SCRAPS AND QUERIES.

Red Birch for Paper Pulp.—B. B., Lebanon, Pa., asks the following question, for which we should be obliged by information about from any one who knows: "I have a large quantity of what I take to be red or river birch. The trees are of all sizes, from quite small to very large. The wood is white and short in fibre. Can you inform me whether it is used in the manufacture of wood pulp for paper, and details?"

NATURAL HISTORY AND SCIENCE.

COMMUNICATIONS.

OBJECTS OF SEX, AND OF ODOR IN FLOWERS.

Read before the American Association for the Advancement of Science, Saratoga, August, 1879.

BY THOMAS MEEHAN,

Professor of Botany in the State Board of Agriculture of Pennsylvania, and Fellow of the Association.

Students of nature, who have thoughtfully observed, must have noted at least two great objects in the creation of sex. The first and leading one is evidently to insure variation; the second to aid and assist reproduction. But our text-books say little of the first; while every behavior of flowers is regarded as relating to the last, and hence we have so much said and written on the advantages of cross-fertilization, as if reproduction were the sole end and aim of sex.

That reproduction is not the sole end of sex is apparent from the fact that reproduction by cell division is more common in vegetation than reproduction by seed. Bulbs, tubers, rhizomes and other subterranean structures, with bulblets, runners and other arrangements above ground are familiar examples. Many plants with colored corollas rarely seed, while some never do. Of these I might name Ranunculus Ficaria, Lilium tigrinum, the Horse Radish, Cochlearia armoraica, &c.; and again are those which depend on insect or similar agency for pollenization, and though apparently as a result bearing seed abundantly, yet rarely producing plants in nature from these seeds. Of these last, I need only refer to Yucca and Orchideæ as the best known of the class dependent on insect fertilization. The terrestrial orchideæ of the United States mostly fruit in great abundance, and there are many thousands of seeds in each capsule; yet my researches have rarely been rewarded by plants that I could believe to be seedlings; while in nearly all cases the relation by offsets from a parent plant was plain. On the other hand, orchid locations are declining, and Yucca confines its species to comparatively limited locations, apparently raising a crop of seeds more for the sake of feeding the larvæ of the Yucca moth, than as an aid in plant distribution. So far as reproduction is concerned, it will not be denied that millions on millions of seeds are created in vain, that thousands of millions of flowers bloom uselessly, that volumes of odor and tons and tons of pollen are given to the winds and to the insects, without any possible benefit to the individual, which could be made to increase without any of these productions of no conceivable benefit to the race, except as might arise from some imaginary good from cross-fertilization. We see from these simple considerations that sex can have but a very remote relation to the good of the individual or the race; and we may reasonably look about for some more important service which sex is to render.

We find this in variety. This is essential to our present conditions of existence. Imagine the higher order of animals increasing by division! Each would be exactly like its parent. Mr. Smith could not tell himself from Mr. Brown. But the union of two distinct individuals, and each individual with varying powers of transmitting identity, leads to infinite variety, by which each can clearly distinguish that which is his from what is his neighbor's. Variety is a greater necessity to sentient beings than to inanimate things; hence we see that propagation through sex is imperative among them. But it can, in this respect, make no difference to a plant. It is of no consequence to one blade of grass that another blade should be or not be just like it. But it is of great consequence to

the animal life that is to feed on them. Each kind is made to prefer some kinds of fruit and vegetables, which must have distinct characters in order to be easily recognized; and hence we have at once a good reason for form, color, fragrance and the infinite variety these productions give rise to. If this view be correct, and I cannot conceive that it can be controverted, it puts a new view on modern teleology. In all the discussions on the various arrangements of plants and animals, we hear only of what good is to result to the individual or to the race. This is the essential character of the doctrine of natural selection. But on the principle that I have sketched out—the principle of variation—we see plants and animals not working merely for their own good, although that is incidentally involved, but for the good of generations yet unborn, and in which they can have no interest. Indeed, following the inexorable law of variation, plants may be said to be laboring to make themselves distinct from each other so that the various animals may be better able to recognize and consume them. They must necessarily be under the control and direction of an outside power, which clearly foresees that there will be mouths, and judgment required to select the food which is to go into them; all of which would be useless unless plants were forced into a variety, which is thus to enable them to be the more easily sacrificed when the proper time arrives. Of course the selfish views embodied in the modern doctrines of teleology must be incidentally true. No individual would work unless it supposed it was working for its own good. Pleasure must be a condition of existence. This also must be a universal law, and "natural selection" so far to be conceded. But this law must of necessity be limited. It is not for the good of a plant that it should be eaten by an animal; but it is perfectly consistent with the law of universal good that it should have just enough of thorns, or bitterness, or some other measures of defence to keep the race from being utterly annihilated.

