms originated by culture. Prof. C. E. Bessey, of Nebraska, read a paper upon the demands made by agriculture upon the science of botany. The demands are as follows, and any of our professional botanists who may be seeking new fields of work, can give them some serious thought:

1. A nomenclature and classification of the plants of the farm, cultivated as well as wild.
2. A better knowledge of the physiology of plants, including such sub-

jects as growth and nutrition, fertilization, heredity, and the physiology of cultivation and improvement.

3. A better knowledge of the pathology of plants, particularly of that ill-defined state known as "lowered vitality."

By all of which is meant not only that botanists should learn more concerning the subjects mentioned, but also that students should be better taught the little we do know about them.

Prof. T. J. Burrill's paper upon an experiment in silk culture was chiefly concerned with a contagious disease which destroyed the worms. This he identified as the *flacherie* of Pasteur, probably the first recognized existence of this disease in America. The other papers were not botanical, except a short report by Prof. W. J. Beal, upon the progress of certain experiments upon the vitality of buried seeds. The officers elected for next year are Henry E. Alvord, president, and B. D. Halsted, secretary and treasurer.

Some Nasturtium Leaves.—One day last month, when plucking a bunch of garden Nasturtiums (*Tropæolum*) I observed two small abnormally shaped leaves on one lateral stem. They were spatulate in form, and each was about 1⅝ inches in length, the blade of one an inch long, and its petiole five-eighths of an inch; while the other had the stem relatively a little longer. A third leaf, only three-fourths of an inch in diameter, was normally peltate. The branch was in flower.

On an other occasion I found another Nasturtium leaf (one and one-half in. diam.) that was round reniform, with the margin of the leaf at its base not brought together and united, the petiole being attached to the blade at its base, instead of being attached on the under surface of the leaf, as with this plant usually. This form might, I should think, illustrate the evolution of the peltate leaf from a rounded leaf by the joining together of the lower margin. The spatulate leaves would, however, require more modification, the blade of the leaf needing to be much widened and extended at its base into lobes before the margins could coalesce into the shield-shaped form.—ROSA SMITH, *San Diego, Cal.*

Notes on Black Knot.—These notes of occasional observations on *Plowrightia* (*Sphæria*) *morbosa* this season may be worth saving, as they differ in some particulars from what has been recorded.

The first examination was January 6, when the asci were found considerably developed and spores beginning to form. By the first of March most of the asci contained spores, but they were still unripe. Development continued slowly until warm weather, then more rapidly until the middle of May, when spores were the most numerous. Most of the spores now had thicker, dark-colored walls, were apparently ripe, and some were being discharged. Ascospores continued to be formed in perithecia which were in depressions of the knot, until June 17, when the new knots were well advanced and bearing conidia.

The mycelium stimulates to excessive development the growth of the year, which, bursting the older bark, permits the fruit of the parasite to form at the surface of the living tissue thus exposed. With the excessive development the tissues lose their character somewhat, but when the knots are young the distinction between bark and wood still exists, the cambium line being deflected outward through the knot.

Knots on the wild plum in this vicinity contain no live perithecia so far as seen, and the same is often the case with the cultivated plum. In a few instances the knot was found on *Prunus serotina*. It has not yet made its appearance in the orchards in the northern part of the state.—A. A. CROZIER, *Ann Arbor, Mich.*

The Æcidium of Adoxa.—The *Adoxa Moschatellina* L. grows abundantly in some localities in northern Iowa, where it is much infested with the *Æcidium albescens* Grev. According to European botanists this fungus is a state of *Puccinia Adoxæ* DC. Teleutospores have not, however, been found in America, and it is not easy to account for the abundant æcidium without them. It has been suggested that the æcidium might be perennial in the subterranean stems of *Adoxa*. To test this some plants were forwarded in the spring of 1884, through the kindness of Mr. E. W. Holway, to Geneva, N. Y., which were thoroughly covered with cluster cups. They were potted and placed in the green-house, and up to the time the leaves normally disappeared continued to bear the æcidium. When cold weather approached the pot was sunken out of doors, where it remained until the following March. It was then placed in the greenhouse and the plants at once started into vigorous growth. Perfectly healthy and rich foliage succeeded, and in due time numerous rhizomes were pushed out beneath the soil, but up to the present month no æcidium whatever has appeared. This seems to prove quite conclusively that *Æcidium albescens* is an annual. The plants were removed a thousand miles from their nearest locality and grown normally, except that they were induced to start some weeks before the usual time in the spring, and no cluster cups appeared. How the æcidium tides over the long interval from one season's activity to another is as great a problem as ever.—J. C. A.

Notes on Florida Lichens.—During my annual winter sojourn in Florida I was somewhat at a loss as to what sort of plants should receive attention. I had time and again collected most of the flowering species to be found from December to March. Arriving in Jacksonville about Christmas and having put my house in order, I was ready for active work. I could not neglect my old friends, the Phanerogamia, and numerous excursions resulted in my collecting nearly one hundred species, all old acquaintances, but several, as *Verbesina heterophylla*, *Polygala grandiflora*, and *Bigelovia nudata* were a novel sight even here in midwinter. *Heterotheca Lamarckii* was very common in old fields. Several species of *Chrysopsis* were also abundant. The foregoing were evidently late bloomers of the fall. During my daily rambles through the pine barrens and the hardwood hummocks I had been looking around for some new field of investigation and this seemed to be offered me in the extraordinary abundance of Fungi and Lichens. To use a common expression, "the woods were full of them," and I was reminded of my mushroom-eating friends at home whom I had seen wandering around barn yards and fields in early morn and to whom, possibly, I stand indebted for giving me hints on this subject. I began collecting, and the results show one hundred and sixty species obtained within a few weeks, and all collected at no greater distance than two miles from my home. For names I am under obligations to Mr. Ellis and Mr. Willey, both well known specialists. Of the species collected four are supposed to be new. The Lichen flora I found everywhere in the greatest abundance—living trees being the favorite resort of the smaller and less conspicuous species. It has been supposed that the Lichens flourish best in a cool, dry climate. Florida is perhaps an exception. I collected about eighty species and am confident that as many more can be found within the state. The field is an inviting one for lichenologists. As I am only an amateur I can not do as much as I might in different circumstances. One of the first forms to attract attention is *Usnea barbata*. This clings in profuse masses from the trunks of *Taxodium* in swamps. The *Cladonias* affect the earth and old logs, always in damp situations. On the leaves of *Osmanthus Americana* and *Magnolia grandiflora* the *Strigula complanata* is common. Not a few species are West Indian and tropical. The accompanying list shows partially what can be done by a little effort in a very short time. Thus far I have found none of the species except Cladonias restricted to any particular habitat, as to trees. The oaks being most plentiful sustain the greater number.—W. W. CALKINS.

[The writer appends a list of 76 species and varieties collected by him, for which we can not take space. This list will doubtless be furnished gladly to those interested in the geographical distribution of lichens.—EDS.]

Second Blooming of Catalpa.—On one of the streets of Mt. Carmel, Ill., stand two large trees of our local native Catalpa (*C. speciosa*, Warder). During the first week in June they were both in full bloom. These flowers all dropped during the first half of that month. To-day, July 20, one of them is again in full bloom. The whole top is literally covered with flowers, and at the same time the beans of last month's flowers are hanging thick. In this second crop the panicles are about as large and full as in the first. The flowers are of the usual size, but a little paler. It is so unusual for a second flowering to be apparently as abundant as the first, that I think it proper to report this instance. Another peculiarity is the short time between the two crops—about six weeks.
—J. SCHNECK, *Mt. Carmel, Ill.*

Ferns of Petoskey.—Within four miles of this popular Michigan summer resort may be found the following: Pteris aquilina, in open ground; Botrychium Virginicum, widely distributed; Cystopteris bulbifera, on springy hillsides; Asplenium angustifolium and Filix-fœmina, not common; Osmunda Claytoniana, in a single locality; Phegopteris Dryopteris, rather common; Aspidium spinulosum, variable and fine, wooded hills everywhere; A. Thelypteris, marshes; A. cristatum, and Goldianum, scarce; A. marginale, fine, and rather common; Adiantum pedatum, dry knolls in woods, abundant and fine.
—A. A. CROZIER.

EDITORIAL NOTES.

DR. GUSTAV W. KÖRBER, lichenologist, died July 28, at Breslau, in his sixty-ninth year.

DR. H. W. REICHARDT, of the University of Vienna, died on August 2, at fifty years of age.

DR. E. KOEHNE, of Berlin-Friedenau, is now editor of the *Botanischer Jahresbericht*, succeeding Professor Just.

THE GAZETTE was the only purely botanical paper represented. The entire editorial staff was there, "taking notes."

DR. ASA GRAY asks that botanists, who can do so conveniently, will send him seeds of *Coreopsis aristosa*, *Baptisia leucophæa*, and *B. leucantha*.

MR. CHARLES WRIGHT, the botanist and explorer, died at Wethersfield, Conn., August 11, at the age of seventy-four.

THE AMERICAN SOCIETY OF MICROSCOPISTS will hold its 1886 meeting at Chautauqua, N. Y. Prof. T. J. Burrill, of Illinois, is president for the coming year.

DR. H. MAYR, teacher in the University at Munich, is taking a four months' journey in America to study the forest vegetation, as we learn from the *Botanisches Centralblatt*.

MR. A. B. SEYMOUR takes the place in the University of Wisconsin vacated by Prof. Trelease. Mr. Seymour has heretofore been connected with the Botanic Gardens at Cambridge.

PROF. BESSEY calls attention to the fact that the styles ("silk") of Indian corn furnish excellent studies in protoplasmic activity. Young styles should be taken from an ear which has been kept in a warm place for an hour or so.

A DISTINCT odor has been noticed by Plowright in the spermagonia of *Puccinia Vincæ* growing on the large periwinkle. It may yet be shown that the spermagonia of the *Uredineæ* attract insects to some purpose.

THE SEPTEMBER NUMBER of the *Journal of Mycology* is devoted to an enumeration of the North American species of the genus *Glœosporium* by Ellis and Everhart. Forty-seven species are described with index of species and host plants.

PHOTOGRAPHS recently received of the new Botanical Garden of the University of Liége show most complete and elaborate grounds and buildings, and the botanist's European trip will no longer be complete without a visit to Prof. Edouard Morren.

AMONG BOTANISTS present were M. S. Bebb, W. J. Beal, E. W. Holway, C. E. Bessey, L. H. Bailey, Jr., V. M. Spalding, W. R. Lazenby, L. M. Underwood, D. H. Campbell, C. F. Wheeler, E. F. Smith, T. J. Burrill, B. D. Halsted, J. J. Davis, Miss L. J. Martin, J. F. James, F. L. Scribner. An inspection of the full list (of which the above is a small fraction) shows that the western botanists were out in force.

THE BROOKVILLE (IND.) SOCIETY OF NATURAL HISTORY is a very active organization, and has just published its first bulletin. The exogenous flora of Franklin county, by O. M. Meyncke, and a list of diatoms, by Dr. E. G. Grahn, are the papers of botanical interest.

DR. FRANKLIN B. HOUGH, well known in this country and Europe for his interest in forestry, died at his home in Lowville, N. Y., June 9, in his sixty-third year. He gave considerable attention to phanerogamic botany, one of his earlier works being an account of the flora of Lewis county, N. Y.

DR. FREIHERR VON BRETFELD, recent botanist to the Agricultural Experiment Station at Halle, Germany, has just accepted the professorship of agricultural botany at the Polytechnikum at Riga. He has recently published an excellent work of 250 pages on the physiology of plants in relation to agriculture.

THE PRESENCE of nuclei, chromatophores and pyrenoids in several members of the *Phycochromaceæ* has been demonstrated by Hansgirg in a paper before the German Botanical Society. They occur in the lower members of the order, while the higher groups, the *Lyngbyeæ*, *Calotricheæ*, and *Scytonemeæ*, appear to have none.

A LIST of European Carices, by Dr. H. Christ, published in the "Comptes-rendus" of the Royal Botanical Society of Belgium, shows 151 species, grouped under 36 sections. There are 98 species and 21 sections of Heterostachyæ; 37 species of Homostachyæ; 2 species of Cephalophoræ; and 14 species of Monostachyæ.

A COMMITTEE has recently been appointed in France to obtain sufficient money to erect a monument to Pierre Belon, a naturalist of the sixteenth century (1517–1564), who did good work for the botany of that day. *La Belgique Horticole* for January and February is largely made up of an account of Pierre Belon, his life and works, accompanied by a portrait engraved in the year 1555.

THE MARRIAGE OF Dr. N. L. Britton and Miss Elizabeth G. Knight, of New York City, occurred on the 27th of August. Both are well known botanists, and the fact of their marriage was made known to the Botanical Club of the A. A. A. S. by the chairman as a matter of botanical news. The club received the announcement with applause, and immediately ordered a congratulatory telegram sent to Dr. and Mrs. Britton.

IN THE FIRST TWO FASCICLES of the *Annuario del R. Instituto Botanico di Roma* for 1885 are some most excellent contributions, accompanied by fine plates. Prof. Pirotta writes concerning the comparative anatomy of certain leaves; also the laticiferous and assimilative systems of certain plants. P. Baccarini contributes a paper upon plant coloring. C. Avetta has made an anatomical study of the vegetative organs of *Pueraria Thumbergiana* (an Asiatic species of Leguminosæ).

SCIENCE gives an excellent account of the Ann Arbor meeting of the American Association in its issue of September 11 (40 pp.), each section being reported with great completeness, when the necessarily limited space is considered.

We would offer but one criticism, and that is the unnecessarily harsh way in which reference is made to the merging of "Microscopy" into Biology. As Section G asked for the change, and thus acknowledged its own unnatural existence, the "I-told-you-so" was hardly courteous.

A Revision of the N. Am. species of the genus *Scleria*, by Mr. N. L. Britton, has just been published in the Ann. N. Y. Acad. Sci., Vol. iii, No. 7. Mr. Britton has long been at work upon Cyperaceous plants, and it is to be hoped that this brief paper is but a prelude to the promised revision of *Cyperus*. Eleven species of *Scleria* are characterized, none of them new, with full bibliography, synonymy, and range. *S. laxa* Torr. becomes *S. Torreyana* Walpers, while several new varieties are added to the other species of the Manual.

Mr. J. G. Baker, in the *Journal of Botany* for September, gives a synopsis of the Cape species of the Liliaceous genus *Kniphofia*, with descriptions of five new species. The genus is strictly South African, including Madagascar, and this synopsis shows eighteen species. The same author, in the same journal, gives a classification of garden roses, which is surely something sorely needed. It may be necessary, as suggested at Ann Arbor last August, for systematic botanists to turn more of their attention to a classification of cultivated plants.

Mr. Thomas Hick, in the *Journal of Botany*, notes the results of a study of "the Caulotaxis" of British Fumariaceæ. By "caulotaxis" is meant the arrangement and relation of the central and lateral axes of a plant. The axis of these plants is generally sympodial, and the excellent plan was adopted of studying the formation of this pseudaxis in developing plants. As a result it was plainly seen how the leaf-opposed flower clusters are really terminal, pushed aside by a more vigorous branch, a result which exactly accords with the theoretical statement of our text-books.

We commend the effort of Queen & Co., of Philadelphia, to produce a serviceable laboratory microscope. In the August number of their *Microscopical Bulletin* (an excellent little journal, by the way) they ask teachers to communicate their opinion regarding the most desirable form of instrument, and state the reasons why preferred. Bausch & Lomb, of Rochester, have for some time tried to meet the demand for a suitable laboratory microscope. It looks as if our instrument makers were waking up, and would not much longer force us to import from foreign makers, when a stand is wanted for common daily use.

Mr. A. A. Crozier, of the University of Michigan, has published a thesis bearing the title, "The Modification of Plants by Climate." It has brought together a great amount of scattered material upon this interesting subject, and, not the least valuable part of the paper, a full bibliography is given. Summing up the whole matter, the conclusion reached is as follows: "It seems to be established that as plants move from the locality of their largest development toward their northern limit of growth they become dwarfed in habit, are rendered more fruitful, and all parts become more highly colored. Their comparative leaf surface is often increased, their form modified, and their composition changed. Their period of growth is also shortened and they are enabled to develop at a lower temperature."

Dr. J. M. Anders, in connection with Dr. G. B. M. Miller, has been continuing his experiments in plant transpiration, and in the *American Naturalist* for September contributes a paper upon the exhalation of ozone by odorous plants. The conclusions reached by his experiments are as follows: 1. Flowering plants, including odorous and inodorous, generate ozone, the former, however, much more actively than the latter. 2. So far as tested, scented foliage does possess the power to produce ozone, and in the case of pine or hemlock foliage in a marked degree. 3. Inasmuch as no reactions occurred on rainy days, it is highly probable that the function demands the influence of the sun's rays, or at least good diffused light.

The December Gazette will be a "Laboratory Number," being devoted to accounts of laboratories and laboratory methods. A letter from DeBary's laboratory, brief descriptions of some of our own methods of work, subjects treated, appliances, little conveniences, etc., will be the general features. We would ask every laboratory worker to send us, within a short time, such an account of his own laboratory and methods as he would be glad to receive from other botanists, not forgetting the "little things" which go towards making laboratory work easy. A list of of subjects that have been successfully treated by students is much desired by many of our workers. Such accounts will be edited so as to avoid repetition and at the same time lose nothing.

The first bulletin of the new Société Mycologique was received a short time ago. Of the 130 charter members, only three are from the United States. The bulletin has 132 octavo pages and contains a list of Basidiomycetes of the Vosges, a new classification of the fleshy Discomycetes, a diagram of the excursion made at the first meeting, giving the points at which rare species were found, and closes with two poems addressed to mycophiles, recited at a soirée given the society at the country seat of Prof. Forquignon. The prime object of the society is to encourage a better general acquaintance with the edible and poisonous fungi, and it has made a very auspicious beginning. A branch or section of the society might profitably be established in this country.

Miss Anna A. Stout, of New York, has announced her intention to bestow upon Brown University the valuable herbarium of her brother, the late William Stout. The collection is especially rich in ferns, and is accompanied by a fern library of about twenty volumes. Miss Stout has already mounted over 1,800 sheets of ferns alone, and estimates that from 800 to 1000 more will be needed. Probably Dr. Garber's Florida phænogams will require 350 more, and the Atkinson collection of N. Himalayan ferns 560 to 570 sheets. Besides these there are many valuable duplicates of well known collectors. What is now sorely needed is a decent endowment of the botanical professorship. A daily struggle for bread and butter is scarcely compatible with the best research, and Prof. W. W. Bailey deserves more time for his own work.

Hypericum gymnanthemum Engelm. & Gray has been variously considered either a species or variety of *H. mutilum* L. Recently a small clump of plants was found in a bog near Posen (Western Germany), which turn out to be this same form of *Hypericum*. In the *Berichte der Deutschen Botanischen*

Gesellschaft, for February, appears a paper upon the subject by R. v. Uechtritz and P. Ascherson, in which it appears that our plant is widely distributed throughout Eastern Asia, distinct enough from *H. mutilum*, and bearing a much older name, *H. Japonicum* Thunb. So *H. gymnanthemum* Engelm. & Gray must be considered a good species, and become *H. Japonicum* Thunb. But is it a rare survival, its kindred having gone far to the East? Or has it been introduced in recent times? The authors are inclined to think that it has come from America with clover seed.

WE NOTICE elsewhere the new botany of the Science Series which Messrs. Appleton & Co. are now bringing out as claimants for the favor of High School principals and superintendents. That there is a demand for a book on botany adapted to such schools is undoubted, and that the demand has not yet been met is equally true. The abridged and simplified work of Dr. Bessey comes nearer to it than anything that has yet appeared. That work, however, admirable as it is, is ahead of the times, and we must wait and labor to convince school boards and superintendents that a botanical laboratory, equipped with microscopes, is just as essential to a good school as a chemical laboratory. In the second place, Bessey's book requires a teacher that knows *something* about *all* plants, instead of the kind usually employed who know a *very little* about a few plants, the *phanerogams*, and appear to be wholly ignorant that any others exist.

THE MEETING of the American Pomological Society at Grand Rapids, Mich., September 9 to 11, attracted quite a number of prominent botanists. Prof. Bessey, of Nebraska, gave an evening lecture on fungi in their relation to plant diseases, and a number of others presented papers and took part in the discussions. In the course of a short address Commissioner Colman referred to the new work of the Department in the study of plant diseases, under the charge of Prof. Scribner, and added: "I feel that this is a most important field for investigation, and the attention which has been given to the subject by this meeting confirms the wisdom of the course I have pursued in giving this matter special attention." After the address Prof. Beal, of Michigan, offered the following:

Resolved, That this society heartily commends the action of Commissioner Colman, of the U. S. Department of Agriculture, in the appointment of a person to investigate the diseases of plants, and desires to assure him of continued support in his efforts to develop this new line of inquiry.

