wild is high. I covet for these men the psychic income of intelligent, public appreciation to make up for that which they will never get in terms of money.

In the course of my trip I traveled over hundreds of miles of trails made by the CCC boys. I saw millions of young nursery trees tended by CCC boys. I talked from a region inaccessible except on horseback or on foot over a phone line put up by the CCC boys. I saw beautiful camp sites which they had fixed up with necessary facilities. Here and there I met them responding to fire drill in a regular camp or in a spike camp. As a result I gained the impression that the public for two generations to come will be reaping the reward from work done by CCC in 1933, 1934 and 1935 in the national forests of the United States.

HENRY A. WALLACE,
Secretary of Agriculture

SCIENTIFIC BOOKS

FAMILIES OF FLOWERING PLANTS

The Families of Flowering Plants. II. Monocotyledons. By J. HUTCHINSON. xiii + 243 pp. 107 figs. Macmillan and Company. London. $6.00.

THE first volume of this work, that dealing with the Dicotyledons, came out in 1926 and was reviewed in SCIENCE by the present reviewer. Sir Arthur Hill, in a rather over-enthusiastic foreword to the present volume, says that the lapse of time between the first and second volumes has been an advantage, "since it has allowed botanists time to study and digest the earlier volume and to realize that not only do they appreciate the value of his researches, but that they are also generally in agreement with his conclusions."

One wonders where and how Sir Arthur learned this. I would concede that no matter where they lead, such general surveys as the author has attempted are about the most valuable contributions that a botanist can make towards our understanding of the plant kingdom, but that Hutchinson's conclusions with regard to the Dicotyledons have been generally accepted is incomprehensible, even though they had been brought down from Mount Sinai. Botanists, and especially taxonomists, usually do not find it so easy to see the forest on account of the trees.

The present volume on the Monocotyledons seems both more easy and more difficult to evaluate than did Volume I. I find myself more inclined to agree with the author's conclusions, but I can not be sure that this is because of their soundness or due to my own relative ignorance. At any rate, comparisons with the schemes of Bentham and Hooker, Engler and Prantl, Hallier, Lotsy or others are overwhelmingly in favor of Hutchinson.

The general plan of the present volume consists of an introduction, all too brief, followed by an outline of the sequence of families with brief notes on general tendencies. All this takes but 25 pages. The bulk of the work, pp. 26–229, is given over to a systematic description of the orders and families, under which are given keys to all the genera except those of the Gramineae and Orchidaceae. Thus we have in one small book all the genera to date, which in itself is exceedingly useful, particularly since botanical exploration has been so active in recent years. The book concludes with a short glossary and a complete index.

The author's conclusions may be stated as follows, largely in his own words: The Monocotys are regarded as monophyletic and as showing a close resemblance to the Dicotys at but one point, that between the Butomales-Alismatales and the Ranales. Hence the last order is considered as the stock which gave rise to the Monocotyledonous evolution, with the two orders mentioned as the most primitive. Such resemblances between members of the two classes as that of the Arales to the Piperales, the Menispermaceae to the Dioscoreaceae, etc., are regarded as homoplastic and not genetic.

The hypothetically most ancient known Monocot had an apocarpous gynoecium, a biseriate perianth of sepals (often green) and petals (often white), and the rootstock was a rhizome. This group, termed the Calyciferae or calyx-bearers, is made to include 12 orders, and reaches its zenith in the Zingiberales. A line of reduction among the Calyciferae leads to the almost wholly aquatic groups, Juncaginales and Aponogetonales, climaxing in the Najales.

Somewhere among the Calyciferae (Commelinales or Butomales) there was evolved a more terrestrial race—the Liliales—and these are considered the source of the remaining 16 orders. Their chief features are the development of the corm or bulb, and an attractive uniseriate perianth. This group is termed the Corolliferae or corolla-bearers because of the resemblance of the combined whorls of the perianth to the corolla of the Dicotys. The Corolliferae are considered to comprise six lines of descent which originated among the Liliales. These are: (1) Haemodorales-Burmanniales-Orchidales; (2) Agavales-Palmales-Pandanales-Cyclanthales; (3) Arales; (4) Typhales; (5) Dioscoreales-Alstroemeriales-Amaryllidales-Iridales; (6) Juncales-Graminales-Cyperales.