May we not conclude from all this that variation and not reproduction is the one great law to which we are primarily to refer all sexual phenomena; that reproduction occupies only a place subservient to this law; and if so may we not proceed to review the theories which have been established under a mistaken idea of the order of things?

I propose to examine, but I shall confine myself here to only one subject; indeed to but a part of that subject, namely, the relation which odor in flowers bears to modern theories of cross-fertilization.

(To be continued.)

VEGETATION AND MAN.

BY REV. L. J. TEMPLIN.

The whole history of the vegetable kingdom from its inception to the appearance of man seems to have been one of preparation. It was a course of gradual development from the lowest and most simple forms of vegetable organisms, up through a regular ascending scale, to the most perfect and complex forms of the present time. At just what stage of geological history vegetable life was introduced, is not very definitely determined. It is now thought that this introduction must be placed back in the times of the Laurentian rocks that have until quite recently been considered nonfossiliferous. This opinion is based on the fact that these rocks are composed, in part, of extensive beds of limestone, which contain large quantities of carbon. This carbon, it is reasonable to suppose, was originally taken from the atmosphere, and "fixed" or consolidated by the action of plant life. It is at the beginning of the Lower Silurian rocks that we find the first undoubted appearance of vegetable remains These are all Thallogens, flowerless plants lacking proper stems and leaves. To this class belong all the algæ or sea weeds. Towards the close of the Silurian age appears a higher order of plants—the Acrogens—having both stems and leaves, but having no true flowers. These include ferns, club-mosses and other spore bearing plants. In the next, or Devonian age, there existed enormous ferns, lycopodiums, tree-rushes growing over twenty feet high, and lepidodendron. Here also we have to note the first appearance of a still higher class of plants, the Gymnogens, or cone-bearing trees. That there had existed, previous to their appearance, plants that bore some general resemblance to our pines is doubtless true, but that these conifers were derived from more ancient forms by "descent with modification," does not seem to rest on any basis of proof. The fact, too, that from this period we find the two great divisions of plants—Acrogens and Gymnogens—running a parallel course, when, in fact, the one should precede and the other follow, as ancestor and descendant, makes it a little awkward for evolution. It was, however, in the next, or Carboniferous age, that

was being poured on, and both plants came out comparatively uninjured.

And just here comes in appropriately a word about the "freezing of trees and plants in winter." I do not feel quite satisfied to accept the editor's theory that trees cannot freeze solid without being destroyed thereby. I would like to have him test this in a New England forest on a cold winter day by trying an axe on some of the trees, and also note the explosions often produced by the cracking of limbs in a sudden freeze—like that produced by ice in a sudden and severe freeze after a thaw. One of our citizens, who has been in the "Christmas tree" business for several years, says that the weather was so cold in Maine in the early part of December, 1880, that the balsam fir trees could not be handled without breaking in pieces, and he was obliged to give up the job. This sounds to me very much like freezing solid. Is it not just possible that trees are so protected by their bark from the direct action of the sun's rays that the frost comes out as it does from plants in leaf during a fog, as in cloudy weather?

EDELWEISS.

BY MISS M. EVELYN HUNTER.

This little Alpine plant is known to botanists as the Gnaphalium Leontopodium, but to the Swiss as Edelweiss, which signifies noble purity. Some of our own native species, as "life-everlasting," are of the same genus, a fact that I found hard to believe at first, as the one was so celebrated, and the other so little noticed by writers or florists. When, however, the Americans are carefully examined together, the resemblance is noticeable even to the uneducated eye, and while their claims to good looks are far inferior to those of the Alpine beauty, we find they have other claims when closely looked for. Most people consider the Life-everlasting, including Antennarias with Graphaliums, homely specimens of nature's handiwork, and in their wild, uncultivated state they are not attractive plants; but I think if their capabilities were developed by cultivation they might repay the florist in time by becoming uncommonly prettily marked plants,—that is if the flowers could be enlarged, and this I do not doubt. Antennaria plantaginifolia could never rival the Edelweiss, as the greater size of its velvet-like flowers, with delicate tracery of royal purple, give it an elegance of appearance that the Antennaria could never attain. This Edelweiss, that was for so many years found only on the inaccessible cliffs of the Tyrolese mountains, where the bold hunter of the chamois risked his life to gather its flower for his love, has now become civilized to such an extent, that the seeds are sold at 1s. per packet by Freeman & Freeman, Economic Seedsmen, Norwich, England.

