its prophylactic value, and possibly its wide application for promotion of the health, vigor and increase of economic value of birds, particularly under certain unfavorable climatic conditions or during winter months.

However, these results are far from final. At present it is even impossible to predict with appreciable accuracy the prophylactic, therapeutic or economic application of this method in poultry production. More thorough work under well-controlled conditions is needed towards the evaluation of the exact influence of other factors involved in this method of ionization of air, such as production of ozone, nitrous compounds and possibly thermal effect, presence of ultra-violet, x-rays, etc., and then the standardization of ionic concentration, doses and duration of exposure of birds of various ages and physical state of health.

In general, the initiative of Professor Tchijevsky and his co-workers is of significant biological interest. It may serve as an inspiration to those who wish to attack the problem and to get some definite and perhaps useful results. There are many possibilities, however, not only in animal production but in various fields of animal and plant economic biology. Moreover, it suggests a wide field of research in relation to medicine, preventive and curative.

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EXPERIMENTAL ADAPTATION OF FRESH-WATER CILIATES TO SEA WATER

YOCOM[1] maintains that he has not been able to find any record of an attempt to adapt fresh-water ciliates to sea water. He obviously overlooked Finley's paper. Finley[2] asserts that he tested fifty species of fresh-water protozoa and that he succeeded in adapting twenty of them, including *Paramecium aurelia* and *Paramecium caudatum*, to pure sea water, with no significant change in the morphology and only a "relatively slower pulsation of the contractile vacuoles."

I have repeated Finley's experiment several times, using *Paramecium caudatum* and *Paramecium multimicronucleatum*, but I was unable to confirm his contention. The animals always died when the concentration of sea water approached 40 per cent. There were also marked changes in the morphology of the animals, and there was a marked decrease in the frequency of the pulsations of the contractile vacuoles. I hope to publish a more detailed account of these experiments in the near future.

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DISTRIBUTION OF SEPARATES OF CERTAIN PAPERS BY THE LATE DR. BASHFORD DEAN

THERE have been placed in my hands, by Mrs. Bashford Dean, for distribution among students of fishes, certain reprints of Dr. Dean's studies on the archaic fishes, found among his effects after his untimely death.

If research men who are interested in the morphology, anatomy and embryology of the cyclostomes, sharks and ganoids will go through Dr. Dean's bibliography either in Vol. 1 of the "Bibliography of Fishes" or in Art. 1 of the Bashford Dean Memorial Volume, and will indicate to me what articles they desire, I will forward these so far as they are available.

It may be some time before the actual sending out can be done, but I should like to have all requests in before the distribution is begun.

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SCIENTIFIC BOOKS

PRIMITIVE LAND PLANTS

Primitive Land Plants, also known as the Archegoniatae. By F. O. BOWER. Macmillan, London, xi + 658 pp. 465 ill. Price, $8.00.

PROFESSOR BOWER may be said to have devoted a long life of research chiefly to those plants collectively known as the Archegoniates, that is, to the mosses, liverworts, ferns and so-called fern-allies—the club-mosses and horsetails. Any intelligent person working in this field would naturally be much concerned with the beginnings of land floras, and Bower published "The Origin of a Land Flora" in 1908. Since then he has summarized his work on "The Ferns" in three important volumes (1923–1928) and formulated his ideas on "Size and Form in Plants" in a stimulating work (1930).

Meanwhile there has been a notable accumulation of additional facts regarding both living and fossil Archegoniates—especially the recognition of the Devonian group Psilophytales. These discoveries have served to draw together the Bryophyta, Pteridophyta, Lepidophyta and Arthrophyta, and, it seems to me, put an end for all time to notions that the earliest land plants were polyphletic transmigrants of Algae.

Bower now returns to the origin of land plants in

[1] Harry B. Yocom, *Biol. Bull.*, 67: 273–276, 1934.
[2] Harold Eugene Finley, *Ecology*, 11: 337–347, 1930.

what is essentially a new book and in my opinion a much better book—better not only because of the greater amount of factual knowledge available for the discussion, but better for the ripened point of view and the emphasis placed on size and form and function—that is organographic rather than purely morphological.