THE ANT-INHABITED PLANTS form an exceedingly interesting subject in the second volume of Beccari's *Malesia*. Hernandez, about the middle of the seventeenth century, described the stipular thorns of *Acacia cornigera* of Central America, into which certain ants eat, feed upon the pulpy interior, and live in the dwelling thus made. Such inhabited thorns grow larger and distorted, and the ants seem to pay for this hospitality by protecting the tree from other marauding insects. Two woody *Rubiaceæ*, of Sumatra, were described in 1750 by Rumphius as inhabited by ants. They are both epiphytic and attached to the host tree by a large tuberous base, which is cavernous and occupied by ants. The ants by their irritating presence cause the tuberous growth to enlarge, but the enlargement begins during germination, before the ants attack it, an instance of a plant preparing beforehand for expected guests. It is said that seedling plants which fail to become inhabited perish. Dr. Gray, in a review, says that "it is most supposable that this extraordinary formation was acquired gradually; that the normally fleshy caulicle of the ancestral plant, made a nidus by an insect, developed under the disturbing stimulus somewhat as a gall develops, until at length the tendency became hereditary and the singular adaptation of plant to insect was established."

THE SUDDEN DEATH of Hon. George W. Clinton, of Albany, N. Y., was announced in the papers of September 7. He was seventy-eight years old, a son of DeWitt Clinton, and his name is a very familiar one to botanists, especially those of an earlier day. A part of the promised pleasure of the Botanical Club at Buffalo next year was the presence of this venerable and most entertaining botanist, who knew the plant haunts of that locality better than almost any one, and whose company was always delightful. The lateness of the news prevents any fuller and more worthy notice in this issue. The following from the *New York Tribune* gives some of the details of his death:

ALBANY, September 7.—The body of George W. Clinton, vice-chancellor of the Board of Regents, was found in the Rural Cemetery this afternoon, about a quarter of a mile from the lodge. Of late he had manifested a great interest in the study of botany, and when here before it was his custom to follow his favorite study in the cemetery. Last spring he was a frequent visitor. This afternoon at two o'clock he went up for the same purpose, apparently in his usual health. Reaching the lodge, he rested a while and then started up the avenue, in which direction he was found two hours later. Death had apparently been painless and is attributed to heart disease.

CURRENT LITERATURE.

Talks Afield about Plants and the Science of Plants. By L. H. Bailey, Jr. pp. ix, 173. 12mo. Boston: Houghton, Mifflin & Co.

It is a most praiseworthy desire to present the truths of science correctly to the great mass of people who have neither time nor talent to study for themselves. The press to-day in its "scientific columns" has done much to disseminate nonsense, and no science has suffered in this respect more than botany. Hence we are always ready to welcome such a book as the one before us—cheap, attractively written, well adapted to its expected readers, and, better than all, truthful so far as it goes. A professional botanist may discover grave omissions in his special department, but such he ought to find in such a book. We bespeak for Mr. Bailey a large circle of readers, and this attempt to make science attractive to all can not be too highly commended. No criticism is needed regarding the many interesting things omitted, but rather the wonder is how many important things have been compressed into these few pages, and an attractive style preserved, a style that is of necessity somewhat diffuse. The topics presented are such as follow: the flower, the stem, the rose family, the composite family, a peep at the inside, cross-fertilization, hidden flowers, the compass-plant, how some plants get up in the world, carnivorous plants, witch-hazel, a thistle-head, etc.

The Grasses of Maine. Designed for the use of the students of the Maine State College, and the farmers of the state. By C. H. Fernald, A. M. Augusta, 1885. 8mo. pp. 70. 42 plates.

This work, which is privately published and only intended for local use, is a creditable production. One is at once struck with the attractive form in which it is issued, the printer's part being done in a very satisfactory manner. Looking deeper, the author's part is found equally good, and it is only disappointing in its brevity. The value of the grass family as a source of sustenance and revenue is first discussed, successively followed by a description of the general structure of the grass plant, definitions of the terms used in describing grasses, the physical and chemical constitution of grasses, a key to the genera, fifty pages of descriptions and notes on the species, and a suitable index. This occupies about half the volume, the remainder being filled with forty-two full page plates of grasses from Vasey's "Grasses of the United States."

The systematic part gives botanical descriptions in simple language, and notes on the agricultural value of the species. The Latin names are divided into syllables and the accent marked. Authorities following the Latin name are written out in full. Keys to the species of the larger genera and references to the plates assist the novice, who attempts determining the name of a grass, as much as it is possible to do in the absence of a teacher.

Although primarily intended for students, it must be of great service to intelligent farmers throughout the state. The paucity of information, however, regarding the agricultural value of grasses is astonishing. It is almost all derived from Flint, Gould and Vasey. If one examines the works of these writers it is found that they quote from each other, and very largely from Sinclair's standard work "Hortus Gramineus Woburnensis," pretty largely without giving credit. A thorough work on agricultural grasses based on original observations and recent experiments is much needed.

Although Professor Fernald's work contains nothing new, it seems admirably fitted for the practical objects in view, and worthy of special commendation.

Descriptive Botany. A practical guide to the classification of plants, with a popular flora. By Eliza A. Youmans. New York: D. Appleton & Co. 12°, pp. xxvi, 336.

We have before us another attempt to prepare a work on botany suitable for High Schools and Academies. Our judgment as to what is needed by such schools does not at all coincide with that of the author. The study of descriptive botany, while valuable in its place, when pursued *alone* and *as an end* tends to superficiality and gives the student a mere "bowing acquaintance" with plants. The author adheres strictly to the title of her book, and we have in it not a word in regard to the internal structure or functions of plants. Another volume of the series "by an eminent authority" is promised, to treat of physiology. This divorce however will be fatal to the common school work; it will be very rare that any school will give the time necessary to a study of both books.

The method adopted for studying the topic selected is undoubtedly the best, namely, that which requires the student to study the plants and not the book. We think, however, that it will prove impracticable with this book, for this reason: in attempting to cover the whole ground of descriptive (phanerogamic) botany so many terms are introduced that in the time allotted in any ordinary school the pupil can get specimens of only a very few of them, especially of those applied to the flowers. By commencing in the spring and working through the whole summer he might get the majority of illustrations, but no school works so.

In fact the first part of the book is little else than an illustrated glossary. Here is a fair sample:

"The stamens and pistil of flowers have been called *essential* organs, because seeds can not be formed without their presence. As the calyx and corolla cover and nourish [sic] these, they have taken the name of *protecting organs*. When the protecting organs are both present in a flower, it is said to be *dichlamydeous*. When there is only a calyx, it is *monochlamydeous*." Page 45.

There is in the book hardly a hint as to homology or the cause of the affinities which are so emphasized on p. 75.

There is the too common quota of errors:

"A *compound raceme* . . . . . . When spreading it is called a *panicle*." p. 31.

"RHAPHE.—The connection between the base of the nucleus and the base of the ovule[1]." p. 104.

[1] Previously defined as the point at which the funiculus is attached.—ED.

"Those fruits that consist of achenia on a dry receptacle, as the sunflower, or an enlarged pulpy receptacle, as the strawberry, are aggregate fruits." p. 113.

"The *archegone* or *pistillidia* of mosses also arise in clusters of leaves and are cell-like bodies, having a cap or *epigone* of the same nature as the perigone of antheridia. But the pistillidia bursts its cap, leaving part of it as a sheath below, and is carried upon a stalk . . . at the top of which is seen an urn-shaped body of curious structure, called a *sporange*." p. 180.

"VAGINULE.—The collar or sheath at the base of the seta, resulting from the bursting of the epigone." p. 181.

In the latter part of the book, a "popular flora," the author has undertaken the impossible task of selecting the "common" plants which are "found everywhere" for description and omitting others. It is an impossible task, because it is self-evident that what is "common" in one locality may be extremely rare in another. In glancing through it we noted more than thirty species which every class brings in each spring which were omitted. What is true for this locality is probably true for others.

There is no index to the glossary. Altogether we must conclude that though the publisher's part of the book is excellent, the author's work still leaves the "long-felt want" unsupplied.

Chapters on Plant Life. By Sophie Bledsoe Herrick. Illustrated. Harper & Brothers, New York, 1885. Square 16°, pp. 206.

Popular, accurate and entertaining books on plant habits are few and far between, and it behooves us to welcome every attempt to enlist the interest of young people in the study of plants. Mrs. Herrick has made a successful attempt in this direction—not perfect, to be sure, yet still fairly successful. Her style is vivacious and the book will undoubtedly prove entertaining to those for whom it is written. It is specially commendable in that it does not ignore the existence of the lower cryptogams, some of the most interesting chapters being given to them; in all eight, out of sixteen. The necessity of using the simplest possible terms has been met in some cases by the adoption or invention of admirable ones; in others there is much to criticise. For example, it is misleading to call the oosphere of the mosses and allies an ovule (however etymologically correct it may be) and then use the same word for the ovules of phanerogams. Since the word cell has been frequently used, egg-cell would have been equally simple and entirely accurate. Instances like this are numerous. The whole list of names and terms ought to be carefully revised if another edition is called for. Of course in such a book one does not expect scientific precision, but such liberty does not license inaccuracy, much less error. Errors there are, quite a number of them, big and little and of all degrees of heinousness. It is unfortunate that this should be so, because the book is addressed to those who are not likely to be able to detect them. Some of these errors are among the eighty-four illustrations, most if not all of which have been drawn by the author and photo-engraved. Although marred by these sins of commission, we hope the book will be widely read, not only by "Harper's Young People," but by all boys and girls who are interested in living things. It will certainly do much toward awakening such an interest.

BOTANICAL GAZETTE.

VOL. X. NOVEMBER, 1885. No. 11.

Notes on Carex—VI.

BY L. H. BAILEY, JR.

1. The half-dozen most critical and trying groups of Carices, within the Manual region, may be named as follows: (1) The scoparia group, including CC. scoparia, lagopodioides, cristata and var. mirabilis; (2) C. laxiflora and its varieties, with CC. oligocarpa and digitalis; (3) CC. stricta, aperta and vulgaris; (4) C. straminea and its varieties; (5) C. Pennsylvanica and its immediate allies, CC. varia, Emmonsii and Novæ-Angliæ, and even C. umbellata; (6) CC. aristata, trichocarpa, and the var. imberbis.

2. C. Pennsylvanica and C. varia are apparently distinct. I should define and contrast them as follows:

C. PENNSYLVANICA Lam. *Stoloniferous*, forming large patches: *leaves usually as long as the mostly slender culms* (which are commonly less than ten inches high), *narrow, soft and grass-like: spikes one to three, approximate, usually contiguous* (the two lowest very rarely more than a half inch apart), *globose, all closely sessile, commonly more or less dark colored.*

C. VARIA Muhl. *Not stoloniferous: stouter: leaves broader* (1½ lines to 2 lines), *usually shorter than the more or less prolonged culms* (which are from ten inches to two feet high), *rather rigid: spikes three to five, globose or oblong, scattered* (from ½ inch to 1½ inches apart), *mostly light colored, the lowest often peduncled and commonly subtended by a conspicuous bract.* The very large forms with oblong and peduncled spikes and leafy bracts are taken as the type by Dr. Boott, and the more ordinary forms are referred to var. minor. It appears hardly worth while, however, to make such a division.

3. C. Bebbii Olney I referred to C. lagopodioides in my preliminary Carex Catalog. I have sharp notes from correspondents

who would refer it to C. scoparia. My specimens, from Olney, are large and decidedly like C. lagopodioides, especially in the character of the sheaths. I have seen other specimens which appear to be nearer C. scoparia. It appears to lean strongest towards C. lagopodioides in general habit However, it is immaterial to which species it goes. Enough that it goes. Von Boeckeler makes short work with these species by making C. scoparia a variety of C. lagopodioides.

4. C. lagopodioides Schk. is often slender and very loose-headed northward. These forms are exceedingly puzzling, and they are distributed under a great variety of names. They approach C. cristata var. mirabilis. Olney proposed a varietal name to cover most of these forms, but never defined it. It is an important variety and I subjoin its character:

Var. MONILIFORMIS Olney Exsicc. *Culm slender, especially above, where it surpasses the long-pointed lax leaves: spikes two to ten, small, nearly globular* (usually less than ¼ in. in diameter), *all distinct, the lowest separated, bright straw or rust colored, the points of the spreading perigynia conspicuous.*—Cambridge, Mass., to New Brunswick and Vermont. A very similar form comes from Louisiana. The extreme forms bear little resemblance to the ordinary C. lagopodioides, but they always preserve the loose sheaths and other characters of the species.

5. C. fulva Good., and C. lævigata Smith, have never been found in the United States, so far as I know, since B. D. Greene collected them at Tewksbury, Mass. They were probably chance introductions and should be dropped. C. fulva occurs in Newfoundland, however. In fact, the original specimens were collected there. C. extensa Good., credited to Long Island in the Manual, also occurs, or did occur in 1870, near Norfolk, Va. (*McMinn.*) The same collector also found there the European sand Carex, C. arenaria L. It is singular that so few Carices become naturalized. So far as I know but six European Carices are naturalized in this country: C. præcox Jacq., C. acutiformis Ehrh. (C. paludosa Good.), C. extensa Good., C. hirta L., C. glauca Scop. (in Canada), C. muricata L., and probably also C. panicea L., and C. leporina L.

6. C. straminea is remarkable from the fact that all its varieties are connected with the type by a complete series of gradations. The individuals of these intermediate forms are also common. The extreme form of the species is var. aláta (C. alata Torr.) The type of this variety has heavy, conical, greenish spikes which are peculiarly striking. The intermediate forms

are more common than the type, however. For a half way form Olney proposed the name var. pseudo-straminea. So also the peculiar var. silicea (C. fœnea var.? sabulonum of the Manual) with its nodding culm passes directly into the species. The type of the variety grows in loose sand on the sea beach. A little inland its culm is erect and the plant often counterfeits var. chlorostachys Bcklr. (C. fœnea Willd.). I am now growing plants of this variety here at Lansing to see what effect an inland habitat will have. I have found a very near approach to this variety on Lake Michigan. Var. chlorostachys holds its characters the best of all the forms of the species, although there is great difficulty in disposing of a quarter of the specimens one receives. Its strongest union is with var. alata. So far as I know, this variety does not get far away from the Atlantic and Gulf borders, unless it be in the upper Canadian provinces. C. fœnea var.? ferruginea of the Manual is midway between the type of C. straminea and the var. tenera Boott. I was misled by numerous specimens, which I supposed to be authentic, to refer var. tenera to the species in the Carex Catalog. The plant designated by Prof. Dewey as C. tenera is well worthy a varietal recognition, however. It is not the plant which is commonly taken to be var. tenera. I should designate the variety as follows: *Culms nodding at the top: spikes four or five, heavy, globular or broadly conical, all separated, bright tawny or rusty.* Commonly confounded with forms of C. scoparia. An important character of the representative stramineas is the stiff culm which surpasses the very long-pointed leaves. I am satisfied that much of C. cristata, var. mirabilis belongs with C. straminea, and the rest of it with C. cristata and C. lagopodioides. There are no characters in it which are not also in one or all of these three species. It needs either to include more forms or none at all. I am planting a caricetum in which to study the sedges as they grow.

7. Mr. H. N. Patterson has collected C. misandra R. Br. (C. fuliginosa Sternb. & Hppe.) in Colorado this summer. It appears to be new to the United States. It is distinguished from C. frigida All., its nearest ally, by its *ovate or club-shaped spikes, androgynous terminal spike, and slender peduncles which are exserted from loose, colored sheaths.* It was named from Arctic American specimens. The C. fuliginosa of Schkuhr is the same as the older C. frigida All. Sternberg and Hoppe misapplied Schkuhr's name to the plant now designated C. misandra, supposing that they had Schkuhr's species. C. fuliginosa of Stern-

berg and Hoppe is therefore the oldest name of C. misandra, although the plant was first recognized as distinct when Robert Brown named it C. misandra. Under the circumstances it appears that Brown's name should stand.

The Study of the Parasitic Fungi.[1]

BY T. J. BURRILL.

It needs no argument to show the practical value of the studies undertaken upon these minute—probably degraded—members of the vegetable world, for they subsist on living plants of the higher orders, upon which our domestic animals and ourselves depend for the means and materials of physical existence. It is not, indeed, usually known or suspected what proportion of our crops and useful vegetation is destroyed by the microscopic growths which live as parasites or saprophytes upon them; but when we come to understand that in very great measure the things called "blights," "mildews," "rusts," "smuts," "rots," "ferments," etc., are really due to the despoliations of these same microscopic but multitudinous forms of fungi, some appreciation can be gained by any one, even with a moment's thought, of the immense aggregate loss that occurs. Perhaps, in one sense, it is well that cultivators do not fully realize the number and variety of parasitic growths which await the development of their valuable plants, and which are liable so badly to injure the latter, and so seriously to affect the receipts for expended labor. Surely, in many cases, there would be sufficient ground for discouragement and hesitation to venture in opposition to such an array of dangerous enemies, against whose insidious and covert attacks fighting seems futile.

But knowledge of the existence of such things can not make that existence more hazardous, nor the results more distressing; while here, as in the other battles of life, to be forewarned is to be forearmed. Knowledge is power, and as much so in this case as in any other; if the latter is still wanting, it is only because the former has not been attained. Is it attainable? There are difficulties in the way. The objects are very minute; we can not see them by the unaided eye as individuals, we can not thus watch their modes of dissemination, germination, growth and development; we only see them, if at all, in the mass, and know of their

[1] From Bull. Ill. State Lab. Nat Hist., Volume II.

presence by their results. They have singular, and, to the students of other forms of life, unfamiliar physiological powers and properties; they assume peculiar disguises, and pass through unlooked-for stages of development, of which the connecting links are hard to make out; they lie dormant now, and again become wondrously quickened and enormously multiplied under circumstances not readily traced. But little by little, qualified observers have acquainted themselves with their existence as true species, veritable and distinct plants, and little by little have learned something of the mysteries of their life histories. Sometimes the advance in knowledge is gained by casual and lucky observations; but mostly by painstaking, systematic research, aided by all the appliances of the equipped laboratory and the fruitful skill of trained powers of manipulation and acute perception. A step gained is not only so much secured, but renders more possible other or further advance. The more becomes known, the easier progress is made, since that already acquired points the way towards new achievements. The beginning has been made, though this can scarcely be said to have been true until within very recent times. The men are now living and working who have made known all the ascertained facts of physiological processes and results in these parasitic fungi. The germination of fungus spores was not observed until within the present century.

During the last part of the first half of this century learned discussions arose upon the specific distinctions between the parasite and the host, and esteemed botanists held the view that what was taken for the former was but a diseased condition of the latter—the rust of wheat, for example, was only the degraded cell-tissues of the wheat itself. Such difference of opinion, however, no longer exists among those who have possession of the information now acquired. The tissues of higher plants do not change by any processes of degradation or transformation into the things called fungi, and neither do the latter originate in any other manner than as descendants of preëxisting parent forms through as rigid specific lines as can be traced among any animals or plants. It is known, too, that however much the fungus is formed within the tissues of the host plant, it began its growth outside of the latter and gained introduction only by forcible entrance. Spores are never taken up by absorption and carried by aqueous currents from part to part of the plant. The fungus passes through the tissues very much as roots pass through the soil, sometimes apparently without in any degree successful opposition, sometimes nearly or quite baffled in the struggle by the mechanical and physiological resistance of the host plant.

A Botanical Tramp in North Carolina.

BY GERALD M'CARTHY.

Of all the districts the Washington botanist has to choose from, the amphibious section along the Atlantic coast, southward of Norfolk, including the great Dismal Swamp, is the most interesting, especially in its summer flora.

Having decided to collect in this region, June 22, 1884, found me at Norfolk, Va., with a store of drying paper and presses prepared to

> "Botanize for summer months three,
> Maugre the doughty mosquito and all that with him might be."

Norfolk is a most malodorous town and an excellent place to avoid at this season of the year. Some good sedges are found hereabouts, but as my visit was too early for them I secured scarcely anything worth mentioning.

The next morning found me aboard the small steamer "Newbern" bound across Carrituck and Albemarle Sounds, for the Alligator River and Lake Mattamusket, in Hyde county, North Carolina. The course of the steamer lay so far from these points, however, and transportation was so difficult to procure, that I found it expedient to change my plans somewhat, and to begin with the Tar River country of North Carolina. The port at the mouth of Tar River, whither our steamer was bound, proved to be a straggling, untidy town of some 2,000 inhabitants.

The Tar River, so called, I presume, from the large amount of pine tar which is floated to market on its waters, is a good sized stream, as yellow as the Tiber from the clay brought down from its head waters. The country on both sides of the river resembles that bordering on the lower Potomac, and the two floras have many things in common. Here, however, we find the dominating *Taxodium distichum*, with its accompanying parasite *Tillandsia usneoides* hanging in mossy festoons from the scantily foliaged branches. Its light gray color contrasting with the sombre hue of the cypress gives to the country the appearance of having but recently emerged from a Noachian bath—a suggestion that seems to be well borne out by the superabundance of water everywhere present.

