sanctuaries include areas modified to a greater degree than second-class ones.

(1) *Research reserves* of the National Park Service are essentially nature sanctuaries. They recognize two additional divisions of a park: (a) a greater part of the park open to the public and traversed by trails and roads, and (b) an area of development, hotels, etc. (2) *Natural areas* in the U. S. Forest Service sense are partial nature sanctuaries but primarily floral. (3) *Primitive areas* and *wilderness areas* in the U. S. Forest Service sense are primitive only in human transportation and conditions of living. Vegetation may be cut over and various animals wanting. (4) *Research area* and experimental area usually imply modification (except in the National Parks).

Except in desert and tundra, first-class nature sanctuaries are not available outside the national forest and national parks, and in rare instances in state and provincial parks. Buffer areas may serve as recreation areas, game reserves, etc. They are areas of partial protection not always available on all sides of natural areas. Reserve areas in the national parks and national forests are probably too small to serve as true nature sanctuaries. They have not been selected with reference to animals, and no buffer area of protection within which animals will not be disturbed is ordinarily set aside.

Nature sanctuaries are essential if any of the original nature in North America is to be saved for future generations for scientific observation of, among other things, the important phenomena of fluctuation in abundance of plants and animals, their social life, etc. Due to lack of knowledge of these fluctuations custodians view each change in abundance with alarm and desire to apply remedies immediately; hence, constant pressure must be exerted on government agencies to prevent the current popular idea of "control" and "improvement" from entering into the management of national parks, provincial and state parks and other reserves containing natural areas suitable as nature sanctuaries with buffer territories. The experiment of leaving areas essentially alone, which was so successful in a few of our parks, is worthy of repetition. In general much control activity is useless because it is applied to animals at their maximum abundance and barely hasten the natural decline.

The Ecological Society of America urges a subdivision of all but the small reserves into sanctuaries, buffer areas of partial protection and areas of development for human use where this is one of the aims of the reserves. A further aim of the society is to promote adequate scientific observation bearing on the fluctuations in abundance, to stimulate cooperation between the controlling agencies in charge of game and vegetation reservations in order that more logical units be developed and better methods of administration adopted.[1]

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THE WATER CONTENT OF MEDUSAE

MY accuracy has been questioned by Bateman,[1] who writes that "Gortner's statement that medusae contain 99.8 per cent. water is contradicted."

The statements which he criticizes are as follows:

> As I write these lines there lie before me two sheets of paper. One is the photograph of a large Medusa (jellyfish) from the Atlantic Gulf Stream which was photographed immediately after being removed from the water and being placed upon the open pages of a magazine. The Medusa, as removed from the water, weighed in excess of 500 grams. In the photograph one can read the distorted print through the more or less transparent outer portion of the umbrella, but the central portion of the Medusa which measured approximately 10×12 cm was sufficiently dense and opaque to prevent the print underneath from showing in the photograph.
>
> The other sheet of paper is the opened pages of the magazine upon which the Medusa had been allowed to dry after being photographed. These pages simply appear as though they had been wetted and then dried. No noticeable film is discernible on the surface of the pages. The print is clear-cut, and even exposing these pages to ultra-violet light results in extremely slight fluorescence. The weight of these pages exceeds by less than 0.45 gram the weight of the pages before the Medusa was dried upon them. Less than 0.10 per cent. of dried residue from the large Medusa including the salts, etc., in the adherent sea water and all of the inorganic constituents of the living organism![2]

In the discussion to this paper (p. 702) I pointed out that I was dependent upon the statement of the collector as to the weight of the living medusa, but that I had myself confirmed the dry weight, also that on other occasions I had personally made somewhat similar observations. In another connection I have stated that "in some instances, as in the case of the jellyfish, only an insignificant fraction of the organism is composed of organic material, as little as 1 per cent. of the jellyfish being organic matter."[3]

Bateman's flat contradiction of my statement rests, in so far as I can ascertain, on his acceptance of the data of Krukenberg[4] (who reports 4.60 per cent.

[1] Full details of nature sanctuary plans will appear in the society's official organ, *Ecology*, early in 1933.

[1] J. B. Bateman, "The Osmotic Properties of Medusae," *Jour. Exper. Biol.*, 9: 124–127. 1932.

[2] R. A. Gortner, *Trans. Faraday Society*, 26: 678–704. 1930.

[3] R. A. Gortner, "Outlines of Biochemistry," N. Y. (1929). *Cf.* pp. 227–8.