As among the Dicotys, or, for that matter, among

all organisms, plant or animal, the direction of evolution, *i.e.*, whether from simple to complex or from complex to simple, haunts us. Hutchinson is a believer in the hypothetical views of the origin of the higher plants which was put forward by Arber and Parkin some years ago, which hypothesis would derive the flowering plants from the complex Mesozoic cycadophytes, hence simplification of floral parts (reduction) always characterizes derivative groups and complexity of floral organization characterizes primitive groups.

As a general principle this may well be doubted, and it certainly loses much of its cogency when other than floral structures are considered. But taxonomists started with flowers and the millennium will doubtless be in the offing before they can make intelligent use of the rest of the plant. I would not wish to imply that reduction is not often the mode of evolution, *e.g.*, Hutchinson is obviously right in considering Najas reduced and not primitive, as it has frequently been considered.

Hutchinson has found it necessary to reshuffle the Liliaceae and Amaryllidaceae, and this I can not commend too highly. The old criterion between the two families—superior ovary in the former and inferior ovary in the latter, is boldly discarded. His criterion is largely the type of the inflorescence. Thus the Amaryllidaceae get the tribes Agapantheae, Allieae and Gilliesieae; the tribes Trilliaceae, Smilacaceae, Ruscaceae, Xanthorrhoeaceae, Alstroemeriaceae, Velloziaceae, Hypoxidaceae and Agavaceae are given family rank, as indeed many of them have in previous taxonomic schemes. There is also considerable shifting of genera back and forth.

The actual geological history of the Monocotys is for the most part unknown. Certainly too little is known to afford any check on the conclusions of the present work. Pondweeds, palms, grasses and sedges are already present in the Mid-Cretaceous, so that if evolution has proceeded, as outlined by Hutchinson, we are obliged to visualize an unsuspected antiquity for the lilies and buttercups.

I could wish that the climatic regions were more sharply drawn, *e.g.*, Tillandsia is hardly confined to the tropics and subtropics, and some of the most striking genera of the Bromeliaceae occur in the temperate altitudinal zone in the Andes. More of the excellent distributional maps would have added to the text, and there are minor points that might be criticized; thus I can not conceive southwest Australia as the original home of anything primitive, *cf.* Anarthria of the Restionaceae.

The book represents a tremendous amount of intelligent work and I find it extremely stimulating and very useful. I do not see how any botanist, except the most narrow, can but derive a great deal of pleasure and profit from it. I hope that it will be provocative of much more discussion than I believe it will, human beings being what they are. The author is to be congratulated in having formulated a much more consistent and better scheme for the Monocotyledons than that of any of his predecessors, in spite of what the ultimate fate of his views may be.

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METEOROLOGY

Physical and Dynamical Meteorology. By DAVID BRUNT. xxii + 411 pages, with 112 figures. Cambridge, England: At the University Press. New York: The Macmillan Company, 1934. $7.00.

SOME twenty-two centuries ago meteorology already was accounted an important science; so important indeed that the discriminating Aristotle wrote a sizable and excellent book on it. Then for two millennia the rains came and the winds blew with never an explanation of how or why—curiosity was inhibited by faith and inquiry estopped by authority. Slowly came a drowsy awakening, with a few observations and the foreshadowing now and then of some meteorological fact; and in the midst of this awakening a galvanic shock to alertness by the invention of the telegraph, by means of which a vessel, a fleet or a community could be warned of a coming storm many hours before its arrival. Finally, at the beginning of this century, all the world became air- and weather-conscious, since when the science of meteorology has been going faster and faster on the wings of the flying machine.

Not long ago meteorology was a descriptive subject that required no preparation to study and but a few weeks' time to master, whereas to-day it ranges nearly the whole field of classical physics with all the mathematics that implies. The now formidable state of this science is convincingly illustrated by the book under review, though it ranges but half the field implied by its title, omitting atmospheric electricity and meteorological acoustics. Applied meteorology of every kind and climatology also are omitted, and indeed are no proper parts of the subjects under discussion.

After a brief account of descriptive meteorology, as a background of facts, the author develops neatly, and with many equations, the thermodynamics of both dry and humid air, including, of course, the necessarily tedious discussion of the temperature and pressure changes in a rising mass of air through its dry (precondensation) stage, rain stage and snow stage. Entropy is illuminatingly discussed and wet-bulb temperatures shown to be full of valuable information when treated with proper mathematical respect.

The next topic is of the utmost importance, exceed-