The Magnolias, both *glauca* and *grandiflora*, flourish luxuriantly. The handsome *Cyrilla racemiflora* is very abundant in the swamps; as is *Gordonia Lasianthus*, and *Stuartia Virginica*, which vie with the Magnolias in the gorgeousness of their blooms. *Clethra alnifolia* is everywhere, and loads the air heavily with its perfume. *Callicarpa Americana, Itea Virginica, Physostegia Virginica, Nesæa verticillata, Asclepias paupercula, Mikania scandens*, and the Carolina Rose, are the most common of the smaller plants. In the water are found *Nymphæa tuberosa, Nelumbium luteum, Nuphar advena, Pontederia*, and *Sagittaria*. *Sorghum Halapense, Arundinaria macrosperma, Tripsacum dactyloides, Zizania aquatica*, and a small variety of *Elymus Virginicus* are the principal grasses. *Scirpus pungens, S. lacustris, Carex glaucescens, Scleria triglomerata*, and *Dichromena leucocephala* and *D. latifolia* are abundant, though my visit was rather too early to get good specimens of any of them.

I kept a sharp look-out for *Dionæa muscipula*, but failed to observe it, though I afterward found it at a point about forty-five miles distant. The insectivorous plants are well represented by *Sarracenia purpurea, S. flava* and *Drosera longifolia*.

The mistletoe, *Phoradendron flavescens*, is quite abundant, but appears to have a decided partiality for shade trees along the principal streets of the towns.

This village, in common with most others of this wet district, was suffering from a plethora of shade. The streets are usually lined with wide spreading gums, whose branches often form leafy arches over the street on one side and over the roofs of the low-built houses on the other, shutting out the health-giving sunshine. The roofs become moss-covered, and the bed-rooms are pervaded with dampness. Can any one marvel, then, that ague, rheumatism, and malaria should be the scourge of this section? The trunks of these trees are invariably open, exposing the hollow, blackened interior; their boughs are usually knotted into fantastic, and often weird shapes, and from many abraded swellings ooze drops of amber gum.

GENERAL NOTES.

Poisonous Plants.—1. *Cicuta maculata*, L. Paul was a healthy and strong boy of fifteen years, living at Duck Creek, Brown county, Wisconsin. While making a bridge over a small creek on his father's farm, with his younger brothers, one day about the middle of June, he ate the whole root and the lowest part of the stem, about four inches in length, of a young and large water-hemlock. He tried to induce his brothers to do the same, as it tasted like turnips. They, however, only chewed bits of the root and spit them out. Paul soon felt sick at the stomach, and after drinking some water vomited the whole poisonous meal, as his brother afterward stated. He become worse, lay down on the grass, and his sister was called, who twice gave him a small portion of milk, freshly drawn from pasture cows. But the third time the patient was no longer able to take the tin can used for milk-pan; unconsciousness and lockjaw had set in. He was carried home and died shortly after, although a physician was promptly called. The death occurred within seven hours after eating the plant.

The writer of this went some days afterward to the place and learned the facts as stated here, and identified the deadly poisonous plant as water-hemlock (*Cicuta maculata*, L.).

2. *Pastinaca sativa*, L., one of our most appreciated vegetables, has a bad record as "wild parsnip," growing frequently along ditches, roads, and hedges. In the year 1878, an employe of the Northern Wisconsin Railroad died from eating parsnips, rooted up by himself from a ditch. His wife, who refused the meal, preserved her life, but his two children and the hired girl could only be saved from death by a physician's aid. I was told of this by an acquaintance of the family, and it was also so stated by the newspapers. Two other fatal accidents, near Depere, Brown county, Wisconsin, were reported in the papers about two years ago, by which several persons lost their lives from eating wild parsnips. The matter is important, and serious enough to call especial attention to this plant and its effects.—J. H. SCHUETTE, *Green Bay, Wis.*

Galium verum in New York.—If Dr. Gray's mention, in the Manual, of Essex County, Massachusetts, as the only station of *Galium verum*, except its occasional occurrence among ballast plants, be not supplemented by later reports, it may be of some interest that the plant is well established here. Three years ago I found a single tuft on the farm of Mrs. Phœnix Bockée, near "The Separate," in the township of Stanford, Dutchess county, New York. Now, although limited to a single field, a pasture with thin limestone soil, it grows there in great masses of a rod or more in diameter, filling all the surrounding air with its heavy fragrance.—MARTHA BOCKÉE FLINT, *Amenia, N. Y.*

Littorella lacustris, L.—A new locality for *Littorella lacustris* is worth recording. Macoun's Catalogue gives three stations, one in Ontario, one in Nova Scotia, and one on Lake Champlain. I find it along the southern shore of Lake Utopia, Saint George, New Brunswick, where it flowers when the water is lowest, about the middle of August.—J. VROOM, *St. Stephen, N. B.*

EDITORIAL NOTES.

REV. E. L. GREENE has been appointed instructor in botany at the University of California.

A BOTANIC GARDEN has been established at Reikjavik, Iceland, which will undoubtedly introduce many valuable economic plants to the attention of the islanders.

PROF. JOHN M. COULTER has been appointed State Botanist of Indiana, a position with more of sound than substance, but looking towards better things.

DR. XAVER LANDERER, professor of botany at the University of Athens, Greece, died July 19.

M. E. JONES, of Salt Lake City, Utah, distributed lately a list of some 1,300 species of plants, collected by him during 1884, from Texas to California, which he has for sale.

A LARGE ILLUSTRATED WORK on the flora of France, by H. Baillon, is announced. It is to be issued in forty or fifty parts, with ten colored plates each. The price is moderate.

IN THE OCTOBER *Nuovo Giornale Botanico Italiano*, O. Mattirolo presents a paper on the development of the seed-coat in the genus Tilia, accompanied by three most excellent plates.

JOSEPH F. JAMES has a paper on "affinities of the genus *Dionæa* Ellis," and one on "progress of vegetation in the Ohio valley," in the Journal of the Cincinnati Soc. of Nat. Hist. for July.

WE LEARN FROM THE *West American Scientist* that the care of the Engelmann herbarium, which is to be deposited in the Shaw Botanic Gardens at St. Louis, has been offered to Dr. C. C. Parry.

THE AMERICAN NATURALIST for October contains a most excellent resumé, by Professer Bessey, of the botanical portion of the A. A. A. S. at Ann Arbor, and of the proceedings of the Botanical Club.

PROFESSOR TRELEASE has recently treated of the "spot disease of strawberry leaves (*Ramularia*)" and "when the leaves appear and fall," in the second report of the Wisconsin Agricultural Experiment Station, and of grape rot in the transactions of the Wisconsin Horticultural Society.

DR. C. ROUMEGUÈRE, editor in chief of the *Revue Mycologique*, has been made a commander of the Royal Military Order of Christ by His Majesty Don Louis I., King of Portugal. It is a great and unusual honor to be bestowed upon a botanist, and one who has devoted his whole life to science.

THE LAW OF MICHIGAN now requires two bulletins a year from each department of its Agricultural College. Several have already been issued, including one from the botanical department, on "vitality of seeds," and one from the horticultural department, on "fruits, vegetables and trees."

THE SYNOPSIS of the genus Selaginella, by J. G. Baker, is concluded in the October number of the *Journal of Botany*. It is accompanied by a complete, and hence invaluable index. This paper has extended over three volumes of the journal, and has described 312 species, 105 of which are described for the first time.

THE SEVENTH FASCICLE of a magnificent work on the forest flora of Cochin-China by L. Pierre, director of the botanic garden of Saïgon, has just been issued. The plates are 40x65 cm. and sometimes double. The work is published by the French government, under the auspices of the Minister of Marine and the Colonies.

PROF. EDOUARD REZEL, the director of the Imperial Botanic Garden at St. Petersburg, celebrated the 70th anniversary of his birth the 13th of last August. A great number of his friends and collaborators joined in celebrating the day.

THAT THE MICROPHYTES have wonderful powers of resistance is shown by the recent experiments of Professor McKendrick, of Glasgow. Attempts were made to destroy organisms like bacteria by cold, instead of heat. Temperatures of 120° below 0° F. were applied, but when thawed the fluids contained living organisms still.

F. C. LEHMANN, who has spent over ten years in tropical America, has returned to his labors, after a short visit to Europe to arrange for the elaboration and publication of the results of his extensive collecting. He will make his headquarters at Popayan, United States of Colombia, and especially investigate the conditions of plant distribution.

THAT WE NEED some popularized information on the subject of parasitic fungi is shown by a recent editorial note in a leading horticultural paper which says, in reference to the new work entered upon by the Agricultural Department, that, "Prof. Trelease has been engaged to work up the diseases of plants, and Mr. Scribner to work up the microscopic plants.

AN EAR OF RICE pop-corn, sent to the New York Agricultural Experiment Station, as a new variety, under the name of Bear's Paw, was peculiar in being flattened in a fasciated manner. Four hills were planted and thirteen ears grown, of which twelve showed fasciation like the original. It is, to all appearances, the transmission of a malformation.

THE CULTIVATION of barley in Iceland, which was discontinued about the middle of the fifteenth century, has been resumed under the auspices of the government, and with full success. The reason it has not been carried on in recent years is evidently not due to the increased cold of northern regions, as usually maintained, but to the fact that cattle raising was more profitable.

HACKEL, in his monograph of the European species of Festuca, maintains that the histological characters of the leaf are of great diagnostic value, even for closely related varieties and forms. Of the various tissues the sclerenchyma offers the best characters, and the epidermis comes next, while the mesophyll and fibro-vascular bundles are quite uniform and worthless for this purpose.

DR. G. L. GOODALE returned on the 26th of September from a brief stay in Germany, whither he sailed about the first of August. He went chiefly for recreation, but visited a few of the chief laboratories. A conference with Mr. Carl Zeiss will result in the production of a cheaper and more convenient dissecting microscope, a large number of which have already been ordered for the botanical laboratory at Cambridge.

PROFESSOR D. P. PENHALLOW has treated of the distribution of the reserve material of plants in relation to disease in the *Canadian Record of Science* for October. He uses the peach tree as an illustration, and shows, *inter alia*, that a relation exists between the amount of starch deposited in the bark and the quantity of potash in the ash. An unhealthy tree, presumably suffering from the yellows, has more starch and less potash.

THE LABORATORY NUMBER (December) of the GAZETTE is meeting with much encouragement from our principal laboratories and many private workers. We would ask every worker, whether in a laboratory or not, to send to us descriptions of any devices, simple or otherwise, he may value in his work. All kinds of suggestions are desired, such as any botanist would like to obtain from his fellows. We do not desire to omit any laboratory, public or private, and if this is done, the failure must not be laid to our charge.

IN THE *American Naturalist* for November, L. P. Gratacap gives the results of some experiments upon the growth of plants watered with acid solutions. Without giving any of the many interesting details of the work, the general conclusion reached is that "the action of acid upon soil containing growing plants is to increase the mineral constituents of the latter, and that slightly acid waters percolating through a pulverulent soil richly provided with comminuted and impalpable matter would assist its introduction into plants needing these elements.

ON THE 18th of this month Dr. Asa Gray completes three-quarters of a century of his life. Few botanists can show so many years of botanical activity, and certainly none have been of such uninterrupted and illustrious service in the cause of botanical science in this country. His career, reaching back into the very beginnings of American botany, is still at the very zenith of its usefulness. The grip upon North American plants, which only many active years can bring, renders his recent work and the work yet planned of very great importance, and American botanists are very earnest in their hope that many years may yet elapse before his busy brain and pen cease to work for us.

WE WOULD CALL the attention of our readers to the fact that the General Index for the first decade of the GAZETTE is being prepared, and will be a most exhaustive one. Every species mentioned, every subject (not only formal ones, but also those incidentally referred to), every author, all with abundant cross references, will be given. It is the intention, in short, to place in the hands of botanists an index which will put at their finger tips all the information which the BOTANICAL GAZETTE has contributed for ten years. This index will only be sent free to subscribers to Volume XI, and as only a limited edition will be printed, it is necessary for subscribers to be prompt in sending their names. For particulars our advertisement on the second page of the cover may be consulted.

MR. HEMSLEY's report on the insular floras collected by the Challenger Expedition is one of great interest, for the questions suggested by insular floras are often very puzzling. It is upon these islands, too, that the native flora is being sadly interfered with, and where it is very peculiar, as in the case of St. Helena, a complete knowledge of it can not be obtained too soon. In fact, four recorded and peculiar species have already entirely disappeared from the island mentioned, and others are rapidly approaching extinction. St. Helena and the Bermudas are taken as presenting the two types of insular floras; the former very ancient and very distinct, and its origin very uncertain; the latter entirely resembling that of neighboring islands and continents. It is stated that not even a well marked species would be lost if the Bermudas were submerged.

MR. G. MURRAY, in his annual reports as Inspector of Fisheries in England and Wales, gives some interesting accounts of the inoculation of fishes with *Saprolegnia ferax*. The cultivation of this fungus was carried on with flies as hosts, and inoculations were effected by rubbing the head or sides of the fish with an infected fly. Experiments were mostly made upon species of the Salmonidæ. Some experiments were very successful, others not at all so; in the former cases the fungus appearing and death following promptly. In one case, where the disease broke out in a fish tank, it was found that oospores of Saprolegnia had been conveyed to the fishes by the earth-worms used as food, and that the worms had obtained them from moist ground upon which had been thrown the bodies of diseased fishes. Afterwards another fungus, *Dictyuchus*, appeared in the cultivations and entirely displaced *Saprolegnia*, the latter rapidly and completely disappearing.

MUSHROOMS are coming to the front, and information concerning them may soon be broadcast enough in this country to bring within the reach of our people a very palatable, cheap, and abundant food. Dr. Rothrock has recently lectured upon this subject, in the Fairmount Park series of lectures. After describing a number of nutritious and dangerous fungi, the lecturer said: "There is a point to be insisted upon, that as fungi, which were edible and delicious and nutritious, are probably more abundant here than in Europe, where they are an important article of food, it is in the interest of the community that every one should know them. Every public school should have, where every child could see them, plaster models, life size and color, of the edible and the poisonous species. This idea could easily be realized, and would involve almost no expense, whilst its practical benefits would be larger than we can at present conceive of. Even the Chinese government prints and distributes broadcast over the land what is known as the Anti-Famine Herbal, a book describing nearly 500 species of plants which in time of scarcity may be utilized as food. Are we still to remain in this respect below these, whom we consider barbarians?"

A RECENT PAPER[1] by M. Leclerc du Sablon on the dissemination of the spores of vascular cryptogams may be briefly summarized as follows: The structure of the sporangium is quite similar in plants of the same family. In Equisetaceæ the sporangium presents the same structure as in a large number of Phanerogams (e. g. Borrago, Iris). It is composed of "spiral" cells, and it is to the difference between the contraction of the pure cellulose of the wall and the lignified cellulose of the spiral that the rupture is due. The movements of the spores after they are set free are due to the difference in the contraction of the lignified and non-lignified parts of their appendages. The dehiscence of the sporangium is explicable on the same principle, but is made pos-

[1] Ann. des Sc. Nat. Sér. 7, tome ii, p. 5. July, 1885.

sible by a different arrangement of the lignified parts. Here the external walls of the epidermal cells are composed of pure cellulose, while the internal and lateral walls are lignified; the external face of the cells, therefore, will contract more. The dehiscence of the sporangium of Ferns is characteristic and and unique. The different movements effected by the cells are due to the variation in pressure produced by the dryness of the air in the interior of the cells. The opening of the sporangium is therefore not due to the contraction proper of the cell-walls. In all three groups of vascular cryptogams the determining cause of the rupture is the same, viz: the dryness of the atmosphere.

In *Flora* for September 1st, J. Schrodt commences a paper on a similar subject, "Das Farnsporangium und die Anthere; Untersuchungen über die Ursachen des Oeffnens und Umrollens derselben."

PROF. WILLIAM TRELEASE has published, with plate, a resumé of his observations on several Zoogloeæ and related forms in the Johns Hopkins series of Biological Studies. The following note as to his method of culture is interesting to workers: "At first various starchy substances were employed as media for the growth of the different species, but I finally restricted my cultures to boiled potatoes carefully cut in halves, the exposed face being inoculated in one or more points by means of a needle scrupulously fired before and after each inoculation. These were kept in sauce-plates, under inverted tumblers, some of which were not disturbed until the end of the culture, while others were opened from time to time for microscopical study or for material to be used in starting new cultures. It is needless to say that many of these failed through the introduction of other germs in one way or another; but by means of frequent transfers, pure cultures of all ages were kept under daily observation for about three months."

CURRENT LITERATURE.

Parasitic Fungi in Illinois: Part I, Uredineæ. From the Bulletin of the Illinois State Laboratory of Natural History, vol. II, pp. 139-255. By T. J. Burrill, Ph. D. Peoria, 1885.

The first striking feature of this work is its size, for although embracing but a single order as illustrated in one State only, it requires, exclusive of the preface, over one hundred and fifty octavo pages for the enumeration. Eighty-two true species and forty-seven imperfect forms are described. The recent catalogue of the parasitic fungi of Wisconsin gives sixty-five true species and thirty-four imperfect forms of Uredineæ, and that of Iowa gives seventy-nine true species and fifty-five imperfect forms. It is plain that the parasitic fungi are receiving marked attention, and the rusts in particular. Much credit for the size of the Illinois list is due Professor A. B. Seymour, now of the University of Wisconsin, who collected two seasons under the direction of the State Laboratory, and who has remarkably keen powers of observation.

Each species of the list is amply described, the localities for each host plant cited, some synonymy given and notes often appended. The whole is preceded by a key to the genera and followed by a glossary and index of species and host plants. The work throughout shows evidence of thorough and critical study, and is a very valuable contribution to American mycology. The labor on the synonymy is especially commendable. The author is cautious and yet judicious. He does not follow Dr. Winter in tracing back to æcidial or varietal names in case these occur, as introducing too great an element of uncertainty, but adopts the more conservative plan advocated by Dr. Farlow. There is much to be said in favor of this, and it will undoubtedly tend to give greater stability to our nomenclature for the present at least. The author also emphasizes the desirability of always writing the authority for the whole name, and not merely the authority for the specific part of it, as is now too common among many mycologists. The basis of the nomenclature used is summed up as follows: (1) the use of the oldest specific name known to have been used for the species as such, (2) the name of the teleutospore and uredospore stages are alone considered in the question of priority, and (3) the name of the author responsible for the specific appellation has been appended, being enclosed in parenthesis in case the generic association has been changed, and the name of the author of the binomial combination, whether the parts were adopted from others or not, finally follows. Out of the eighty-two true species, a dozen have their æcidial forms described along with the other stages.

An admirable plea is made for the more thorough investigation of the parasitic fungi as of great economic importance. This portion would be valuable and interesting reading to the majority of intelligent cultivators.

Physiological Botany: Part II. Vegetable Physiology. By George Lincoln Goodale, A. M., M. D., Professor of Botany in Harvard University. 8°. pp. 195–499; together with *Practical Exercises*, pp. 36. New York: Ivison, Blakeman, Taylor & Co. 1885.

Since the publication of the first part, the appearance of the concluding portion of this work has been eagerly looked for by the teachers and students of botany in this country. It will at once occur to the reader, as he lays down this volume, that here is a really new book; not new in its facts, of course, but essentially new in the arrangement, and thoroughly original in the presentation of them. On further consideration, he will be impressed with the very wide range of literature from which these facts have been gathered, and he will be thankful that the author has not been content with a mere mention of the name of the observer, but has given copious references to the literature, and in many cases a citation of the passage in point. This will certainly prove very helpful to teachers and their pupils alike—helpful to the former, because it will save the time otherwise spent in hunting up these scattered papers for more valuable work; and helpful to the latter, because it will impress upon them that there is much knowledge which could not be put into a five hundred page book.

The reader will also be impressed with the comprehensiveness of the treatment. One can hardly mention a topic in vegetable physiology which is not elaborated or touched upon. No one can look at the table of contents without noticing at once the number and variety of the topics and their very logical arrangement.

Of all the chapters in the book, perhaps the one on assimilation may be said to the most thorough and satisfactory. An excellent distinction is insisted upon between assimilation proper, or the appropriation of carbon and its combination with hydrogen and oxygen, and assimilation as meant by animal physiologists. There is likely to arise confusion unless such a distinction is observed.

It is gratifying to find the subjects of geotropism, heliotropism, *et id omne genus*, cut off with the brevity that our ignorance concerning them demands, for an explanation that does not explain, only serves to mystify.

The subject of fertilization, however, hardly receives due attention, though other phases of the reproductive processes are well treated. It ought to be pointed out here that Strasburger, in a later work (Neue Untersuchungen, Oct., 1884), corrects his statement quoted on p. 435 as to the union of one of the synergidæ with the oösphere. (See Bot. Gaz. ix. 328.)