[4] C. F. W. Krukenberg, *Zool. Anzeiger*, 3: 306. 1880.

solids in *Rhizostoma cuvieri,* 4.20 to 5.80 per cent. in *Aurelia aurita* and 3.70 to 4.25 per cent. in *Chrysaora hyoscella*) and the observations of Moebius[5] (who reports 2.06 to 2.10 per cent. in *Aurelia aurita*), and the non-acceptance of my data. It is somewhat surprising that Bateman does not report independent data of his own, since he used a large *Cyanea* in his own studies.

Unfortunately, I can not designate the species for which I have personal data, since no zoologist was available at the time the organism was secured. A photograph of the organism as secured, and as later dried down on a sheet of paper 23 × 30 cm has, however, been published.[6] This medusa was not *Gonionemus* sp., as Bateman erroneously assumes. In no place have I made any statement as to the water content of *Gonionemus.* Perhaps I am in error in wording my statements so that they might be interpreted as applying to all medusae, but I have said "a medusa,"[2] "one species of jellyfish (*medusa*),"[6] "the organism may contain," etc., and have recognized that the physiological condition of the organism, *e.g.,* presence of egg masses, etc., may make for a higher solid content. However, I still believe, from my own observations, that some salt-water medusae have a water content exceeding 99 per cent. and hope that investigators having access to such material will reinvestigate this question, for it is those organisms with the low solid content which present the interesting physiological problems.

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THE PHYSIOLOGICAL BASIS OF THE TWISTING HABIT IN PLANT GROWTH

IN connection with the interesting paper of Dr. William Seifriz in a recent number of SCIENCE[1] on the spiral habit of growth, correlated with the twisting of the stem or trunk of many plants, considered as a result of physiological rather than environmental conditions, it was thought that it might be of interest to add a bit of evidence which has been obtained in this laboratory.

In the course of an experimental program on the genetic effect of x-rays, an investigation has been undertaken of the physiological abnormalities of seedlings of the citrus fruits grown from irradiated seed. It is hoped at a later time to publish the results in full, but two seedlings are of interest at the moment. From the time of sprouting, these young plants showed a decided tendency to spiral in a counter-clockwise direction. Both plants twisted so markedly that the trunk was bent from the vertical and the leaves, during early life, were crushed against the stem. After six months the habit was abandoned, and the later growth was normal. Both plants showed some evidence of tissue inversion and other characteristic x-ray injuries during early life.

The seeds used in the work were obtained from a citrus experiment station, and represented a normally quite stable seed bed stock. Before treatment, they were soaked in distilled water for fifteen minutes and left in a moisture-saturated atmosphere for twelve hours. They were then dried on filter paper and were given doses of 2,400 roentgens of radiation from a thick-walled tungsten-target Coolidge tube operated at 200 k.v.p. and 30 ma. current. The seeds were then planted in flats in a mixture of sand and peat moss and maintained in a greenhouse, protected from wind and from sharp temperature change. Since the source of light was the sun, since undue mechanical shock was avoided for the seedlings, and since but two of the entire group showed any tendency to twist, it seems logical to assume tentatively that in this case a typical spiral growth, resulting in extreme twisting of the stem in a developing tree, was the result of a physiological rather than an environmental condition —possibly x-ray induced abnormal mitoses.

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AN UNUSUAL CRETACEOUS CIRRIPED

THE decision of the International Commission on Nomenclature (Opinion 118) that *Scalpellum gabbi* Wade[1] is a *nomen nudum,* on account of the extremely cautious wording of Wade's account of it, seems to make some further action necessary to place this rather unusual barnacle on a satisfactory basis. Wade figured the carina and an upper lateral plate. These are not known to belong to one individual, and it is even possible that they do not belong to the same species; but it happens that the carina was selected by Charles Darwin as the essential plate in diagnoses of fossil species of Scalpellum, most of which are known by detached plates. Wade's figures of the carina are ample for the recognition of the species, which is quite peculiar among Cretaceous forms for the subcentral position of the umbo. Only four other Cretaceous species, all European, have this advanced form of carina. It may be doubted whether Scalpellum developed this type of carina so early, and it may turn out that these Cretaceous species belong to

[5] K. Moebius, *Ibid.,* 5: 586. 1882.
[6] R. A. Gortner, *Gamma Alpha Record,* 22: 42. 1932.
[1] SCIENCE, January 13, 1933.

[1] U. S. Geol. Surv. Professional Paper 137, p. 191, plate 62, figs. 3, 4, 6, 7.