[To the excellent hint of our correspondent we may add the encouragement that the low form of Life-everlasting—the Antennaria plantaginifolia, occasionally does become somewhat rosy, and would no doubt get into improved ways by care.—Ed. G. M.]

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Concluded from page 22.

Mr. Charles Darwin in Cross and Self-fertilization, chap. 10, page 381, says:—"We certainly owe the beauty and odor of our flowers, and the storage of a large supply of honey in them, to the existence of insects;" and Professor Asa Gray in his recently issued "Structural Botany," p. 217, follows by observing "anemophilous flowers are mostly destitute of odor, and not nectariferous;" and further, p. 218, "nor do we know that fragrance or other scent, or that nectar subserves any uses to the flowers than that of alluring insects." You see that the idea uppermost in the minds of these authors, is that some direct good to the plant must be inferred from its peculiar form, color, fragrance or secretions, and the absolute necessity of mere variation is wholly ignored. But we have color and odor even in minerals. We do not look to any special benefit to them from these possessions, but we can understand why they should possess them under the universal law of variety. Besides, odors and sweet secretions are not confined to flowers, but pervade all parts of the plant in various degrees.

The leading veins of the leaves of the Catalpa, as recently shown by Mr. John A. Ryder of the Philadelphia Academy of Natural Sciences, are furnished with glands which secrete nectar and furnish food for innumerable ants. We may

agree with Dr. Gray that this nectar is for alluring insects, but where does the good to the Catalpa come in? Odor and color abound in great variety among mushroom and fungi generally, and in Lichens and sea weeds; have these been developed to make them attractive to insects for any purposes that we can conceive of in connection with individual good? They have separate sexes; but notwithstanding their color and odor, cross-fertilization is not effected by any insect agency. If, as Mr. Darwin says, we should not have had beautiful or odoriferous flowers had insects not existed, how did these lower orders of plants come by color? We cannot understand it on any theory of natural selection, but we can understand it on the basis of the necessity for a universal variety in all things. Again bright color is not confined to flowers In tropical countries colored leaves abound, and of these the Begonias, Crotons and Dracænas of our greenhouses afford familiar examples; and, strangely enough most of these colored leaved plants belong to classes which are supposed to be anemophilous, or fertilized by the wind, and can therefore have no interest in making themselves attractive to insects.

But perhaps the most remarkable fact of all is that the statement of Dr. Gray, that anemophilous plants have flowers mostly destitute of odor is probably incorrect. Certainly there is odor in a large number of anemophilous plants. In monœcious and dicœcious classes, color or fragrance is usually present in the male flowers, and often both are there, but wanting in the female, unless in flowers with a conspicuous corolla, such as in cucurbitaceous plants. In these cases the degree of fragrance is equal. But odor to a greater or less degree exists in the Willows, Poplars, Maples, Rhus, Spinach, Indian Corn, Palms, Sweet Chestnut, and others; but always in the male and never in the female flowers. Instead of anemophilous flowers being mostly destitute of odor, I have not been able this year to find any male flowers of this class that have not odor, with the single exception of the common field Sorrel, Rumex Acetosella. The Sweet Chestnut, Castanea Americana is indeed remarkable for the prodigious amount of odor and other material which, under prevailing notions of individual good, must be regarded as absolute waste; but which comes to be looked on as the height of wisdom under the laws involved in variation. As the branch grows the axillary buds which in many plants remain dormant till spring, and then, perhaps, make a new branch, push at once and make a spike of male flowers. A bunch of these will fill a room with fragrance. There are about fifty clusters of these flowers in a spike, five flowers in a cluster, five spikes to a branch; and hence twenty-five hundred male flowers, and these all fall before the female flower with its attendant male spike is formed, and which appear at the termination of the growth instead of at the axils. There is no conceivable use for this immense crop of precocious male flowers with its attendant fragrance under any law of reproduction; but if we take into consideration the immense number of minute creatures on the earth, in the atmosphere, in water, everywhere,—and the evident design of nature that they should be fed, we may understand under the laws of variation how even a chestnut may be made to scatter this food in profusion through the atmosphere, even though not the slightest benefit to itself or to its race should follow the act. Even the views of Professor Huxley that the coal measures of England are the product of pollen which fell during 30,000 years in the carboniferous era, are explainable under the operation of this law of variation for the purpose of ultimate universal good; but under no theory of individual benefit from natural selection that I can see.