The illustrations in the second part do not compare favorably with those in the first. The figures of the structure of the pollen-grain and the embryo sac are much too small for clearness, and some of the figures of apparatus are quite coarse.

The practical exercises, which form a separately-paged appendix to the volume, will serve a good purpose in the laboratory work of the student. They contain many valuable hints as to material for study, and enumerate the more important physiological experiments that can be performed by a skillful manipulator in a well-equipped chemical and physical laboratory, including also a large number which require only a little skill and less apparatus.

The second volume of "Gray's Botanical Text-Book" is a worthy companion to the first one by Dr. Gray himself.

Report on the Flora of Western and Southern Texas By Dr. V. Havard, U. S. A. From Proc. U. S. Nat. Museum. Sept. 23–30, 1885. pp. 85.

Since 1880 Dr. Havard has been stationed at several posts, and has also accompanied several exploring expeditions in Western Texas. His report is divided into two parts. Part I discusses the vegetation in the general way, under the following heads: general view; rainfall; temperature; valleys; valleys east of the Pecos (Concho, Colorado, Brazos, Red River); the Pecos; valleys west of the Pecos; the Rio Grande; hills, bluffs, and mesas; staked plains; prairies; coast; mountains; salt lakes basin. Part II is made up of economic notes on the plants known to have useful or baneful properties, or to be of value to agriculture or industry. Altogether, it is a careful and pains-taking report, and forms a valuable contribution to our knowledge of the botany of a very interesting region.

The Mycologic Flora of the Miami Valley, Ohio. By A. P. Morgan. From the Journal of the Cincinnati Soc. Nat. Hist. 1885.

There are before us three papers, a continuation of the Mycologic Flora of the Miami Valley, in which Mr. Morgan displays much hard work, and work that can hardly help giving an additional impetus to the study of western mycology. They comprise by far the larger part of Order II, Polyporei, of the Hymenomycetes, and have been delayed in their distribution until the completion of the bulky genus Polyporus. This genus, like the genus Agaricus of the Agaricini, includes most of the Order. A short paper will contain the remaining six genera.

The paper on Polyporus is the first attempt to give a systematic account of the species of any region of the United States. The Polypori, unlike the fleshy Agarici, are mainly leathery or woody plants, on which account they are easily preserved and have been liberally sent abroad by collectors. The native American species, therefore, have been chiefly named from the dried specimens, and the consequence is an extensive synonymy, which it will take a long time yet to clear up.

The species of Polyporus, in these papers, are presented in the arrangement of Fries, in the second edition of the *Epicrisis*, this answering almost as well for them as for the European species, and not in the arrangement of the *Novæ Symbolæ* of Fries, which would probably be necessary for a full account of the Polyporei of the United States.

Of the eighty-six species, thirty-four are not found in the Epicrisis, and are therefore practically inaccessible to the ordinary student. Fifty-two species, therefore, are identical with European forms, while thirty-four are native; of the latter, however, several are found in other lands. Seven of the species were first found in the Miami Valley, by Mr. Lea, and published in the Cincinnati Catalogue in 1849; and although Mr. Morgan's researches have doubled Mr. Lea's list, he has been able to add but three new species.

Mushrooms of America—Edible and Poisonous. By Julius A. Palmer, Jr. Prang & Co. Boston [1885]. Chart or Roy. 8°. pp. 4. 12 col. plates.

Although the author, in his first sentence, disavows having prepared the work for botanists, yet the several hundred botanists of this country will surely take as great an interest in it as the general public. It is an admirable and much needed work, intended to introduce the novice to a number of common edible mushrooms, and to warn him of some poisonous ones. It is lamentable that one can not gather mushrooms for the table indiscriminately, but as this can not be done, it is some consolation to learn that, although abundant in individuals, there are comparatively few really deadly species. Four of the most common of these are illustrated, together with six others which are to be avoided. The remainder of the work embraces a dozen and a half edible species. Almost everyone will recognize some old acquaintances among them, and regret that their value as food had not been known long since.

Although mushrooms are plants, they have the comestible qualities of flesh, and to some extent may replace this costly article of diet. The Société Mycologique, of France, devoted to diffusing a better knowledge of the value of mushrooms for food, has a few members in this country; but a work like the present is a strong additional agent for obtaining the same result. The certain recognition of the different kinds is essential to securing and maintaining popularity. All that word and picture can do toward this is here furnished. The plates are naturally and artistically colored with the skill which has brought Prang & Co. deserved fame, and the text is simple and accurate. Under each plate is a description of the species, in which it has only been necessary to use seven words requiring definition, no one of these having more than six letters. Following the description is the recipe for cooking.

The work is issued in three forms: as a chart for the wall, loose sheets in a portfolio, and bound in book form. It is to be hoped that it will meet with sufficient sale to warrant the publishers in continuing the work, as they express a willingness to finally illustrate most of the larger North American mushrooms.

Recherches Anatomiques sur les organes vegetatifs de l'Urtica dioica L. Par A. Gravis. 4 to. pp. X. 256. 23 plates. Bruxelles. 1885.

This is a most elaborate work, and the plates, as is usually the case in European monographs, are beyond all praise. The author has not only studied anatomically the species mentioned, but all its relatives, so that the labor involved a pretty thorough examination of the order. To give some idea of the care taken, the author states that over 15,000 sections of *Urtica dioica* alone were made, in view of which fact, who will soon dare to contradict the results? M. Gravis is strongly of the opinion that anatomical and embryological characters will furnish the same useful basis of classification among plants as it has already done among animals. His criticism of previous anatomical work among plants, however, is that certain regions of a certain age have been examined, to the entire neglect of other regions and other phases in development. Accordingly in the case of *Urtica dioica* the author treats of the stem, the leaf, and the root, and in each case has made an exhaustive study of the tissues from the first appearance of these organs to their completest development, no region being neglected. The tracing of the fibro vascular bundles into and through the nodal regions, and the working out of the leaf structures from the cotyledons on, are especially fine. The contribution is not only a pleasure and a help to those who like good work, but also a very good lesson to the many who seem to think they can learn all about the anatomy of a plant from a few sections.

GRAY MEMORIAL VASE.

BOTANICAL GAZETTE.

VOL. X. DECEMBER, 1885. No. 12.

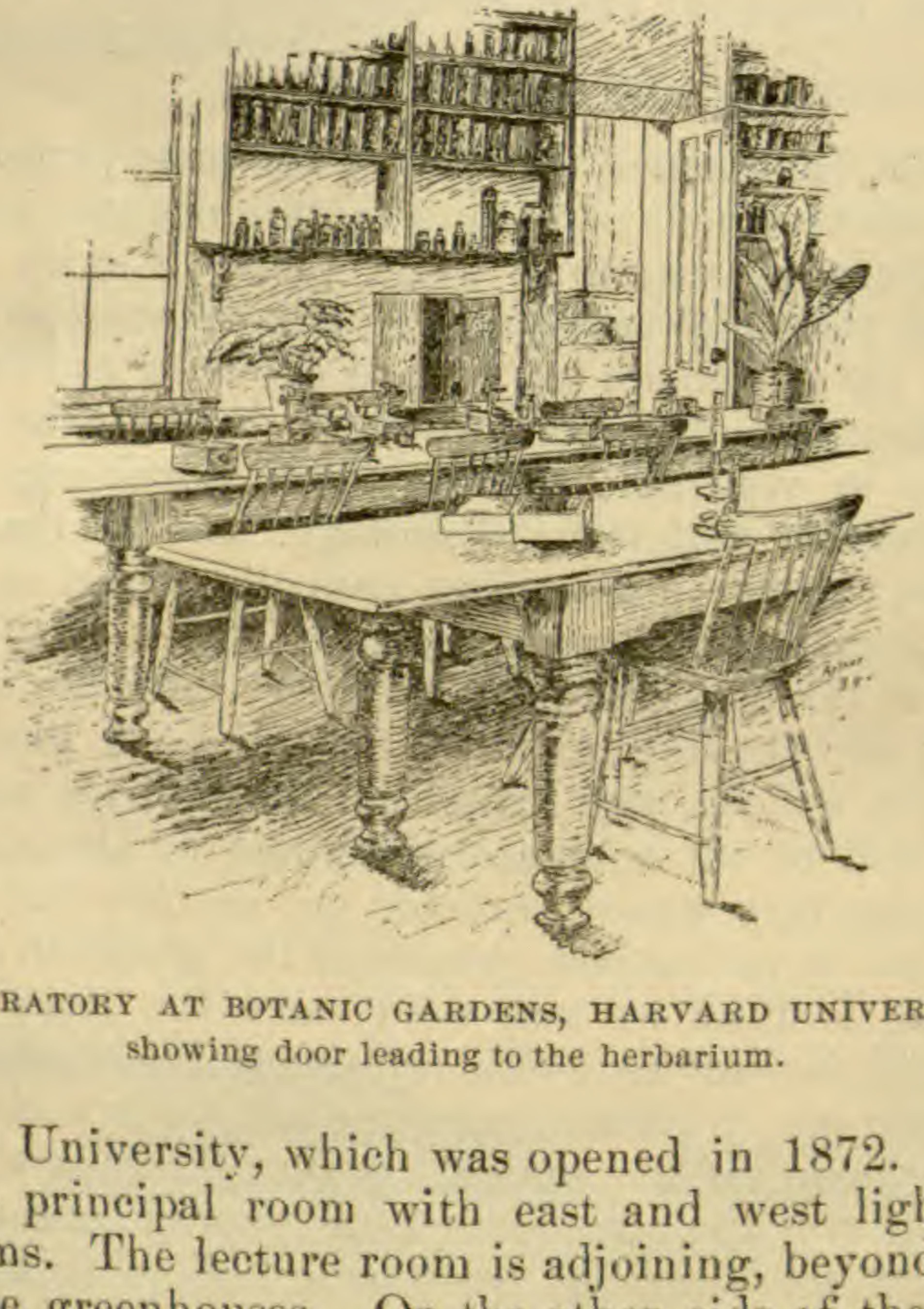
Some Botanical Laboratories of the United States.

BY J. C. ARTHUR.

It can not be disputed that one of the most powerful auxiliaries to the advancement of botany in this country is the laboratory. It leads the way to a wider range of study and a more intimate and thorough acquaintance with the structure and life of the plant. Its tendencies are toward habits of careful investigation, and through this channel we are to look for the more recondite studies in vegetable anatomy and physiology which will compare favorably with those of zoology. The fact that the laboratories of the German universities annually attract many students of botany from this country shows the interest in this method of study, and at the same time a reactionary influence is evident in stimulating and shaping our own institutions of like nature.

But have we yet any American laboratories worthy of the name that will at all compare with those of Germany? If we ask the masses they would probably say no, they had never heard of any. But let us instead propound the question to the scientific public. I think we may safely take the *American Monthly Microscopical Journal* as a fair representative of this class. Its editor, a year ago, in championing a doubtful hypothesis, asserted in disparagement of his opponents that "comparatively few of the botanists ever use a compound microscope, and of those who do not many are aware of the amount of labor involved in a thorough microscopical investigation my means of thin sections." When this journal made reply by referring the editor to "the every-day experience of our laboratories," he answered that "the amount of scientific investigation in botanical histology that is being conducted in this country is not very great, and we have not a wonderful array of well-equipped botanical laboratories either. It is not our custom to make assertions in these columns that are not sustained by facts of which we are cognizant." But if the general scientist is so positive and thinks he could marshal facts in his support, let us turn to the several hundred botanists of the country. Even here the majority would likely shake their heads doubtfully as to the value of our laboratories, an anomaly we shall allude to again.

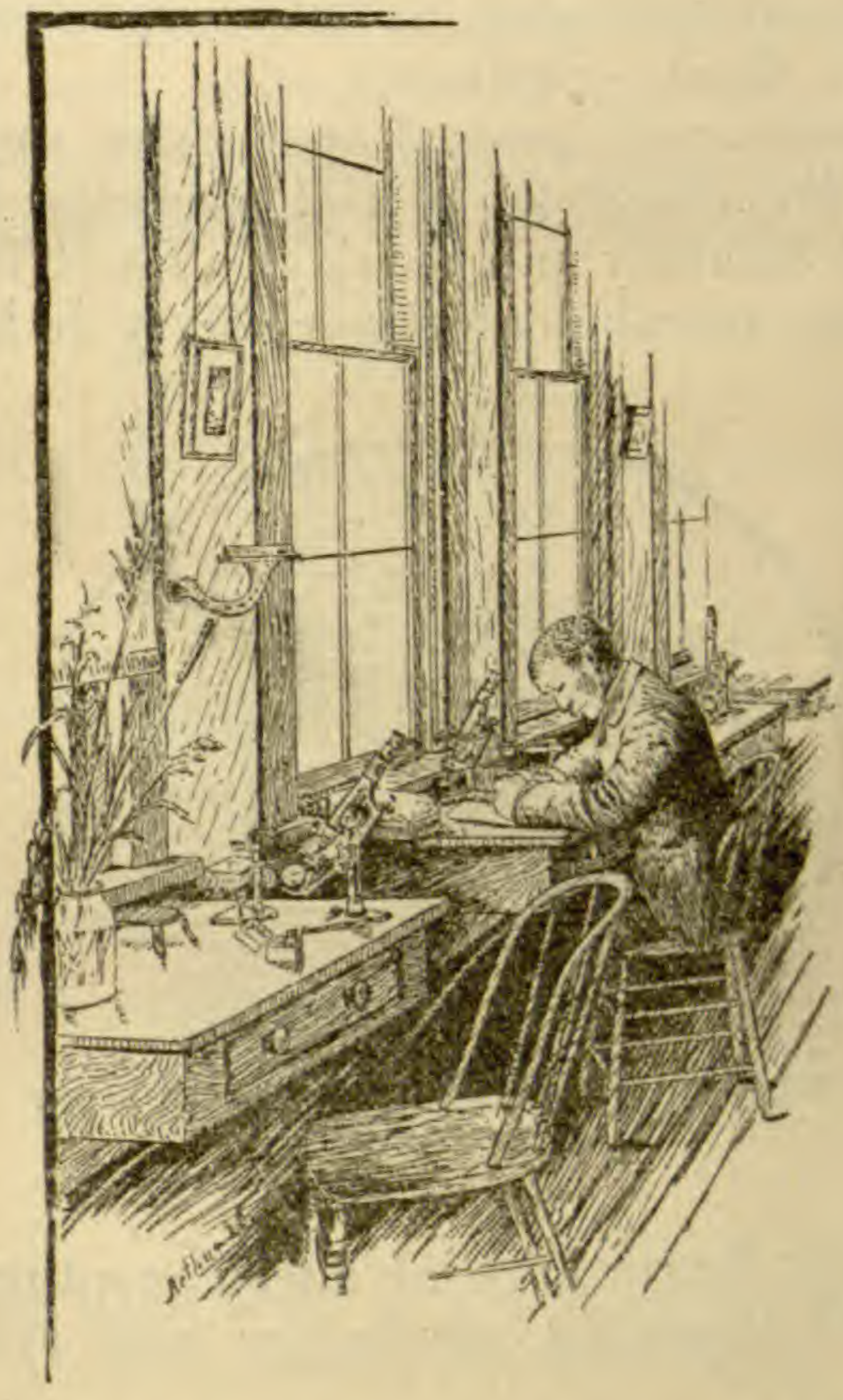
It is the purpose of this article to give a brief account of a few American laboratories in order to demonstrate both their existence and their capacity. The reader can then judge for himself whether we have laboratories that are noteworthy or not. Among the first to be established was that at the Botanic Gardens



LABORATORY AT BOTANIC GARDENS, HARVARD UNIVERSITY, showing door leading to the herbarium.

of Harvard University, which was opened in 1872. This consists of one principal room with east and west light, and two smaller rooms. The lecture room is adjoining, beyond which are the extensive greenhouses. On the other side of the laboratory one passes up a few steps and through a short passage way into the great herbarium, the largest and most valuable one on the continent, beyond which is the fine Gray library. Students can have access to these under certain restrictions. East of the laboratory lies the Botanic Garden, which furnishes abundant material for study, including aquatic and marsh plants. West of the laboratory is the garden of the North American flora, the corner for sub-alpine plants, plats of grasses, cactus beds, etc. All these are made tributary to the needs of laboratory students.

The laboratory of cryptogamic botany has, after several transfers, been assigned to a large and well equipped room in the Agassiz Museum. Here is an abundance of light, water, instruments and material, and in an adjoining room the special works of reference and exsiccatæ, probably the most complete in the country, and also the library belonging to the Agassiz Museum, to



BOTANICAL LABORATORY FOR ADVANCED WORK AT CORNELL UNIVERSITY.

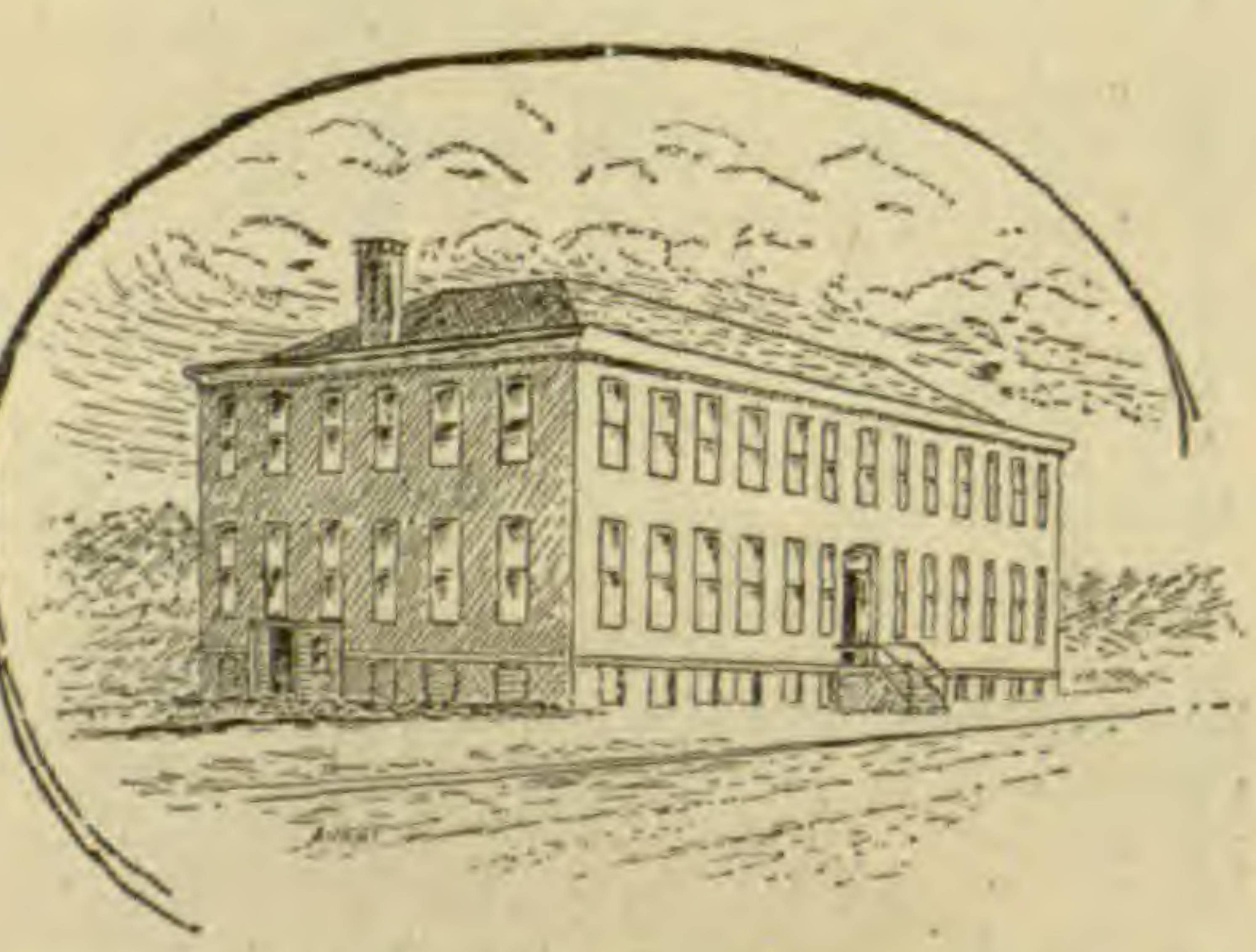
which the student can have access. This laboratory is shared by one of the instructors in zoology.

Two years ago provision was made for the main phanerogamic laboratory at College Yard in order to relieve the students of the long walk to the Botanic Gardens. Three rooms of good size in Harvard Hall were plainly furnished but abundantly supplied with instruments and material. There is here an herbarium of New England plants ample for most elementary requirements, and a small library of morphological and physiological works, while only a short walk across the campus takes one to the main library of Harvard College.

The microscopes used in the Harvard laboratories are Zeiss (1 large stand, 3 No. VI), Verick (12), Leitz (3), Wales (1), Ross (1), and a set of six objectives by Tolles, with plenty of accessory apparatus.

