height of the migratory flight of the smaller birds. Of course, if the dimensions were greater than those assumed, the altitudes must be correspondingly increased, but the largest bird, whose distance was determined by the focal adjustment already described, had an altitude above sea-level of

$$(1321 \times \sin 20°) + 235 = 687 \text{ feet},$$

and was certainly much lower than the smaller birds.

The speeds can be roughly estimated from the times of transversing the lunar diameter (29′.5). This time was on the average about one-half second, giving

$$\text{velocity} = \frac{29.5}{0.3} \times \tfrac{1}{2} \text{ ft. per } \tfrac{1}{2} \text{ sec.}$$
$$= 98.4 \text{ feet per second,}$$
$$= 67 \text{ miles per hour.}$$

But the swiftest flights, with every allowance for the difficulty of their estimation, were at least twice as rapid, which, if the distance were the same, would imply a velocity of at least 134 miles per hour. Some of the swifter trajectories may have belonged to very small birds at lower altitudes and smaller distances, but I have already assumed a size which is nearly that of our smallest birds. Any increase in the estimate of size enlarges that of distance and velocity. I am not ready to admit the probability of an error of judgment in the estimation of apparent sizes of as much as 100 per cent, and I have already increased the more vulnerable time-estimate for the swiftest flight from 0.15 to 0.25 seconds. Judging from the appearance of many of these darting specks, and with every allowance for errors of estimation, I am of the opinion that some of these apparent velocities are real, and that certain small birds (not the swifter swallows, humming birds and swifts, for these have all gone a month before the dates in question) can maintain a flight of 100 miles per hour without being stripped of their feathers.

In SCIENCE for January 1, 1897 (Vol. 5 N. S., p. 26), Mr. H. H. Clayton gives the height of a flock of ducks, flying southwest in December, as 958 feet above the Neponset valley, and the velocity as 47.8 miles per hour; and in SCIENCE for April 9, 1897 (Vol. 5 N. S., p. 585), the same observer gives the height for a flock of geese, migrating northeastward in March, as 905 feet above the Neponset valley, or 960 feet above sea-level, and the velocity of flight as 44.3 miles per hour. It thus appears probable that the larger birds migrate at a lower altitude than the smaller ones, and at not over half the speed of the swiftest flights.

Even more remarkable than the speed of migration are the psychological problems involved in these semi-annual movements of enormous multitudes of creatures. There was, to me, something awe-inspiring in this spectacle of a throng of tiny beings launching out into the unknown deep, in pale moonlight and through the hours commonly given to sleep, flitting swiftly and unerringly to a far-off goal, while beneath, and heeding them not, slumbered a dreaming world. What mighty impulse of daring is this which can transform a timorous sparrow, content all day to hop from bough to bough near to its nest and mate, into a bold adventurer, starting out, Columbus-like, on a voyage of discovery? If it were a matter of individual courage and wisdom, we men might shrink from the comparison—the ardor, the inerrancy, are so superhuman. Rather must we liken the migratory impulse to an irresistible force, drawing the winged wayfarers into its current, and bearing them they know not whither. It must not be forgotten that for the young birds, constituting no small number of the host, this journey is absolutely new, and not the result of experience. If the movement were the result of knowledge and trust, we might well exclaim: Oh to be as confident of eternal beneficence, and as full of foresight as are these little wanderers!

FRANK W. VERY.

LADD OBSERVATORY,
PROVIDENCE, R. I., September 3, 1897.

SCIENTIFIC LITERATURE.

Year-book of the United States Department of Agriculture, 1896. [1897.]

In the preface to this volume, Mr. Charles W. Dabney, Jr., remarks that it falls far short of the ideal set for it, and regrets that it was not possible to give it more 'editorial revision' than it has received. We may all hope with

Mr. Dabney that each year-book will be better than its predecessors; but it seems to us that there is nothing to apologize for in the present work; and as for 'editorial revision,' we believe the mostly eminent writers of the articles it contains know perfectly well what they are about, and that revision of any sort would be an injury to them and a detriment to the volume. It is the proper work of the editor to obtain, select and arrange suitable articles for the volume, and this Mr. Dabney has done in a most admirable manner; but the time has come for scientific workers to insist on having their manuscripts printed as written, instead of being changed and even interlarded with gross errors, as is sometimes the case.*

The frontispiece of the year-book appropriately consists of the portraits of Senator Morrill and Hon. Wm. H. Hatch; the fine face of Senator Morrill is especially welcome, and will not easily be forgotten, even by those who have only seen the picture. The first part of the book, the report of Secretary Morton, has long been before the public, and need not be specially discussed now. It is, however, a document that should be read by all who take any interest in agriculture or agricultural science. The observations on the free distribution of seeds, and on the affairs of the experiment stations, will be endorsed by nearly all those who are not connected with the 'political machine.' Whatever opinion one may hold as to the propriety of the free distribution of seeds by the government, the present system must be condemned as wasteful and unjust. Whatever views one may have as to the desirability of local control, it cannot be permitted for experiment station authorities to break the letter or the spirit of the law, or waste the funds entrusted to them. The people of the United States, after all, are partners in business, and cannot wholly escape responsibility for one another's actions. It is, besides, a serious injury to the majority of stations, which are admirably applying their funds, that the minority should be able to drag the name of the experiment stations in the mud.

The body of the book consists of thirty articles bearing on as many problems of agriculture and kindred arts, and while probably no living person is competent to sit in critical judgment on such a varied assortment, it will not be questioned that each essay is of great value. We think that any educated citizen of this country, turning over the pages, cannot fail to feel very proud of the volume, as affording evidence of the highly satisfactory condition of at least one of the great departments of the government. If he is acquainted with the official agricultural publications of other countries he will have the further satisfaction of knowing that the United States is leading, not following, in the matter of educating the agricultural population, for the year-book is as truly an instrument of education as any college or university.

Mr. H. J. Webber's article on the 'Influence of Environment in the Origination of Plant Varieties' is very interesting, though he does not directly meet the question whether acquired characters are transmissible, while apparently being of that opinion. Dr. C. W. Stiles' essay on 'The Country Slaughterhouse as a Factor in the Spread of Disease' is very opportune. Mr. Marlatt's 'Insect Control in California' is an extremely valuable article and will help to settle some hot disputes between entomologists and horticulturists. 'The Superior Value of Larger Heavy seed,' by Messrs. G. H. Hicks and J.C. Dabney, is not only of much practical value, but of considerable theoretical interest. It is impossible now to discuss the remaining articles, but special attention must be called to 'An Ideal Department of Agriculture and Industries,' by M. E. Tisserand, Councillor of State and Director of Agriculture in France. This is a most suggestive and interesting article, and we should express our thanks to Mr. Dabney for arranging for its publication in the year-book.

T. D. A. Cockerell.

Mesilla, N. M.,
August 10, 1897.

* Some readers will think this too strong a statement, but we could readily give the facts of the cases we have in mind. It may be added that those responsible for the errors were scientific experts of excellent standing, as learned as any that could be obtained, but they did not happen to know everything. The publications were not those of the Department of Agriculture.