The main plan of the present work may be stated briefly. The first 23 chapters are devoted to a factual account of what is known of the several classes of Archegoniates. The next six treat features common to all, such as alternation, embryology, conducting system, etc., followed by a chapter devoted to comparative organographic analysis, and a final chapter summarizing the results, which are hence mainly inductive. The work is in no sense an attempt to unravel phylogenetic relations but is an effort to visualize stages by the method of comparative morphology.

The stated foundation of the work is the alternation of generations, and the invariable alibi for inconvenient facts is homoplasy. Obviously, space does not permit detailed comment on this notable work and many aspects and conclusions must be passed over. Bower considers the alternation of generations as tied up with the occupation of the land. He considers this opinion to have safely survived the shock of the discovery of apogamy and apospory, but is bound to admit that the cytological basis for alternation which seemed to result from Strasburger's discovery of the doubling of chromosomes in syngamy and halving their number in meiosis or reduction breaks down among the Algae. In this great group, although some behave like normal land plants, others show no relation between the nuclear cycle and the somatic cycle, and even among the Archegoniates gametophytes may be diploid and sporophytes haploid. Only by considering instances of the last kind as ruled out by their infrequency and the standardized reverse as the significant can the theory proceed logically.

In contrast with the rigid morphology of, say Sachs's 1875 text, where the plant body is divided into caulome, phyllome, rhizome and trichome, Bower adopts Zimmerman's recent concept of the "telome" as the unit of the shoot and therefore primary.

Earliest land plants had indeterminate dichotomizing branch systems not differentiated into axis and leaf. This differentiation into axis and cladode leaves followed in the same manner as the development of lateral pinnae on a rachis in a dichotomizing fern leaf. Bower states that the investigation of the Rhynie plants in 1917 validated this idea. It may seem ungracious to point out that Dawson as early as 1859 had furnished sufficient evidence for this idea in his account of Psilophyton. The reason it was passed over was, of course, that a plant morphologist sees nothing that can not be viewed through a microscope.

The other morphological unit is the "enations," that is, new formations on a surface previously untenanted, hence from their beginnings appendages and borne laterally on a pre-existing part. They are thus secondary and not primary. Microphyllous leaves are enations, as are the dermal appendages of ferns. If this be accepted it follows that neither the modern Psilotaceae nor the ancient Psilophytales are reduced.

Megaphyllous leaves, on the other hand, as shown by Tansley in 1908, are cladodes formed by webbing of a primitive branch system. They therefore have a common origin with the axis, and the old morphological rigamarole about stem and leaf can be consigned to the limbo of forgotten things, where indeed it belongs.

Apparently influenced by Fritsch's idea that it would be unnatural to have green land plants originate from brown or red algae, and that since the filamentous green Isokontae never reach a massive plant-body because the more elaborated members of that group became land plants, Bower looks with favor on this group as a possible source for a land flora, the vascular members of which survived by interpolating between syngamy and meiosis a sporophyte or diplophase, the retardation of meiosis being due to sterilization. This thesis demands the admission that the initial steps of such a process are not observable in any living plants; that apogamy and apospory must be thrown out and the normal considered the real clue; that homology is rare and homoplasy frequent; that the incidence of photosynthesis is variable; that distal fertility is primitive, and that size is the most constant factor in moulding the form of the biont whether diploid or haploid.

Following Campbell and Von Goebel, the Anthocerotales are considered as exemplifying an early synthetic and primitive type. It is conceived that "the inward urge towards increase in size" (whatever that may mean) may take effect in both the diploid and haploid phase, or independently in either. Thus is the difference between the Bryophytes and the balance of the Archegoniates explained—the limited dimensions of the gametophytes in the latter being attributed to "the want of driving-power in the haploid phase" (whatever that may mean).

The Devonian genera Rhynia and Hornea show the following improvements over the Bryophyta: (1) physiological independence; (2) forking; (3) dichopody; (4) definite conducting tracts. The genus Thursophyton adds enations and continued apical growth. Such a plant as Asteroxylon is regarded as originating by the bifurcation of a simple telome like

those of the Bryophytes in which dichopodial development and delay of fructification clearly foreshadow either cladode leaves with distal sporangia (ferns) or a truss of fertile twigs liable to condensation into a strobilus (lepidophytes and arthrophytes). The bracteate cones of the latter are therefore composite in nature.