Excellent provision is made for physiological work, for which there is ample supply of ordinary chemical and physical apparatus with such special appliances as micro-spectroscopes, auxanometers, clinostats, thermo-regulators, etc.

The laboratories are in general open three days in the week from nine until five, except for special students who can attend every day except Saturday and Sunday. There can be accommodated at one time in morphological work sixty, in biological course



BIOLOGICAL BUILDING OF UNIVERSITY OF PENNSYLVANIA.

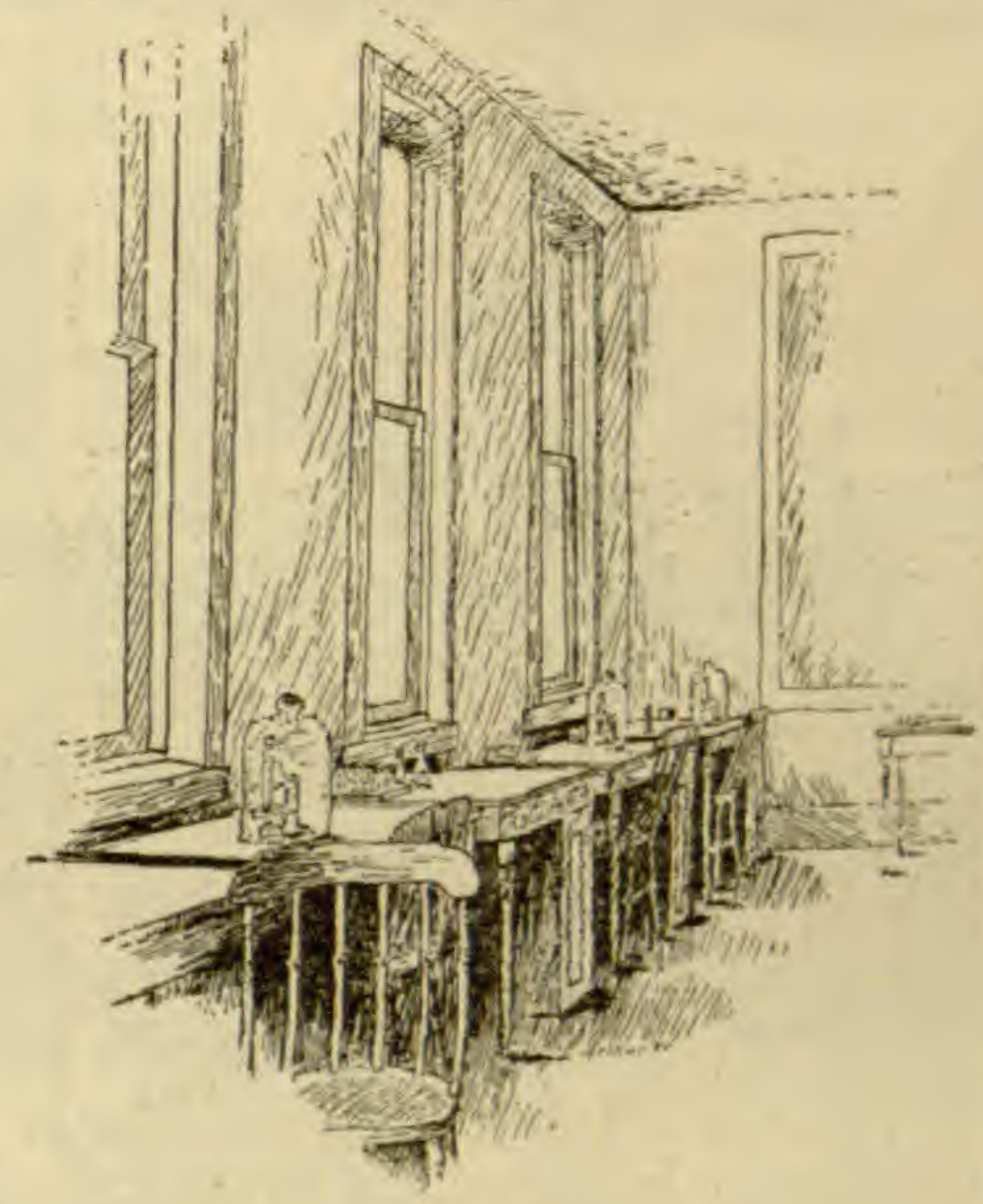
thirty, in histology fourteen, in advanced cryptogamic botany six and in advanced vegetable physiology and systematic botany twelve.

Every facility and encouragement is provided for original research, and the number of teachers of botany who come for study each year gives evidence of the wide appreciation of the opportunities. Taken as a whole the botanical laboratories of Harvard University are the most extensive and important in the country.

The botanical building at Cornell University consists of a main part erected in 1872, 97 by 58 feet, three stories high, which contains what is probably the finest botanical lecture room in America, and an excellent economic and illustrative museum of botany. A two-story extension, 35 by 30 feet was put up in 1882, which with some of the older part is entirely devoted to laboratories. This structure although forming a part of the large building known as Sage College was built expressly for the botanical department.

The laboratory for analytical and general phanerogamic work is on the second floor, 32 by 22 feet, lighted from three sides and provided with movable tables at which two can sit. Eleven dissecting microscopes are found ample, as students furnish their own lenses for ordinary work. Forty or fifty students can be accommodated here at one time.

The laboratory below, 62 feet long, contains twelve tables supported from the wall, having north light, and with room for mov-



SENIOR LABORATORY IN THE BIOLOGICAL BUILDING OF UNIVERSITY OF PENNSYLVANIA.

able tables when required. Most of the microscopic and physiological work is done here. There are twelve microscopes, made by Tolles (2), Verick (2), Gundlach (1), and the later purchases by Bausch & Lomb. They are mostly fitted with $\frac{3}{4}$ and $\frac{1}{6}$ inch objectives, with additional higher objectives and suitable accessory apparatus.

This room opens directly into the extensive and elegant conservatories which supply abundant material for dissection. The herbarium is ample for the need of students, and is especially full in grasses and sedges. A special aid and incentive to botanical work is the wonderfully rich and varied flora of the immediate vicinity.

The laboratories are open daily except Sunday from eight to five o'clock. Fair facilities are offered for original investigation, especially in microscopic and systematic botany. A bequest which was expected to found an extensive library is now in litigation.

The laboratories of the University of Pennsylvania are in the biological building, erected in 1884. This structure is 84 by 47 feet, two stories high, and a basement. The same rooms are used

BOTANICAL BUILDING OF THE MICHIGAN AGRICULTURAL COLLEGE.

both for zoology and botany. The student first takes a course in general biology with laboratory work in Huxley and Martin's Biology, then Gray's Botanical Text-book accompanied with analytical work, before physiological and anatomical botany is reached.

There are two laboratories, junior and senior, each 30 by 22½ feet, and three of less size, designed for students engaged in special or original work, *all* lighted from the north. Each table is supplied with a dissecting and a compound microscope, full outfit of chemical appliances, etc., for which the student is held responsible during his connection with the laboratory. Gas is also carried to each table.

Elementary work is done in the laboratory with simple microscopes made by Zentmayer at the request of Professor Rothrock.[1] There are twenty-four compound microscopes, all by Zentmayer. Rooms are open from 9 to 5 o'clock each week day, but on Saturday no one is in attendance.

In the basement are photographic rooms and aquaria. Works of reference are supplied in the building, and the extensive library and herbarium of the Philadelphia Academy of Natural Sciences are also open to the student. For the prosecution of original research, which is specially encouraged, all needed appliances are provided, or if not already in hand are obtained as required.

The laboratory of Illinois University is a room 22 by 28 feet, containing twenty-four tables for one student each, the usual supply of water, gas and shelving, and is exclusively used for botany. There is also the professor's laboratory, in which is the herbarium.

For elementary work with simple magnifiers the student provides his own outfit. The compound microscopes, twenty-one in all, were made by Spencer & Eaton (1), Ross (2), Möller (1), Bullock (1), Nachet (1), Beck (4), Bausch & Lomb (4) and seven were made in the university shops. There are also thermostats, moist chambers, scales, etc. In the same building are good physical and chemical laboratories, from which any needed apparatus may be borrowed.

A greenhouse near the laboratory is tributary to it. The laboratory is open from 8 to 12 and from 1 to 5 o'clock. The present quarters have been occupied since 1876. A special biological building is expected at some future day.

The botanical department of Michigan Agricultural College rejoices in the most imposing building especially erected for botanical instruction in the country. It is a modified Gothic, completed in 1880 at a cost of \$6,000. The upper stories contain the botanical museum, very instructively arranged. The laboratory on the first floor, also used as a lecture room, is 48 by 44 feet. It is lighted from east and west, and with ground glass windows on the south. Long tables are placed obliquely at each window, at which a number of workers may sit at a time.

[1] This instrument is described at p. 37, Vol. III, of this journal.

The elementary course, with simple microscopes, permits most of the work to be done outside the laboratory. Coddington lenses with convenient supports are chiefly used. The supply of compound microscopes is at present ample (27), and with funds for the purchase of others as needed. The makers are Zentmayer (1), Sidle (1), Berlis (6), Klein (1), Wales (5), Bullock (1), Bausch & Lomb (11), and one by Ross not now used.

The herbarium and library in the same building are fair size, and meet the needs of undergraduate study. A conservatory and a fine botanic garden, including aquatic plants, a few steps away, and a virgin flora in the vicinity, furnish plenty of excellent material. This laboratory has long been noted for the observant and independent work of its students.

At the University of Michigan a microscopical laboratory was established in 1874 for animal and vegetable histology; since 1879 it has been used exclusively for the latter purpose. Here a large amount of the elementary work is done, much of it being what is known as "microscopy." There are forty-three microscopes, mostly Bausch & Lomb.

The botanical laboratory proper, opened in 1882, occupies a room 40 by 20 feet in the third story of the main building. It is well lighted by eight windows and furnished with movable tables, wall cases, charts, etc. Six Gundlach microscopes with suitable accessories, a small but well selected library containing the works of De Bary, Sachs, Pfeffer, etc., sets of the *Annales des Sciences Naturelles* and *Botanische Zeitung*, are at the service of students. Another room is devoted to the herbarium. The laboratory is open each week day from 8 to half-past 12 o'clock.

A few students each year pursue special investigations, the excellent quality of which is already well known to our readers. The friends of the institution earnestly hope the regents may soon find it feasible to enlarge and more fully equip the department, which has shown itself very worthy of support.

At the Iowa Agricultural College the botanical department has permanent quarters in the second story of North Hall. The laboratory, which was opened about nine years ago and more recently provided for as at present, is 40 by 16 feet and lighted by four north windows. Extending out from each window is a truncated wedge-shaped table, at which two can sit on either side and one at the narrower end furthest from the window. By this arrangement five can comfortably see at each window.

The work with simple magnifiers is mostly done outside the laboratory. There are twenty compound microscopes, partly made by Schrauer, having Hartnack objectives, but the larger part by Beck, in addition to which is one large binocular by Beck with full complement of objectives and accessories. The laboratory is open four afternoons each week from two to five o'clock.

The herbarium and library occupy an adjacent room. Phanerogams and cryptogams are uniformly arranged and very fully represented, including a large part of the published exsiccatæ. The library is well stocked with standard reference works, both in English and foreign languages.

The new biological building of Wabash College, opened last year, contains two laboratory rooms exclusively for botany. The room for elementary work is 50 by 25 feet, with north, south and east light, fixed and movable tables, an alcove with north light being devoted to work with the compound microscope. For work with simple magnifiers Bausch & Lomb and Beck dissecting instruments are used.

The room for advanced students is 25 feet square, and chiefly lighted from the north. Twenty microscopes are now in use, the manufacturers being Zentmayer (2), Beck (8), McCallister (1), and Bausch & Lomb (9). Some simple physiological apparatus has been provided, and additions to it will be made from time to time. There is a large library especially full in systematic works on phanerogams, and one of the largest phanerogamic herbaria in the west, probably only second to the Engelmann collection. The laboratories are open from nine to four o'clock each week day.

The new arrangements at Wabash College and the liberal attitude of its board of directors, who say that "any book or any material procurable with money will be obtained for original work," give most excellent opportunity for conducting special investigations.

Purdue University opened its laboratory in 1881. It is 40 by 25 feet and furnished with a dozen tables for two workers each. There are twenty-five available microscopes, made by Beck (11), and Bausch & Lomb (14), with an additional set of Beck's objectives up to $\frac{1}{20}$ in., and A and E of Zeiss. An equal number of dissecting microscopes, made by Beck (4), and Bausch & Lomb (21) meet the requirement for simple magnifiers. The room is open on Saturday from nine to twelve o'clock, on other week days from nine to four. The future is expected to bring new rooms and additional facilities to this promising beginning.

The laboratories of the University of Wisconsin, established in 1881, are located in rooms intended to answer the purpose for some time to come. Some work in zoology is done in them, while the zoological laboratories, which were burned not long since, are being rebuilt, otherwise they are exclusively for the botanical department. The main laboratory, 36 by 22 feet, now arranged to accommodate twenty students at a time, is to be doubled in size. The laboratory for advanced and micro-chemical work consists of a suite of rooms covering equal space with the main laboratory. The rooms are open from four to five hours each week day.

Eleven Bausch & Lomb dissecting microscopes are provided for elementary work. There are twenty-five compound microscopes, made by Gundlach (1), Bausch & Lomb (3), Schrauer (2) with Wales objectives, and Leitz (19), also three Abbe condensers, as many homogeneous immersion lenses, an Engelmann microspectroscope and culture apparatus for bacteria investigations. A very good botanical library and phanerogamic and cryptogamic herbarium occupy rooms in the same building. Plant diseases and parasitic fungi are especially well illustrated in both library and herbarium.

The botanical laboratory at the University of Nebraska was first opened in April, 1885, and at present occupies a room, 25 by 18 feet, fitted up to accommodate eight or ten students at a time. It will shortly be removed to rooms in the new Chemical Hall, ample for twenty-one students at once, to be occupied until the large and commodious biological building is erected, which is expected in about two years. The rooms are now open seven hours a day, but it is proposed to reduce this somewhat.

Twenty-five dissecting microscopes and thirty-six Coddington lenses have been provided for elementary work, which is not yet under way. The compound microscopes are by Beck (15), and Bausch & Lomb (6), and in addition one large Beck instrument with a dozen objectives and a full set of accessories. There is already a very fair botanical laboratory and many sets of exsiccatæ.

The last laboratory to be mentioned in this article, that of the Shaw School of Botany at St. Louis, is also the most recent one organized. The formal opening of this new institution occured Nov. 6, 1885. A two-story dwelling house, near the Washington University, of which the school is a department, has been remodeled for laboratory purposes. At some future time a fully equipped laboratory building will be erected, probably at the Shaw gardens. These gardens are very extensive and elaborate, and far exceed those of any other botanical school in the country.

The instruments now ready for use are sixteen Bausch & Lomb dissecting microscopes, one of Zeiss' best stands, with objectives ranging up to $\frac{1}{18}$ homogeneous immersion and full accessories including spectroscope, and three Leitz stands with powers ranging to $\frac{1}{16}$ and $\frac{1}{20}$ homogeneous immersion.

The present library consists of the Engelmann library and the pamphlet collection of Dr. Trelease, the professor in charge. The herbarium consists of the large Engelmann collection, the Bernhardi herbarium of perhaps 20,000 species, Riehl's Missouri plants, about 10,000 European plants from the Joad collection, secured through the kindness of Dr. Gray, and the excellent collection of cryptogams of Dr. Trelease. This institution will undoubtedly have unexcelled facilities for post-graduate work and research in the near future.

The foregoing sketch of the botanical laboratories of twelve prominent institutions of learning does not by any means include all there are in the country, but we think sufficiently demonstrates the present condition of American laboratories, and is at any rate as extended as our space permits. Others will be described at some future time.

The laboratory system, in connection with the teaching of botany, may be said to have been introduced in this country about 1870. The next five years saw the beginning of a number of laboratories, usually with limited means and room; but by 1880 their magnitude and importance had sufficiently extended to command the erection of special buildings. Those for Michigan Agricultural College and Cornell University have been designed exclusively for botany; those of the University of Pennsylvania, Iowa Agricultural College and Wabash College are for both botany and zoology; the other institutions named still await the erection of special botanical or biological structures. Harvard University, to be sure, has permanent rooms at the Botanic Gardens, but on account of the distance from the Campus and their limited size, they do not much lessen the need of another special building. In all the twelve institutions, except the University of Pennsylvania and the cryptogamic department of Harvard University, the laboratories described are for the exclusive use of the botanical department, and in all but Michigan Agricultural College the lectures are given in a separate room devoted to that purpose alone.

The number of compound microscopes employed is above twenty on the average for each institution; while the number of students who make use of the laboratories during the year ranges from fifty to one hundred. One can rarely visit any of the laboratories named without finding some original investigation of more or less value in progress, and although the sum total of such work is not yet large, it is annually increasing and improving in quality.

Our laboratories are now principally devoted to the study of the structure and development of plants; observations are also carried on to some extend upon the habits of plants; but the deeper problems of vegetable physiology are for the most part unprovided for. A point to be borne in mind, at least by those in charge of our principal institutions, is that in the near future there will be a strong demand for adequate laboratory facilities in plant physiology, pathology and bacteriology. These are three great subjects of high scientific and economic importance, and for their best treatment require rooms and apparatus of special design.

If the candid reader has fully read this article, he must acknowledge that there are laboratories in the United States of fair capacity and equipment. Their recent and quiet growth sufficiently explains the general ignorance in regard to them; even among botanists it is for the most part only the younger ones who have felt their direct influence. But such institutions are destined to multiply, and it is confidently expected that at no very distant day botany will be taught by the laboratory method in all our colleges and in many high schools and academies.

1810.—Asa Gray.—1885.

(WITH PLATE XI.)

The eighteenth day of November, 1810, saw the birth of him who was to be the greatest American botanist, and the eighteenth of November, 1885, the seventy-fifth anniversary of that day, brought to him a fitting recognition of his place in the hearts of his fellow-workers.

At a late day it occurred to the editors of the GAZETTE that it would be highly appropriate for botanists to unite in some tribute of love and respect which should commemorate the seventy-fifth anniversary of the birth of ASA GRAY, and should manifest to him somewhat of the admiration and honor in which he is held. Accordingly a letter was sent to all botanists whose addresses could be obtained in the very limited time at our disposal.[1] The responses were prompt and generous. On the 31st of October Messrs. Bigelow, Kennard & Co., of Boston, were

[1] Doubtless many were omitted who would have been glad to join with us. All such omissions must be credited to the absolute necessity for haste.

asked to prepare a design for a silver vase, with appropriate floral decorations. Having designated the shape of the vase and furnished them with specimens and plates of the species to be used in its decoration, this firm submitted a design on November 3d. After consultation with as many friends as possible at Cambridge, the design was accepted, with slight modifications. Work was immediately commenced on it, and the vase was completed on the night of the seventeenth and presented without formality on the morning of the eighteenth of November.

The illustrations which we present give a good idea of the appearance of the vase. It is about eleven inches high, exclusive of the ebony pedestal, which is surrounded by a hoop of hammered silver, bearing the inscription:

1810 November eighteenth 1885

Asa Gray

in token of the universal esteem

of American Botanists

The lower part of the vase is fluted and the upper part covered with flowers. The place of honor on one side is held by *Grayia polygaloides*, and on the other by *Shortia galacifolia*. On the Grayia side the prominent plants are *Aquilegia Canadensis*, *Centaurea Americana*, *Jeffersonia diphylla*, *Rudbeckia speciosa*, and *Mitchella repens*. On the Shortia side there are *Lilium Grayi*, *Aster Bigelovii*, *Solidago serotina* and *Epigæa repens*. The lower part of the handles runs into a cluster of *Dionæa* leaves, which clasps the body of the vase, and their upper parts are covered with *Notholæna Grayi*. *Adlumia cirrhosa* trails over the whole background, and its leaves and flowers crop out here and there. The entire surface is "oxidized," which gives greater relief to the decorations. The vase was designed by L. E. Jenks, and the chasing was done by Wm. J. Austin, both with Bigelow, Kennard & Co. The heartiest praise has been bestowed upon the design and the workmanship by all who have seen it.

By the request of the committee greetings in the form of cards and letters had been sent by those who gave the vase. These were placed on a simple but elegant silver plate and accompanied the gift. The inscription on the plate reads:

BEARING THE GREETINGS OF
ONE HUNDRED AND EIGHTY BOTANISTS
OF NORTH AMERICA, TO
ASA GRAY,
ON HIS SEVENTY-FIFTH BIRTHDAY,
NOVEMBER 18TH, 1885.

The expressions of affection and respect which are contained in letters to the committee as well as those which were presented to the good Doctor, together with the united and hearty response to the committee's suggestion, all testify how universal is the esteem and how deep is the affection for this genial man, whom we have thus delighted to honor.