In pursuing our studies of the odors of flowers, we shall find many difficulties in believing that they were developed for the chief reason of attracting insects for the purpose of cross-fertilization. Not the least of these difficulties is the fact of many genera of showy-colored flowers existing, which may have one or two species highly odoriferous and the rest destitute of scent. The violets of Europe are of this class. Viola odorata is very sweet; the pansy less so. The rest are comparatively scentless. American Violets show the same characteristics. I am familiar with many species, but I only know of Viola primulæfolia, and Viola blanda, two nearly allied species, that would be called sweet. Has fragrance given these sweet species any advantage in the struggle for life? If so, it is, at least, not apparent. On the other hand, observation will show that the scentless flowers of this genera are just as freely visited as those which have odor. Of the many species of Reseda, I only know of one that is fragrant, the common Mignonette. In my garden, Reseda undata, wholly scentless, is as freely visited by bees as its sweet sister species. Again it is a fact that

among the sweet mignonettes, some are less fertile than others, and that the least productive have the most odor. Another remarkable case in which color and fragrance are in inverse proportion to productiveness is afforded by the genus Rubus—the Blackberry and Raspberry class. Rubus odoratus is beautiful and fragrant. How rarely it fruits is notorious. Rubus cuneatus is not high colored, but it is fragrant; not half the flowers produce anything usually, and many of those that do, give but a very few carpels. Rubus Canadensis has very showy white flowers but no odor, and its "berries" are generally more or less defective. Rubus villosus is less attractive than the last, and is more perfectly productive. But the most fertile of all the species is Rubus occidentalis. I do not know that I ever saw a flower that did not make a perfect fruit; and yet it has no odor, scarcely any petals, and these of such a green shade of white as to be actually inconspicuous. On the ground of variety in which fragrance is to play its part, and which must of necessity permeate all things, we can understand its uses; but we are lost when we attempt to explain such facts as these by any hypothesis that has for its foundation mere individual good.

May we not then logically say that sex in nature is not primarily for reproduction, but to insure variation; that questions which properly come under this law of variation have but a remote relationship to questions of natural selection, but are referable to some external power governing universal good, with which the individual governed has little but co-operation to do, and which as often tends to the destruction of individuals or races as to their preservation.

EDITORIAL NOTES

The Academy of Natural Sciences of Philadelphia.—As stated in our last, it seemed a duty to those at a distance, who were led to believe by the *American Naturalist* that there is something very bad about the manner in which the members of the Academy of Natural Sciences manage their own property, to let them know that those editorials were usually but the "campaign documents," often seen in political circles, and meant but little more. This last editorial preceded—what was in some sort suspected—a special ticket for officers, headed by Prof. Cope for President, and Mr. J. A. Ryder for one of the Curators—Mr. Ryder being the Jessup student, whose terrible indignities in being asked to keep an eye on the museum while the person in charge went to dinner, the *Naturalist* recently held up to a weeping world.

It is but justice to those who read Professor Cope's onslaughts on the Academy, in the *Naturalist* that we repeat what we have before said, that those who really know the true situation of affairs in the Institution have no sympathy whatever with Professor Cope's efforts.

In December of 1879, Professor Cope's "ticket" was defeated, by, in the average five to one; in the election last month, seven to one—Professor Cope indeed polling only eleven votes!

As already noted, it should not be a matter that concerns the world how a local society manages its own affairs. But the editorials of the *Naturalist* lead scientific people everywhere to think differently, and it seems, therefore, but justice to the institution, that we complete the *Naturalist's* half-told tale.

The chief officers elected for the ensuing year were: President, Dr. W. S. W. Ruschenberger; Vice Presidents, W. S. Vaux and Thomas Meehan; Recording Secretary, Dr. Ed. J. Nolan; Corresponding Secretary, Dr. George H. Horn; Treasurer, W. S. Henszey.

Marshall's Garden.—Botanists will be sorry to learn that the garden of the first American writer on botany will soon probably be a thing of the past. The "Arbustrum Americanum, the American Grove, compiled from actual knowledge and observation, and the assistance of botanical authors," by Humphrey Marshall, appeared in 1785; this was about twelve years after he had commenced his garden at Marshallton, Penna. Many of the trees in this garden have been so celebrated as to attract distant arboriculturists. For some years, some dissensions have thrown the property into "law," with the too often result of the property finally passing out of the family hands. It is understood that the new owner is not likely to pay any respect to the associations that have made the place famous.

The Tradescants.—John Tradescant, after whom the Tradescantia was named, was gardener to King Charles. He is said to have founded the first English museum, and one of the first English botanic gardens. His house is still standing in South Lambeth, London. Part