One wonders if anything but the proverbial provincialism of the British warrants the inclusion in a work of international scope of a chapter on the "Evolutionary Relations of British Ferns." Finally, although Professor Bower makes a consistent case for his ideas in this most stimulating book, I can only repeat the doubts which I expressed in 1927 that the middle Devonian structural material on which the present argument leans so heavily may be merely ancient and simple, rather than that it represents a primitive missing link, although I am bound to admit that it has been made to serve such a purpose in a very admirable way.

E. W. BERRY

SUBSIDENCE

Subsidence within the Atmosphere. By JEROME NAMIAS. Harvard Meteorological Studies, No. 2; 25 cm × 19 cm, 61 pages. Harvard University Press, 1934. Price, $0.85.

THIS work is a notable contribution to the very limited amount of literature on the subject of subsidence. The paper is divided into two major portions. The first is a discussion of subsidence from the general standpoint, and diagrams are presented which are constructed from the aerological material which is discussed synoptically in the second part of the paper. The second section gives the salient features in connection with three meteorological situations. In the detailed analysis of the aerological material for these periods special emphasis is placed upon the subsidence inversions observed. The maps presented contain only the fronts, air masses, isobars, precipitation areas and positions of aerological stations. The aerological diagrams provide a continuity in the sequence of the weather over the 24-hour intervals represented by the maps. Cold fronts are shown as heavy black lines, warm fronts by double light lines and occluded fronts by broken heavy lines. The air mass notation is that introduced in this country by the meteorological course of the Massachusetts Institute of Technology.

As a mass of cold air (Pc) moves southeastward from the polar regions over North America it spreads out laterally at the surface, and this spreading is probably balanced by a general sinking of the air mass. Subsidence is a stabilizing process which takes place primarily at the upper levels in the atmosphere, and obviously must be non-existent at the surface of the earth. Day-to-day aerological soundings made within one and the same polar air mass often show that not only stabilizing forces are at work, but also sharp inversions develop. These inversions are generally associated with a sharp drop in relative humidity through the inversion, and not infrequently there is a marked drop in the specific humidity. The author claims that the subsidence inversion can generally be distinguished from the frontal (*i.e.*, change of air mass by advection) inversion by means of the moisture discontinuity, since the inversions accompanying fronts almost always have an appreciable increase in the specific humidity upward through the inversion. While this criterion of specific humidity for the differentiation between frontal and subsidence inversions generally holds it should be pointed out that there are cases when a warm front surface may superficially appear as a surface of subsidence, but, the author claims, the opposite case, that of mistaking a subsidence inversion for a frontal inversion, is more common. This error can generally be blamed on the hair hygrometer, since it is well known that the hair behaves erratically under certain conditions and has a particularly large lag coefficient at low temperatures and at low relative humidities.

The temperature and moisture discontinuities through these inversions often are so pronounced that it is necessary to assume that there are other contributing factors in addition to subsidence which are tending to sharpen the inversion. Indeed, even the problem of the original development of these temperature inversions is not yet clear.

The compensating subsidence due to the outflow of air in anticyclones which takes place across the surface isobars because of the frictional effect in the lower layers can not account for the rapid development of subsidence inversions observed in many of our rapidly moving anticyclones of the winter season. Georgii in 1920 showed that the surfaces of subsidence are not horizontal but present a slope. It is generally smaller than that of either the warm or the cold front. It now seems clear that these surfaces of subsidence are extensive domes which may at times reach beyond the 5 kilometer level and at times practically intersect the surface of the earth along their periphery. An example of a subsidence dome in its embryonic stage and later in its development has been given by the author in a previous paper. The difficulty in determining the topography of the subsidence domes should be simplified with the recent increase in the number of aerological (airplane) stations throughout the United States.

Potential temperature is considered a conservative meteorological element because it remains constant during an adiabatic process with unsaturated air.