The following response is sent by Dr. Gray:

HERBARIUM OF HARVARD UNIVERSITY,
CAMBRIDGE, MASS., November 19, 1885.

To J. C. ARTHUR,
C. R. BARNES,
J. M. COULTER, *Committee*,
And to the numerous Botanical Brotherhood represented by them:

As I am quite unable to convey to you in words any adequate idea of the gratification I received on the morning of the 18th inst., from the wealth of congratulations and expressions of esteem and affection, which welcomed my seventy-fifth birthday, I can do no more than to render to each and all my heartiest thanks. Among fellow-botanists, more pleasantly connected than in any other pursuit by mutual giving and receiving, some recognition of a rather uncommon anniversary might naturally be expected. But this full flow of benediction, from the whole length and breadth of the land, whose flora is a common study and a common delight, was as unexpected as it is touching and memorable. Equally so is the exquisite vase which accompanied the messages of congratulation and is to commemorate them, and upon which not a few of the flowers associated with my name or with my special studies are so deftly wrought by art, that of them one may almost say, "The art itself is nature."

The gift is gratefully received, and it will preserve the memory to those who come after us of a day made by you, dear brethren and sisters, a very happy one to

Yours affectionately,

Asa Gray

Laboratory Appliances.

BY JOHN M. COULTER.

The matter presented in this paper is chiefly an editing of information received from some of our principal botanical laboratories, either by correspondence or by personal inspection. As is well known, most of our laboratories are equipped not so much for the use of trained investigators, but to train investigators; hence the teaching aspect is the most prominent, and the most useful notes to our laboratory workers are those which concern methods of teaching. Our teachers are abundantly able to take care of their own original investigations, but in teaching others how to work they are always more than ready to receive hints. This and the other papers of this number, therefore, are not intended to apply to the professional laboratory, but to the teaching laboratory. The writer then intends to act as a middleman for his fellow teachers and interchange for them their ideas upon the subject of appliances.

An almost unanimous expression is that all appliances should be of the simplest kind, as the best of our work has been done by simple appliances, and such are also much cheaper. The attractive catalogues of our instrument makers should be read with care, for they contain many things of very little use in our work and many other things that can be devised at home and answer the purpose just as well. But the notion of simplicity and cheapness must not be carried too far, as, for instance, it is worse than useless to put in the hands of even beginners cheap and hence poor lenses. To classify the subject, we will treat it under the heads suggested by Prof. Bessey.

MICROSCOPES.—*Compound.* Simple low stands seem to be almost universally used, but it is absolutely necessary that they be able to carry any objective. This advice would seem unnecessary, but the writer has in mind more than one laboratory loaded down with stands so cheap that they are really useless for fine work. Foreign stands and those manufactured in our own country are in about equal demand, and it would be hard to convince the users of either that they could better themselves by using the other, all of which shows that good work can be done with both, and a great deal depends upon what one is accustomed to. In some laboratories the stands are so low ("continental" pattern) that the stage may be kept horizontal for all work, which has its advantages. In all cases the microscope is provided with two objectives, in some cases with one eye-piece, but mostly with two. In the matter of objectives there is a range from 1 inch to $\frac{1}{6}$, the two most commonly used being 1 inch and $\frac{1}{4}$. Such pairs as $\frac{1}{2}$ and $\frac{1}{6}$, $\frac{2}{3}$ and $\frac{1}{5}$ are also in common use. The high power should be of as long working distance as possible. Of course all the laboratories have higher powers that can be used as occasion demands. Several have well emphasized the great advantage of providing thoroughly good objectives even for elementary work, for nothing can be more discouraging or confusing to a beginner than to be asked to try to see with an objective so poor that even his instructor could not use it. Professor Spalding urges the use of a double nose-piece as a great means of saving time as well as wear and tear. In some laboratories eye-piece micrometers are used, and in the University of Nebraska these are simple discs of thin glass upon which a small scale is ruled, and the disc fastened into the tube of the B eye-piece. Such micrometers, when ordered with the instrument, cost about $1.50 each. More laboratories appear to provide stage micrometers, and in some cases one micrometer is made to serve the needs of all the students by each one making measuring slips of his own. This is very simply done by tracing on slips of card-board the micrometer lines by means of the camera with every power used. In this way every camera drawing can be measured directly. In the matter of camera drawing the practice varies considerably. Some require it always; others, in addition to its constant use, require larger free-hand drawings as better illustrating the minor details; others require its use only when exact outlines are needed, or when measurements are to be made; others teach its use and then leave it optional with the student, one saying that "the best workers soon come to prefer the camera;" still others never use it, but only require free-hand drawing. In this wide range of habit the teacher is left to consult his own judgment, except that it would at least seem wise for a pupil to know how to use a camera.

Simple. There is the greatest variation in the matter of simple or dissecting microscopes. The idea in all is the same, but its presentation varies from quite elaborate dissecting instruments, costing $10 or $12 each, to home-made affairs, which seem to answer every purpose, costing 25 cents to $1 each. In the home-made instruments the price depends upon the lens used. At the Michigan Agricultural College Coddington lenses are used of about $\frac{1}{2}$ inch focal distance. The wire handle is held by a narrow slit in a small post in block of wood about 3 inches long. Such an arrangement will make a good dissecting lens cost about $2.10.

This lens can be removed and used as a pocket lens. Probably the simplest form of dissecting instrument is that described by Professor Barnes in this number. In quite common use are the boxed instruments, in which the box is used as the base of the instrument. The Bausch and Lomb dissecting microscopes are in common use, and they are spoken of here in order to recommend those who contemplate getting them, to order the unjointed, instead of the folding stand, as the latter is always a nuisance to pick up by the stage, and, as Professor Trelease writes, "who doesn't pick them up by the stage?"

ACCESSORY INSTRUMENTS.—*Microtomes.* The most universally used microtomes appear to be razors and scalpels, the relative merits of which will probably never be settled. One who uses a razor can not be induced to use a scalpel, and probably the reverse is also true. But either will do if sharp enough, and upon this point of sharpness there is no dissenting voice. A day or two spent in learning how to sharpen a razor or scalpel is never lost time. Plenty of good oil stones should be kept on the tables, and Professor Bessey suggests the use of a mixture of about equal parts of glycerine and water instead of oil. Regular microtomes seem to be not very commonly used, though most laboratories possess one or more for use when necessary, but all the ordinary sections of the laboratory are made "free-hand." As an imbedding substance the laboratories are about equally divided between the pith of elder and that of the common sunflower. Dr. Rothrock says there is nothing better than the latter, but that it should be cut when the stalk is mature and *slowly* dried. In reference to section-cutting the reader is referred to Professor Burrill's paper on the subject in this number.

Forceps. The ordinary forceps supplied with microscopes are universally condemned as coarse and awkward and inexcusable. "Dental forceps," made of steel or brass, nickel-plated, are generally recommended, and if but one is supplied to each student it had better be curved at the tip. They can be bought by the quantity at from 15 to 40 cents each, depending on whether they are brass or steel.

Dissecting needles and *brushes.* All dissecting needles seem to be home-made. The most explicit direction comes from the Michigan Agricultural College, where number 5 needles are broken about $\frac{2}{5}$ from the head and pushed with forceps, blunt end first, into the pith of a small branch of European larch. Of course any fine needle held firmly in any convenient handle is all

2

that is required. While this does very well for dissecting, some of us are not willing to remove delicate sections with them, and every student should learn from the first to handle all his sections with the greatest care so that it may become second nature. For this purpose the most convenient plan is to fasten a small camel's hair brush to the other end of a dissecting needle. The brush should be one easily drawn to a point. The advantage of having it fastened to a dissecting needle is that when not in use the needle may be kept stuck in the table and the brush thus out of the chance of dust. In this way the most delicate sections can be handled without injury and nice habits of manipulation cultivated.

TABLE ACCESSORIES.—*Reagents, etc.* Here, too, the matter of expense varies widely, some laboratories possessing the elaborate bottles with etched lables and dropping tube attachment that are very complete and very costly. In most cases too many reagent bottles are needed to furnish them all of such grade. Probably the most convenient and economical method is that of those who use ordinary cheap 2 oz. bottles with cork stopper, each stopper having a glass rod or small tube running through it to near the bottom of the bottle. Several object to this arrangement, and prefer to use bottles with ground glass stoppers and small pipettes, such as can be purchased at the drug stores as "eye-droppers," which do not cost more than 5 cents each. The ordinary reagents upon the table are Iodine, Alcohol, Potassic Hydrate, Glycerine, and Water; other reagents, such as acids and staining fluids, not being distributed individually, but supplied as needed. The greatest puzzle seems to be how to treat potassic hydrate so that the bottle may be kept closed and the stopper neither eaten nor stuck fast. Professor Bessey suggests a very simple plan. It is to take a narrow-necked bottle and use for the stopper a pipette with bulb large enough to prevent slipping into the bottle. The bulb will thus drop into the neck and act as a stopper and the pipette be ready for use. Several are troubled with the scum that collects on the potassic hydrate. The best remedy for this is to supply but small amounts of the reagent and when the scum becomes troublesome empty the bottle.

Glass-slips and *cover-glasses* go with the saying and need no word of comment or explanation.

SHELF ACCESSORIES.—*Bell-jars.* For covering specimens and cultures these are indispensable. In many cases tumblers will answer every purpose, but there should be larger bell-jars, and some with ground bottoms.

Glass plates. A number of these should be provided large enough for the bell-jars or tumblers. By this means air-tight cells can be made by oiling the bottom of the bell-jars.

Soup plates are very useful for keeping many specimens in, especially the aquatics in such common use. The glass plates or bell-jars can be used for covering them.

Watch glasses. The ordinary watch glasses are in common use for holding small specimens, and especially for containing the reagents used in treating sections. The ease with which they are overturned is spoken of, and a remedy suggested in securing those with flat bottoms. A still simpler and safer way is to use individual salt-cellars.

Test tubes and *tumblers* are also supplied in all the laboratories.

MOUNTING.—All ordinary mounts are made in water, or in the reagent used. Mounts to be preserved for several days are made in glycerine. Thus far all accounts agree, but when it comes to the question of permanent mounting, there is a great variation in custom.

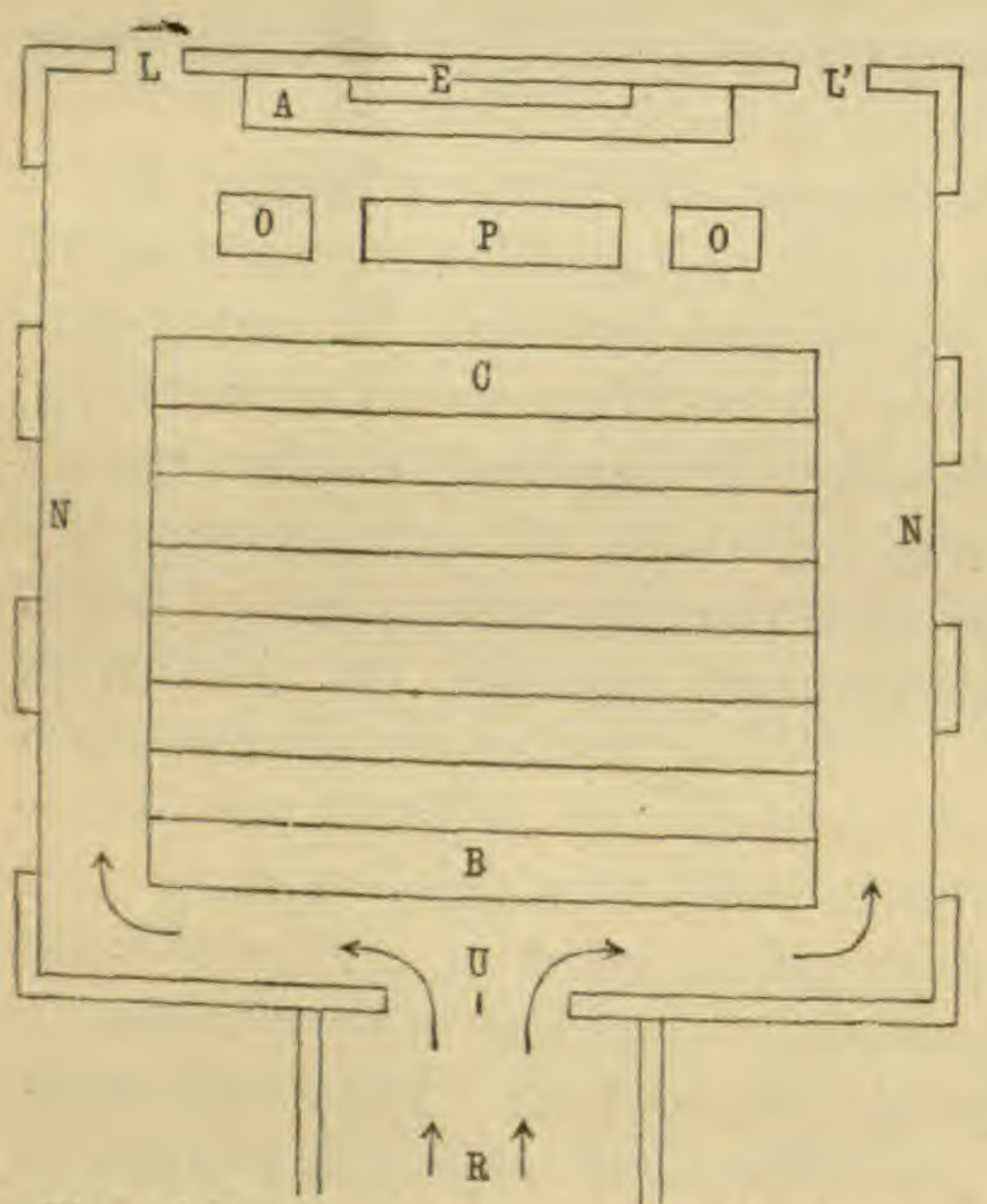
In some cases permanent mounting would seem to be the object of the course, in others it is not employed at all, or even taught. A wise mean seems to be that which teaches how to make permanent mounts, and thus preserves everything worth preserving, but never mounts for mounting's sake. It is questionable whether in the time devoted to the study in most of our laboratories much attention should be paid to this purely mechanical phase of the work. In reference to permanent mounts Dr. Rothrock makes the following suggestion: "When an object is mounted and designed for preservation, an occasional difficulty is experienced as to some suitable substance which is fairly strong and which will not run under the cover when used as a ring to hold the cover in place. For this probably nothing is better than a rather thick solution of gum shellac in alcohol. This will meet the requirement in most cases, providing the object is so thin as to leave no appreciable space between the glass slip and its cover. When the shellac hardens, as it will quickly, a final ring may then be run over it. This is especially valuable when the object is mounted in any of the balsam preparations."

The facts above given embody most of the information received from our best laboratories, and while professional workers may receive from them but few hints, the many who are desiring to equip laboratories in a way both cheap and efficient, will be helped to what they need, by those who have had much experience in such matters.

The Laboratory at Strassburg.

[We are permitted to make the following extracts from a private letter of Dr. Howard Ayres, regarding DeBary's laboratory.—EDS.]

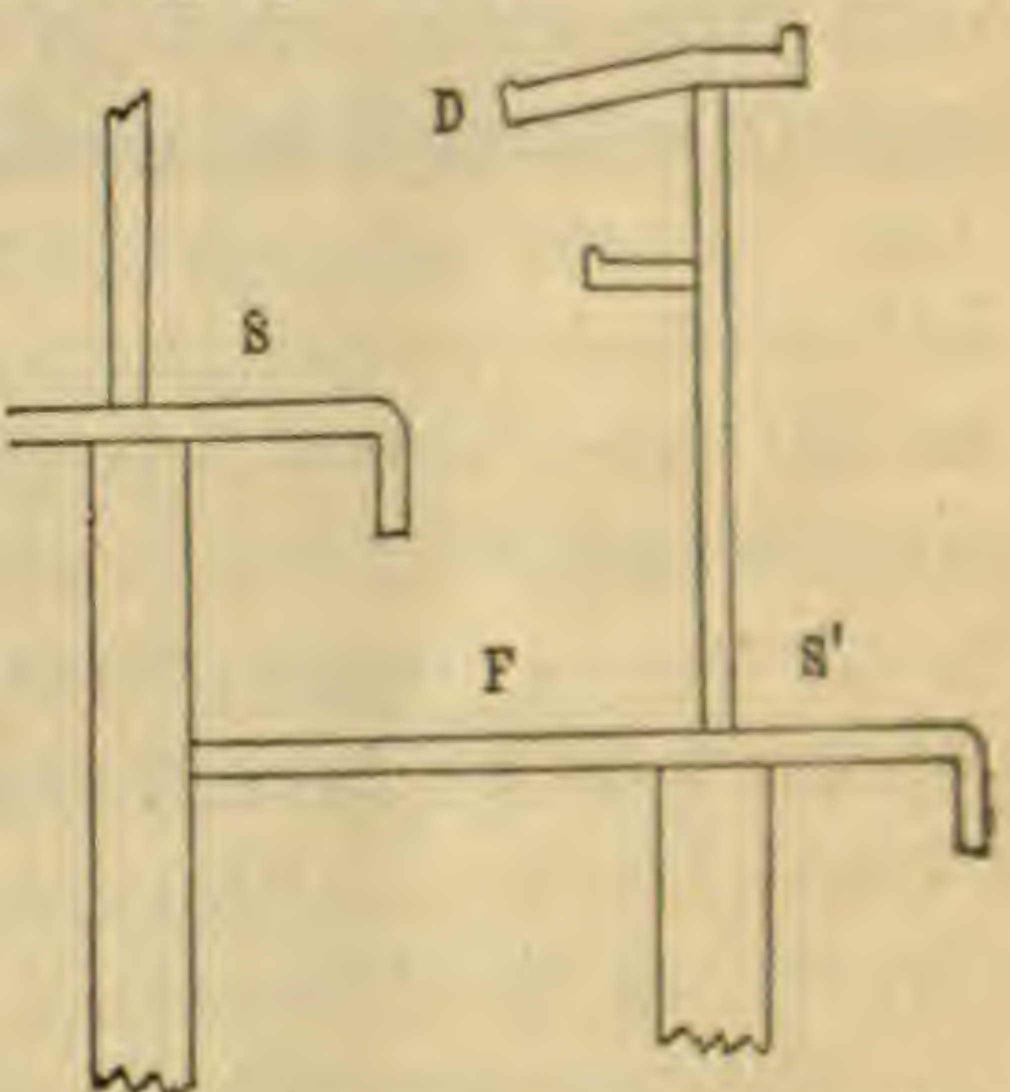
* * * Last July I was in Strassburg to hear DeBary and Oscar Schmidt. The former I heard in his "Allgemeine Botanik Montag bis Freitag, 9–10 v. M., Botanisches Institut." * * * Perhaps a description of DeBary's manner, methods of his laboratory (so far as I saw it) and other details connected with the teaching of botany in Strassburg, may not be uninteresting to you. The new Botanical Institute is a four-story white stone building, situated on the new grounds set apart for the university building, botanical gardens, astronomical observatory, physiological institute, etc., outside the older portion of the city, but within the new fortifications, which are immense earthen embankments. There is a basement for various uses, a ground floor for various others, among which you notice lecture rooms, a second story for general and private laboratories, special library, professors' and assistants' offices or rooms, as you wish to call them.



Plan of Lecture Room: R, main entrance: U, double doors; B-C, seats for 500; N N, large side windows; O,O, desks with drawers; P, Professor's desk; A, table; E, calcium light apparatus; L, L, entrance to Professor's dwelling.

It is 9 A. M. Wednesday morning, as I find myself passing through the large hall towards the double-door, above which is to be seen a porcelain slab bearing the inscription "Hörsaal." On entering there is a passage to right and left behind the last row of seats which are arranged in tiers. On the opposite side of the room is the lecturer's desk, tables, blackboards, calcium light apparatus, etc., and, on each side of his desk, doors which lead into his private rooms—his dwelling—for the professor lives in his "Institute," after the new mode. A diagram of the room may serve a purpose. The seats are plain, straight-backed pine benches, each extending entirely across the room.

To start again: You enter the room, hang up your hat on one of the conveniently placed hooks, take a seat, arrange your "Pandekten" if you take notes, and punctually at 9.15 door L opens and in comes Herr Prof. Dr. DeBary. He bows, "hems" and begins his lecture on Marsiliaceæ. The wall on each side of the blackboard is hung with excellent colored plates, which a normal eye can make use of across the great room! On the table D are seen various glasses of water, pots of plants etc. The professor picks up a green mass and proceeds to divide it into small portions, speaking rapidly the while; each portion finds a separate plate as a resting place; this done, the lecturer opens one of the numerous drawers in O, and takes out lecture (herbarium) specimens, mounted on card and some protected behind a sheet of glass to which the card is pasted. An assistant hands plates and cards to the first and second row of students, and from here on the specimens serve a significant purpose not hard to divine.



Section of Seats: S, S, seats; F, floor; D, desk.

Most of the students bring into class some text-book such as Sachs or Prantl, read and consult figures as the professor talks and sketches or explains his wall cards. Finishing Marsilia, Isoëtes is next taken up, and before the three-quarters of an hour is up he has begun on the Mosses. As a rule the lecture is begun by a short (five minutes) recapitulation of the previous lecture, a most excellent practice for the student. The lecture over, another bow, and the professor disappears through door L. The students are out into the hall without loss of time, some going to another lecture, others up to the general laboratory on the floor above.

On entering the laboratory you find Dr. DeBary there, surrounded by three or four assistants, giving directions for this and that. The professor has a working room—that is, his private laboratory—on this floor. The laboratory rooms are all well lighted, supplied with apparatus of the kind needed by students, and are conveniently near a store-room, containing cases of drawers and shelves with glassware, herbarium and fresh material, reagents and laboratory supplies. In short they are ideal work and study rooms of the present day of botanical science. They were made for that purpose and no other, and since expense was no item in their preparation, and since they were made after the plans of those who knew what they wanted, the rooms could not but be perfectly fitted up. I think, without doubt, that Strassburg has the best botanical institute in Europe. At present Heidelburg is very well provided, but can not compare with Strassburg.

During the first semester, that is, the winter semester, DeBary usually lectures to his classes in the smaller lecture room, in the second story, near the main entrance to the building. The smaller lecture room is used by the associate professors for their lecture work. In the summer semester, when the classes are too large to get into the small room, the large lecture room is used. DeBary gives courses of lectures on some topic of general interest (e. g. Bacteria) very frequently, and in such cases the lectures are public and largely attended by medical men and those of scientific proclivities. These are, of course, given in the large hall, which never fails to be crowded, hearers finding seats on the steps in the aisles. In all his lectures DeBary uses charts to illustrate, as well as blackboard.

A very common course for students to pursue in their botanical work is to take lectures of DeBary and repetitorium of the Privat Docenten, thus impressing the more important points more clearly on their minds.

The courses offered in Botany for the winter semester of '83–'84 were: *DeBary*, (1) Anatomy and physiology of the vegetative organs of plants; (2) Thallophytes (Algæ and Fungi); (3) Botanical colloquium; (4) Laboratory courses, to be arranged upon consultation. Prof. extraordinarius *E. Zacharias*, (1) Physiology of reproduction; (2) Geographical distribution of plants. Privat Docent *Wortmann*, Physiology of assimilation in plants.

In winter semester of '84–'85, *DeBary*, (1) Anatomy and physiology of plants; (2) Bacteria; (3) Botanical colloquium; (4) Work in laboratory. *Zacharias*, (1) Thallophytes; (2) Useful and commercial plants. *Wortmann*, Repetitorium of the whole of Botany for pharmacy and medical students.

Prof. DeBary is the Dean of the Faculty of Mathematics and Natural Sciences of Strassburg University and Curator of the Botanical Institute and Gardens. His department is, perhaps, the strongest in sciences in the University.

Laboratory Courses of Instruction.

BY JOHN M. COULTER.

In speaking of courses of instruction in botany and the methods used, no reference is made to the old "book methods" of teaching the subject, but simply to what are known as laboratory methods. With this restriction three distinct methods are observable in our laboratories. The first will be understood when it is called "systematic botany"; the second is at the other extreme and ignores systematic botany, being a study of structures and the phenomena of life; the third tries to combine the best elements of both. In some laboratories "cryptogams" are unknown, while in others phanerogams are hardly thought to be worth studying. The second method is a natural reaction from the first, while the third represents the counterswing of the pendulum, the most modern phase, and as we expect, the botany of the future. The fact of it is, botany has grown to be so large a subject, that one teacher with the most liberal allotment of time can not compass it all, even in an elementary way, and he rightly presents that phase of it in which he himself is most interested, as, of course, that seems to him the most important. The only laboratories in this country that can pretend to compass the subject are those at Cambridge, where several instructors are provided. Probably the most satisfactory presentation of the subject will be to select representative courses of instruction from several that have been sent, as expressing the ideas of as many experienced teachers of botany. These courses are taken from those laboratories where but one teacher is provided, and where the time varies from one term to three or four years. In most cases the study is a compulsory one for a short time, but all advanced and really good work is done by students who "elect" the study and pursue it for some time.

In reference to those who have but a term or two to devote to the study, three methods are pursued. One is to use a textbook or lectures and then direct all laboratory work towards the so-called "analysis" of plants, which means, of course, the comparison and naming of phanerogams. This may be called the oldest method and is vastly better than nothing. Another plan is to have the laboratory work all directed towards the examination of facts called for in lectures, such as leaves, branches, roots, etc. This method is practiced in two ways, either as corroborating statements already given in lectures, or preliminary to such statements. The latter is much the better way, and has been well elaborated by Prof. Beal in his paper on "The New Botany." A third method is to have the class examine a few types of structure from the lowest to the highest, and thus get some general notion of the structure of the vegetable kingdom, as well as the broad outlines of its groups. The last would commend itself as a very philosophical way of treating the subject, if the object is to study botany, and not one department of it.

For work extending through a greater time, such as is obtained in well equipped botanical laboratories, the following courses, already in use in different institutions, are presented. No names are used, as the courses are only selected as types, of which there are many modifications, but they represent very well our present methods of instruction.

1. Beginners use the facilities of a well-equipped laboratory to enable them to master the subject of assigned "lessons" in some text-book like Bessey's Botany. Each man is told to feel free to take up any part of the topic, although advice is given as to what may be preferable. But in every case *the student* decides what he wants to do while he is in the laboratory. Material is provided for all parts of the general topic of study. The student is counseled to familiarize himself with as many types as possible, but he is encouraged to go deeper into a matter here and there, as interest or opportunity may lead him.

Advanced students are advised to take up particular subjects, and to work them out with thoroughness. Here the rule is to select one topic only, or at most a small group of topics, and to get the desired training by great accuracy and attention to all details. The results in such cases are brought together finally in a paper illustrated by the drawings made during investigation.

2. Beginners are started by having them examine a flower, a seed, a plantlet, a naked branch, anything, in fact, that is convenient or in season. Reports of the discoveries made are given before the class and discussed, the teacher directing all these results toward definite and correct conclusions. No order of text is followed, but simply the order of convenience. The literature of the subjects examined is constantly consulted, though generally after the examination has been made. Soon some topic is assigned, which the student must "work up" by observation and present in a final paper.

For advanced students the work is of a similar nature, but closer observation is demanded and a stricter attention to details, and the study of comparison of structures is strongly urged.

3. Beginners are put to work substantially upon the plan introduced by Huxley and Martin in their "Elements of Biology." Of course different plants are used from year to year. One teacher mentions that a great favorite for beginning the study of vascular plants is *Equisetum hyemale*. Throughout the course the student makes all of his own preparations except a few that require special delicacy of manipulation. Accurate drawings and carefully written descriptions are required and are handed in from time to time for criticism and suggestions. In this way the work is done until the student has acquired a critical knowledge of types selected from all the leading groups of the vegetable kingdom.

Advanced students are then called upon to select some group or groups for special study, usually some group of flowerless plants, as needing more aid from the teacher. In the course from which these facts are taken fungi are usually studied, the student making a thorough study of a few representative species, then identifying fifty or more (generally the parasitic fungi), and finally becoming as fully acquainted as possible with the modern literature of the subject. The whole object, and it is an admirable one, is to see that each student learns how to conduct an investigation and use a library. Then follows, if time permits, special investigations and published work.

4. Quite an elaborate course is as follows: The work for the first year consists of systematic work three hours a week and recitation in Gray's Botanical Text-Book, Vol. I. Next is taken up Goodale's Physiological Botany, with histological and physiological work. Along with this a course of lectures on general classification is given, and Bessey's Botany furnishes collateral reading. This occupies the second year. Then, if the student proposes to enter the medical profession, he is directed to a study, analytical and microscopical, of our native medicinal plants. If, on the other hand, he has an aptitude in that direction, and is simply pursuing botany from a biological standpoint, he goes into a study of life histories of the lower plants.

5. Beginners receive a course of lectures on general botany, accompanied by laboratory work on structures illustrative of the lectures and anticipating them. In this way the broad facts of phænogamic structures and life are brought out. This is followed by work in systematic botany, chiefly with the view of teaching methods of "analysis," the reasons for groupings of so many different grades, and the recognition of great groups at sight.

A second year is then spent in the exhaustive study of plant types, one or a few being selected from each group, and all through the course careful drawings and descriptions are demanded, and frequent lectures attempt to weave together all the facts so as to present the development of the vegetable kingdom and its adaption to habits and surroundings. A library in the laboratories contains all standard books of reference, and a knowledge of the literature of the subjects studied is never lost sight of. At the close of this course papers are prepared upon various subjects that must be presented in a comparative or developmental way, such as "sexual reproduction," "asexual reproduction," "alternation of generations," "development of vegetative structures," etc. During a third year special students select any subject they may feel an interest in or have an opportunity to investigate, the teacher simply seeing that it is not too ambitious or useless.

In the above courses much detail has been necessarily omitted. Other courses differ from them chiefly in the order of presenting subjects. Where and how to begin the study are things not well settled, but in the long run about the same things are taught.

It will be noticed that in the above courses physiology plays but little part, a fact chiefly explained by lack of appliances and lack of time. We venture to predict that if at the end of the next decade the GAZETTE undertakes to give an account of our botanical laboratories, that not only will physiology be found to be well cared for, but other departments not even mentioned in this paper will be prominent.

We can not too strongly emphasize the importance of having the botanical library in the laboratory, that the student may at least become acquainted with the names of writers and their books, and best of all with the literature of the subjects they are investigating.

Several teachers desire to learn subjects which have been of use in the work of special students. For this purpose the following have been presented and their number could be indefinitely increased.

"Structure and development of Onoclea Struthiopteris"; "Influence of climate on vegetation"; "Water in plants"; "Development of stomata of monocotyledons"; "Distribution of the vascular bundles of ferns"; "Biology of the vegetable cell"; "Pathological changes induced by parasitic fungi"; "Development of the pollen-tube in monocotyledons, with the nature and descent of the nuclei"; "The Perisporiaceæ of the region"; "Conjugation of Spirogyra"; "The fibro-vascular system (as a skeleton) of some dicotyledon"; "Water and salts in the various tissues of some plants"; "Plant crystals"; "Development of any embryo"; "The anatomical study of any plant (not at any one phase, but its anatomical development)"; etc. In addition to these attention should be called to the subjects suggested by Prof. Beal in his "New Botany" already referred to.

If any different ideas in the way of laboratory courses of study, or subjects for special work, can be called out by this article, the GAZETTE will be glad to give them room.

Section Cutting.

BY T. J. BURRILL.

Botanists as a whole seem to be far behind the zoologists in the matter of microscopical technic, especially in the preparation of material. Witness the literature upon injecting, staining, hardening, imbedding, infiltrating, fixing, cutting, handling, clearing—nearly all of it directly for or copied from the animal histologist.

No doubt this comes about naturally enough. In the first place animal tissues require a greater diversity of treatment, and to reach the highest results he who works especially upon them must have resources at command little dreamed of by those whose attention has been exclusively occupied with vegetable preparations. Then those who have earnestly worked upon the minute structure of plants are outnumbered many times by the skillful and intensely devoted animal histologist. The very fact that man's body is animal rather than plant, stimulates investigation on the former instead of the latter side.

But however it may be accounted for, botanists and vegetable physiologists, with only exceptions here and there, are much disposed to remain content with the early methods and processes which zoologists (perhaps zootomists is the word) now consider primitive and superseded. For myself I can not help feeling that I shall gain much by following, where I can not make better headway for my special purposes by special methods, the lead of my brothers, the animal histologists. Fixing my thought now upon simple work for the student botanical laboratory, I restrict myself to my theme. Nothing new is offered. What follows is simply some account of results from personal experience as student and instructor.

The first requisite for good section cutting is an *edge*. In a very large number of instances sections for microscopical study can not be made too thin. Nothing but the keenest and smoothest edge will make the thinnest shavings. Among common and usually available articles a good razor furnishes the best edge. The form of the blade is also best, that is, some razors more nearly meet the requirements, so far as form of blade is concerned, than any other common knife. The requisites in a razor for this purpose may be put down as follows: (1) The material must be the best steel, suitably tempered; (2) the edge should be straight from toe to heel and free from "wind" and wabbles; (3) the blade should be of good width, the back firm and heavy and so shaped that in the process of honing the edge will remain straight; (4) both surfaces should be moderately hollow ground, the upper one by preference the most, but neither so much as to make the edge portion sensibly flexible; (5) the upper surface at least should be perfectly polished and free from engraving of any kind. Such razors, or nearly such, can be found in the usual markets and at reasonable cost; the highest priced ones are not commonly the best for our use.

For sharpening the best razor hone should be used. This latter must be perfectly level and free from gritty granules, and the blade must be held scrupulously flat. The best edge is secured by turning the razor at every stroke, after the usual manner, provided each stroke is accurate enough to always rest edge and back upon the stone. After honing until a perfectly true and keen edge is secured, finish upon a leather strop. The latter must be frequently used, but the usual artificial hones should be avoided.

Generally the operator will have to keep his own razor in order, and he can not be too careful about it. It will not do to trust the skill of the common barber in sharpening. Better study his own needs and then acquire the ability to meet them. An examination of the edge (held toward the light) with a magnifier will be instructive. The sharpened razor should never be used for anything besides cutting the thin sections. All preliminary whittling is to be done with another knife.

Having a proper *edge*, the next thing to be here considered is the manner of holding the object to be cut. For some purposes this can be sufficiently well done in the fingers, either by itself or between such substances as pith, cork, etc.; but in the better work contemplated in this description some form of a microtome is essential. Some persons become very expert by the free hand method, and all will do well to practice it at times, but all ought also to know that anyone, however expert, can make vastly better sections, at least for some and usually for most purposes, by the use of a proper holding instrument. Undoubtedly the sliding microtome is the best form, and an object holder that grasps the material is better than one in which the latter is wedged or imbedded; but these are also much more expensive in construction than the ordinary "well" microtome with a screw for raising the object. For this reason my own laboratory is supplied with the latter form of instrument, each student having one clamped to his table. For special work resort is had to the better instruments.

There are, however, two important improvements upon the old well microtomes which can not be dispensed with without serious loss in efficiency. The first is a glass top, the second is a removable tube fitting the well. My instruments are made to order, and cost two and a half dollars each. They are, however, of iron; brass is better. Each is furnished with two or three brass tubes, in which the objects are placed, instead of putting the latter directly in the well itself. The tubes fit the well exactly, and are closed at bottom with a cork. This latter may be pushed up with the object and its holding material to the proper height before placing the tube in the well. The screw works on the tube, raising the whole together. In this way not only is imbedding much easier, but the certainty of the proper movement consequent upon turning the screw is far greater. There is always the same amount of friction to overcome and there is no elastic spring to interfere. The microtome must be fitted for clamping to the edge of the table.

The object to be cut is wedged more or less firmly in the well tube, according to the resistance offered to the knife. Delicate things may be put into pith, and by sloping the latter away so as to leave little of it to cut, the softest leaf or petal can be thus held sufficiently firm, without bruising. The latter is not nearly so likely to happen as when held in the fingers. Harder substances may be held by portions of velvet cork, this also being sloped properly away in a cone shaped top.

In numerous instances, however, some method of imbedding is greatly preferable to simple wedging in the tube holder. For this purpose there are many substances having special merits, and there is no one superior to others for all purposes. The nearest to this, however, for botanical uses is a soap mass, the only one to be herein described.

Take good, white hard soap ("Ivory" soap is excellent), cut in very thin slices, and having gently compressed them in a suitable dish, pour in enough 95 per cent. alcohol to somewhat more than cover the sliced soap. Heat to near the boiling point of the alcohol until the soap is dissolved. Add now a small quantity of glycerine. The amount of the latter can be readily ascertained by pouring out a few drops of the warm mixture and allowing it to cool. Without any glycerine the mass instantly congeals into a white friable substance quite unfit for our purpose, but as a proportion is gradually added the mass hardens less and less rapidly and becomes more and more transparent. For soft tissues the imbedding mass may be thus made as transparent as glass and exquisite for cutting. For harder substances less glycerine must be used.

With this imbedding material fresh vegetable tissues need no preceding preparation, provided there is not a large amount of water in them, while substances preserved in alcohol are admirably adapted for immediate use. If infiltration is desired it is only necessary to keep the object some time in the warm mass. It is clean, and the instruments remain clean. The transparency enables one to see clearly the position of the object and to manage well the cutting. Thin sections are not so liable to roll up as with most other masses. It is readily soluble in water, but not in cold alcohol. In cutting it is better to keep the razor and the object wetted with the latter and transfer the sections to the former. If a well tube to imbed in is not at hand, pour the melted mass into any convenient dish or paper tray, immerse the object, and when the mass cools, cut it out and shape as required.

In cutting let the razor rest flat on the glass top of the microtome and *and hold it firmly with both hands.* Make a long draw or push stroke, so that a considerable portion of the edge of the razor is used each cut. See to it that there is not the least vibration of the blade by which the edge may be nicked. If everything is in order, and the handling properly done, it is surprising how hard substances may be cut without this last occurrence. We ought not to be satisfied until we can readily cut sections one-thousandth of an inch thick without tearing or bruising.

GENERAL NOTES.

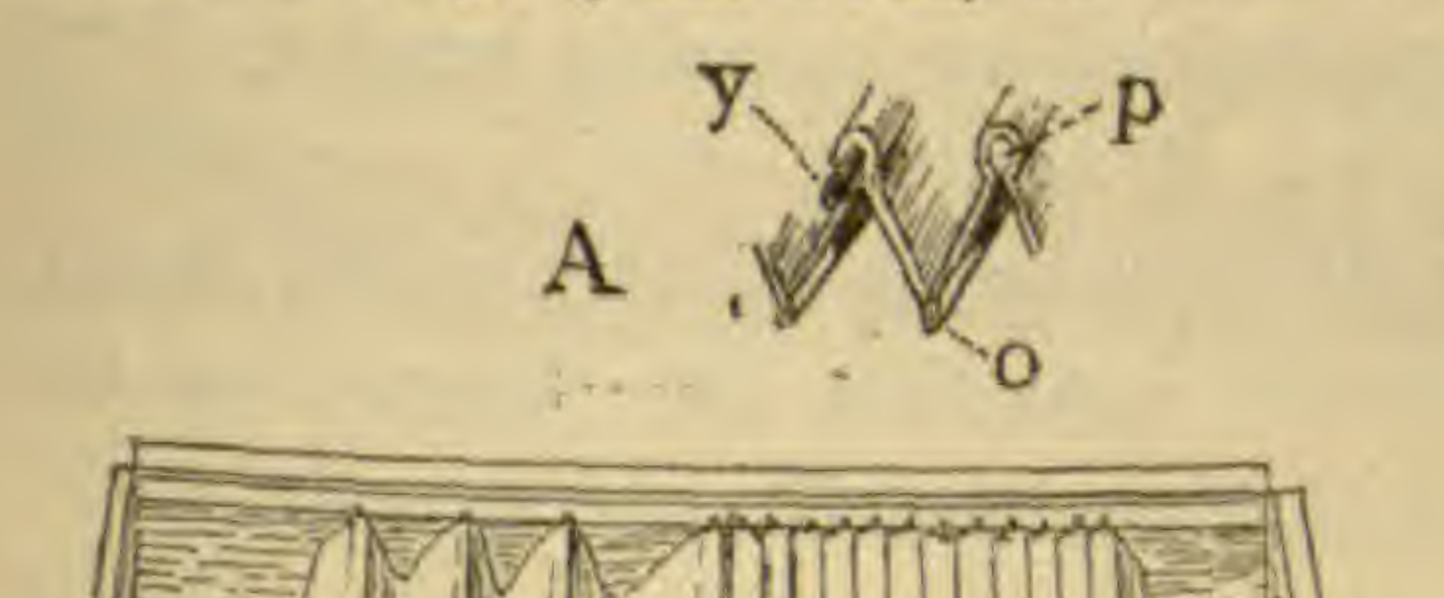
Starch Grains.—Starch grains in the cells of potato can be beautifully shown by first partially drying the part from which sections are to be made, thereby aiding materially the process of cutting. Remove from a fresh tuber a prism one-fourth to one-half an inch in diameter and an inch or more in length. Expose for a few minutes to moderate heat (hot air from a register is excellent) until the *surfaces* are quite free from moisture, then allow to remain in the ordinary air of the laboratory for twenty-four hours. The consistence will now be excellent for cutting, and clean cells without ragged remains of ruptured ones may be seen beautifully filled with starch like baskets of fruit. Mount in water. Stain if desired with iodine.—T. J. BURRILL.

A Spring-Clip.—The accompanying illustration shows a form of spring-clip for microscopical purposes which is at once the cheapest, most easily made and most efficient one with which I am acquainted. It is made of a rather large hairpin, the ends being bent into shape by means of ordinary pliers—preferably round pliers.

A spring-clip.

Quite a wide range of pressure may be readily obtained by bending with the fingers the upper arm to or from the lower.—F. L. SARGENT, *Botanic Garden, Cambridge, Mass.*

A Germinating Pan.—Various methods have been used for testing the per cent. and time of seed germination. Those most commonly adopted in this country and also abroad have been to place the seeds on the surface of porous tile, smooth sand or compacted earth. Without stopping to point out the defects and inconveniences of these methods, I desire to describe an apparatus devised at the N. Y. Agricultural Experiment Station, and which has been found so satisfactory as to supersede all other sorts of germinators at that institution, for general use. It consists of a pan 10 by 14 inches wide, and 3½ inches deep, to be covered with a pane of glass. Along the sides is a ledge ⅝ in. wide, and as much below the upper edge. The pan is best made of tinned copper, the ledge formed by the proper shaping of the sides of the pan, and the edges on three sides turned over to form a groove into which the pane of glass may be slid from one end. These details are not shown in the cut. The seeds are held in the folds of cloth. A strip of white Canton flannel is taken sufficiently wide so that when hemmed on both sides (to prevent seeds slipping out of the ends of the folds) it will be the same as the inside width of the pan. A long enough strip is used to have about twenty-four folds 1½ inches deep, and leave a flap of several inches at each end. The upper margin of the folds is sewn across to permit a ¼ inch brass rod to be run in from which the cloth is suspended in the pan, as shown in the cut. The lower margins of the folds are also sewn across to make them stay in place better. The total length of the strip after the sewing is completed is about a yard. Two such strips are used in each pan.



Germinating pan with glass top removed: *A*, details of folded cloth; *y*, projecting end of rod which runs through the upper seam (*p*) of the folds; *o*, lower seam of the folds.

To put the pan into use, it is filled part full of water, two of the prepared cloths put in, the glass cover adjusted and the whole boiled over a lamp for a short time. This is necessary in order both to thoroughly wet the cloth and to kill any mold or other germs. When again cool, adjust the cloths on the brass rods, and put in the seeds. Each fold will hold twenty-five large seeds, like beans, and a hundred or more small seeds. Water is placed in the pan, but not enough to touch the folds of cloth; the four flaps drop down into it, however, and keep the cloths sufficiently wet by capillarity, which is increased by the long nap on the under surface of the cloth. The folds are numbered consecutively and the record kept by the numbers.

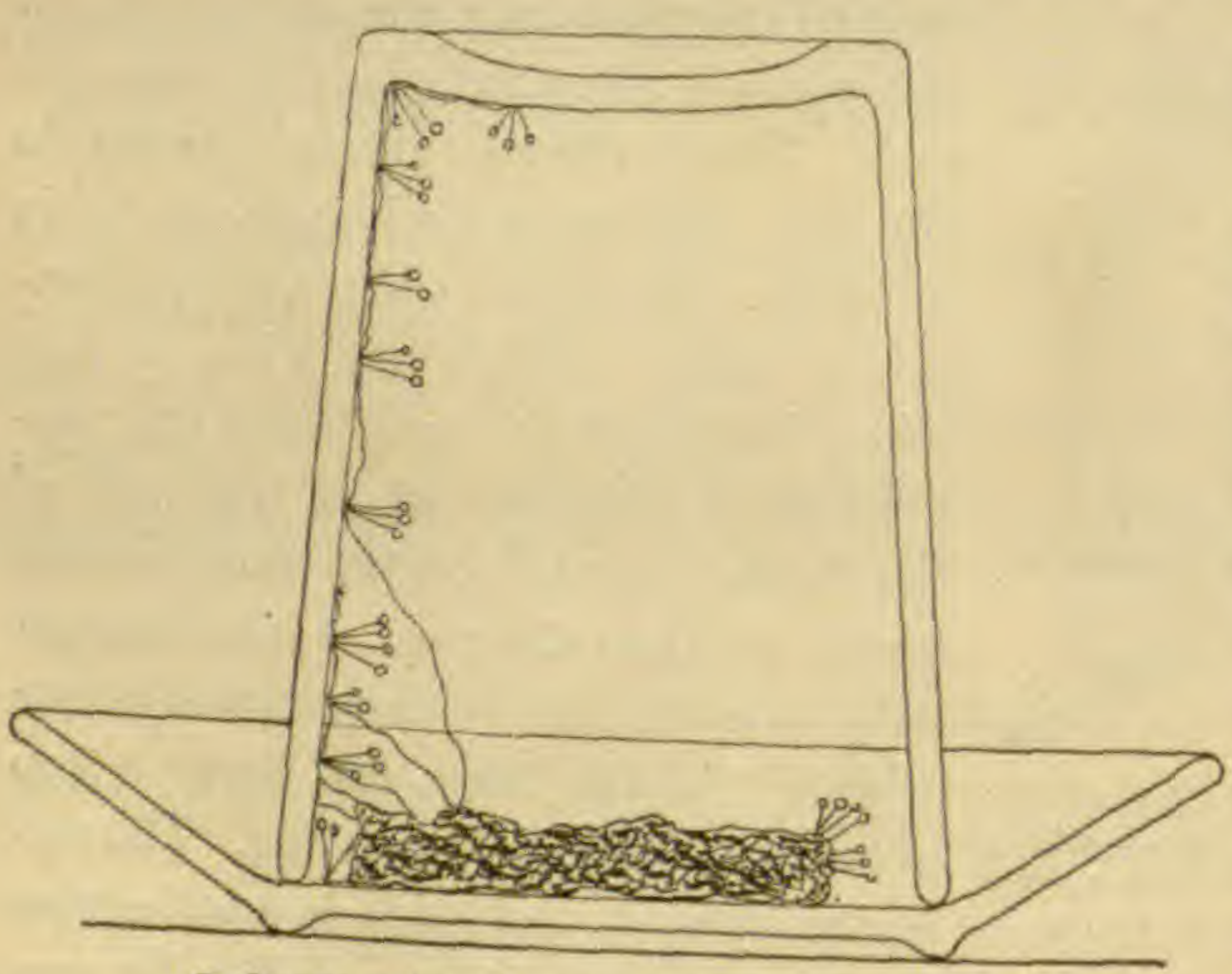
The advantages in a pan of this kind are the facility with which the seeds may be examined and counted, the thorough and uniform moisture of the seeds throughout the longest trials, its lightness and cleanliness. It is necessary to renew the cloths from time to time, as they will slowly rot out, even with the best of care.

This has been recently introduced, I am told, at the U. S. Department of Agriculture, and at one or two other places, under the name of the Geneva germinator.—J. C. A.

A Convenient Laboratory Plant.—One of the plants that has proved most instructive in our laboratory is a *Mucor*,* of the Rhizopus section, which springs up spontaneously and can be left growing almost indefinitely on bread.

On freshly cut wheat bread it makes a prompt and rank growth when covered by a tumbler, and illustrates heliotropism very strikingly if grown so as to be strongly shaded on one side and well lighted on the other.

The best cultures for study are usually obtained by inverting tumblers over pieces of rather stale bread, which often fails to show the mold for a number of days (sometimes a week or more). When this appears it usually grows slowly, so that the plants are not crowded. At first the colorless, stolon-like hyphæ spread slowly over the bread, after which they creep off onto the glass, usually reaching a length of a half inch or less, but occasionally becoming two or even three inches long. Where they touch the glass, they attach themselves by short rhizoids and send up tufts of (usually) 2 to 5 pale-brown fruiting hyphæ, each ending in a black sporangium. Where the piece of bread is small, they are scattered over the glass so as to be accessible for observation, without disturbance, several weeks, and at first manifest a slightly developed negative geotropism.


Culture of a Mucor under a tumbler.

Although the bread appears quite dry, it really contains a considerable

* M. Stolonifer!

quantity of moisture, which, nevertheless, evaporates very slowly. But the mold abstracts much of this and promptly sets it free by transpiration; and when a piece of bread nearly as large as the mouth of the glass is used, the transpired water is so copious that it soon collects on the sides of the glass, appearing first as a faint mistiness, then as drops. Even before the moisture is visible, the plants show a marked sensitiveness to its presence, the tufts of fertile threads standing out at right angles to the damp surface. When the inverted bottom of the tumbler is reached, the same repellent action is evident, the tufts being pendent, while the few which develop in the angle around the bottom bisect it. Now and then a cluster of sporangia comes from the exact edge of the piece of bread, when it makes equal angles with the side and top.

The figure, representing a few of the many cases observed in a single culture, illustrates this negative hydrotropism* better than a description. Both heliotropism and hydrotropism are so much stronger than geotropism in this common mold that they are very easily demonstrated to a class by it.

WM. TRELEASE.

Cultivation of Pollen-spores.—In the cultivation of pollen-spores those of monocotyledons are most responsive, and of all that have been tried those of Tradescantia are the most serviceable. The pollen tube begins to develop in a very few minutes, and within an hour becomes many times longer than the spores and has received the spore contents. An ordinary moist chamber is used, constructed of blotting-paper or card-board, as suggested by Bower and Vines in their Practical Botany, p. 16, and by Goodale in his Physiological Botany, p. 430. The points which experience with this special plant suggests are:

1. The culture drop, for a quick response, should be a saturated solution of cane sugar.

2. The spores should be first placed upon the cover glass, and then the culture drop added. If the spores are sown on the culture drop they will remain too far removed from the objective, and the tubes will mostly grow towards the objective and so be seen in optical section instead of in profile.

3. Spores should be obtained from flowers that have been open for some time.

Tradescantia is so common, the moist chambers are so simple, and the response so immediate, that it would seem a pity for any student to fail seeing the extine ruptured and the intine developing into a pollen tube.—J. M. C.

A Cheap Dissecting Microscope.—No laboratory or workers need be unsupplied with dissecting microscopes. If even the cheapest form manufactured by the opticians is beyond the means of the school or individual, an effective stand may be made as follows: Into any block of wood of suitable size fix upright a short piece of stiff wire or rod having a smooth surface. Bore a hole in a fine-grained cork, a little to one side of the center, so that the cork will slide smoothly on the rod. Bend one end of the smaller wire into suitable shape to hold whatever lens is at hand, and make a hole of proper size in the cork at right-angles to the first. This arrangement gives ample and smooth movements of the lens in any direction for adjustment. The plan may be elaborated to any desired extent. If the rod be fixed in a plain piece of board, dissecting may be done on a piece of glass laid flat on the board. Pieces of black or white paper underneath will give the backgrounds against which any object may be seen. For dissecting in liquid a deep individual butter plate answers well. If one desires some transmitted light the object may be dissected on the bottom of an inverted tumbler which has a *smooth* concavity. Sloping blocks may be placed at the sides for hand-rests. Still better illumination may be had by fixing two such blocks, one on each side of the upright rod, and placing between them a strip of mirror glass inclined at an angle of 30°–45°. In fact,

3

* Negative hydrotropism of M. mucedo.—Wortmann: Bot. Zeit. 1881, Detmer: Pflanzenphysiol. Practicum, 312.

with a little ingenuity and mechanical skill, one may construct a stand for dissecting which will equal in efficiency any of the simple microscopes offered for sale. Of course the lenses must be bought. They may cost any sum the purchaser chooses, from 25c. to $10. The most convenient powers are an *inch* and a *half-inch*, magnifying respectively 10 and 20 diameters. If one already has objectives for compound microscope nothing better can be got.—C. R. B.

A Method of Spore Germination.—In view of the difficulty experienced in growing the spores of those Pteridophytes whose prothallia are destitute of chlorophyll, the following experiments, though incomplete, may perhaps be of service for further investigations:

The spores were sown upon the surface of fine earth, in shallow earthen saucers, and covered with small frames constructed as follows: A shallow box, or rather frame, about four inches across, was made from four narrow strips of wood, the bottom being constructed of fine wire gauze, thus forming a sort of small sieve. This was filled with fine earth pressed firmly down so as to allow as little air as possible to get in between the bottom of the box and the surface upon which the spores were sown. The spores were thus practically under ground and yet could be readily examined by simply lifting the frame. By this process a number of spores of *Botrychium ternatum* were made to germinate, and small prothallia were obtained. In this case germination did not occur until nine months after sowing the spores.

The construction of the frames used was due to a suggestion of my brother, Edward D. Campbell, on my explaining that I wished to contrive some means of easily getting at spores that were to be sown under ground.—DOUGLAS H. CAMPBELL, *Detroit, Mich.*

Fungus Spores.—Fungus spores, as a rule, germinate best when sown *upon* a drop of water in which there is dissolved a small proportion of gum. If the aqueous drop is put on a slide, the spores dusted on the slightly viscid fluid and the whole kept in a moist chamber for twenty-four hours, at the ordinary temperature of the laboratory, an examination will often be rewarded by an instructive exhibition of germinal tubes. The same may be said of pollen grains, though the addition of a little nectar or sugar to the fluid, in this case, is useful.—T. J. BURRILL.

Potassic Hydrate Bottle.—In a laboratory where a considerable quantity of potassic hydrate is uesd, a bottle furnished with a siphon (kept always filled, closed by a pinch-cock near the lower end), and a U-tube will be found convenient. The U-tube should be sealed with potassic hydrate so that the air which enters the bottle, as its contents is used, may bubble through this liquid in the tube and thus be deprived of the carbonic dioxide which would otherwise cause a precipitate in the bottle. By such an arrangement one may always have clean potassic hydrate in any quantity without annoyance from the pellicle of potassic carbonate, sure to be formed in open bottles, the sticking of glass stoppers, or the dissolution of cork ones.—C. R. B.

Streaming of Protoplasm.—The streaming motion of protoplasm can be exhibited very satisfactorily in the thin membrane (upper epidermis of scale-leaf) found between the scales of the bulb of the common onion. All that is necessary to do is to transfer a piece of the fresh membrane, snipped off by a pair of scissors, to a drop of water on a slide, cover and examine with a power of four hundred or so times. The temperature of a comfortable room is about right. with less heat the movement is very slow. Success is more certain if the bulb has started to grow, as they often do in a cellar.

Care should be taken in removing the membrane, for the cell walls are very delicate and easily wrinkle, forming unsightly and annoying, irregular lines over what should be the clear open cell.

The material commends itself for its accessibility at any time, and especially in winter when other things may not be readily obtained, and for the extreme ease of preparation.—T. J. BURRILL.

Laboratory Articles in Back Numbers.—This journal has already published considerable, during its ten years of existence, in reference to laboratories. To make this scattered information more readily serviceable, we herewith give references to the more important articles and items:

Teaching and means of illustration.—Methods of teaching, VI, 233, 302; Making of charts, VI, 186.

Instruments and material.—Convenient dissecting microscope, III, 37; Compound microscopes for botanical work, VI, 193; Apparatus for m easuring growth, VI, 172; Stopper for bacteria culture vessels, X, 308; Material for laboratory use, IV, 196, V, 133, VI, 244, 294, VII, 10, 35, 125.

Manipulation.—Section cutting, V, 28, VI, 194; Mounting, V, 27, VI, 194; Staining, IV, 201, V, 65; Cleaning cover-glasses, V, 30.

Physiological demonstrations.—Direct observation of the movement of water in plants, VIII, 260; Study of ovules and germinating pollen grains, X, 353; Growing fern prothallia, X, 356; Cultivation of spores, VI, 204; Cultivation of bacteria, X, 391; Demonstration of continuity of protoplasm, VIII, 323, X, 322.

Herbarium work.—Applying pressure in making botanical specimens, I, 21; Pressing to preserve color, VI, 256; Cement for herbarium, IV, 215, IX, 62; Carbon bisulphide for preserving plants, II, 101.

EDITORIAL NOTES.

THE NEW botanical laboratory at the University of Strassburg cost $130,000.

HOGG'S standard work on the microscope has reached its eleventh edition.

EDMOND BOISSIER, a well known botanist, died September 25, at Valleyres, Switzerland, at 76 years of age.

DR. GRAY WRITES: *Coreopsis delphinifolia* has been lost from the Botanic Garden at Cambridge. Who can generously supply it anew, from roots or seeds?

BACTERIOLOGY receives the chief attention of the new Institute of Hygiene recently founded in connection with Berlin University, and presided over by Dr. Koch.

IT MAY BE interesting to know that the contributors to the Gray vase represent several provinces of British America and thirty-three States and Territories of the Union.

OUR JANUARY NUMBER will contain a portrait and biographical sketch of Dr. Asa Gray, together with a few of the congratulatory addresses and poems sent to him on his last birthday.

THE SHAW SCHOOL OF BOTANY was opened November 6, with a public lecture by Dr. Trelease, to be followed by a course of four lectures on fertilization of flowers. The laboratory work began promptly with fifteen students, who took up the study of grasses.

THE NEW LABORATORY for the investigation of plant diseases in the Agricultural Department at Washington, makes slow progress toward securing an outfit, owing to lack of funds. It is hoped that Congress will make early provision for this need at its present session.

WE HAVE MADE arrangements by which any who desire can obtain excellent cabinet photographs of both sides of the Gray vase, which, of course, far surpass any engraving that can be made. They can be had at 50 cents per pair, or single ones of either side at 25 cents, by addressing PACH'S STUDIO, CAMBRIDGE, MASS.

AN EXCERPT from the transactions of the Kansas Academy of Sciences gives a list of the parasitic fungi of Kansas by Professor Kellerman. It includes 181 numbers and closes with indices of genera and host plants. *Septoria Kellermaniana*, a new species by von Thuemen, on *Vitis cordifolia*, is described; the other new species await description in the Torrey Bulletin.

THE MOST immediate relative of the mahogany tree, *Swietenia humilis*, Zucc., has never been found since it was collected by Karwinski, more than fifty years ago. Considerable interest consequently attaches to fine specimens of flowers, leaves and mature fruit which have recently been sent to the Gray Herbarium by M. Dugés. This species, like its congener, is an inhabitant of tropical Central America.

THE LAST NUMBER of *Drugs and Medicines of N. A.* contains some excellent figures of medicinal plants and quite sustains the promise of preceding numbers. In the figure of *Aquilegia Canadensis*, however, the artist forgot the five styles which ought to be exserted from the stamen cluster. *Aconitum Columbianum* Nutt. should be written instead of *A. Fischeri*, as our American species is distinct from its Asiatic representative. Cf. Bot., Calif., ii. 428.

PROFESSOR TRELEASE'S paper on "Several zoogloeæ and related forms" contains descriptions of new species of chromogenous bacteria as follows: *Bacterium candidum, B. aurantiacum, B. luteum, B. chlorinum* and *B. incarnatum.* The other species studied were *Micrococcus candidus* Cohn, *Bacterium tumescens* Zopf, *B. violaceum* Bergonz., *B. hyalinum* Ktz., *Cladothrix dichotoma* Cohn, *Leptothrix buccalis* Robin, *Saccharomyces glutinus* (Fres.), and var. *candidus* of the same, named by Trelease.

THE MOVEMENTS of protoplasm in plant cells is much interfered with by the usual method of sectioning and mounting in water. Dr. de Vries has had marked success by using a 5 per cent. sugar solution for moistening the knife and mounting. After mounting, the solution is removed from under the cover-glass by means of blotting paper and a fresh drop supplied. The preparation is then allowed to stand an hour or two before examination to permit the protoplasm to recover its mobility.

INTERESTING EXPERIMENTS have been tried on the temperature of growing fruits by Dr. Ord, given in the *British Medical Journal*. He used a slender, pointed thermometer which could be easily thrust into the fruit. The trials were made on cucumbers in a hot-house, and the variations due to fluctuation were indicated by the temperature of a bottle of water suspended at the side of the fruit. A difference of one or two degrees was found between the temperature of green fruit and the air or water in the bottle, the latter two usually varying one way or the other by about a degree; a difference of a degree was also recorded between the two extremities of the fruit, which represent different stages of growth. This is suggestive of an interesting line of research.

THE OCCURRENCE of protoplasmic rotation in plant cells has recently been carefully investigated by Dr. H. de Vries. With the exception of *Vallisneria* and *Anacharis* it is usually noticed in cells which are not united into tissue, *e. g.*, filaments of fungi, algæ, *Chara* and *Nitella*, and in higher plants in hairs, pollen tubes and very young embryos. He sought to determine if it did not occur in other cells, and has arrived at the conclusion that (1) it occurs in cells of the most diverse tissues, and that (2) it may be observed in all strongly growing cells in any organ taken from large, vigorously assimilating plants. *Tradescantia rosea* and *Tropæolum majus* were the special examples investigated.

THE

BOTANICAL GAZETTE.

INDEX.

VOLUMES I TO X.

1875–1885.

CRAWFORDSVILLE, IND

PUBLISHED BY THE EDITORS

INDEX TO SUBJECTS.

* * * *Names of new species are printed in italics.*

A

B

C

D

G

H

I

J

Q

R

S

T

U

V

INDEX TO AUTHORS.

S

T

U

V

W

Y

INDEX TO ILLUSTRATIONS.