ment of color patterns, relative length of wing, tail and feet, the form of the bill, etc. (the latter features often combined with conspicuous resemblances in color markings), are common, not only in birds which inhabit different continental areas, but in other classes of animals, indicating that the range of differentiation is limited, and that repetition is necessary; such repetitions have no necessary genetic relationship, being for the most part adaptive.

In the three families Tyrannidæ, Pipridæ and Cotingidæ, there are several transpositions of genera from one to the other, on the basis of newly acquired evidence respecting their affinities. There are also several important changes in nomenclature, as where *Procnias* takes the place of *Casmarinchos*, etc., and current purisms are abandoned for the original forms of names.

As in the previous volumes of this series, the treatment is strictly systematic and technical, and shows the author to be the master of his subject, while his methods are eminently worthy of emulation. With this volume his great task is half completed, and it is the wish of all systematic ornithologists that he may have the health and strength to finish in due time this vast undertaking, which easily takes rank as the most important contribution to American systematic ornithology yet undertaken.

J. A. A.

Annals of the Lowell Observatory. Volume III.: Observations of the Planet Mars during the Oppositions of 1894, 1896, 1898, 1901 and 1903 made at Flagstaff, Arizona. Percival Lowell, Director of the observatory. 1905. Pp. xiv + 293 + 60. 4to.

In the body of this book are 293 pages, with all the details of observations during the oppositions of 1894, 1896, 1900–1 and 1903 treated separately, and subdivided into eleven chapters. The first chapter under each opposition deals with general matters pertaining to methods and dates of observation. Each of the other ten chapters gives the details of the observed surface features in order of longitude from Syrtis Major back to the two Syrtes.

Nearly all the observations were made by the director himself, and are described individually and relatively in such manner as shows a symmetry of method and similarity of purpose running through work on all the four oppositions. The observations made by Mr. Douglass and Mr. Drew, while being narrated in the same methodical sequence, have been published as the supplement of sixty pages. These embody the entire report on the opposition of 1898–9, and an auxiliary report on the opposition of 1900–1.

While there are many illustrations scattered through the volume, yet the major portion is given in the appendix of twelve plates inserted between pages 266 and 267, under the title: "1903 Drawings of Mars, being selected reproductions direct from the record-book Views from the Globe made from Observations of the Opposition"—whatever that may mean. Following these plates, pages 267–281, is a complete "Index of Names on Maps and Globes of Mars" inclusive of an index to volumes one and two of the *Annals*.

"Of the making of books, there is no end" is a dictum of about twenty centuries ago, and a thousandfold more true since the advent of printing than then. That this book is a handsome example of the "art preservative" no one can deny: large type, leaded; extra wide margins, with marginal headings; typography for the most part even, and press-work superb: the paper, heavy plate. It is a pleasure to read such books, whatever be their contents. It is all the greater pleasure when one finds such a piquancy of style, and such a wealth of detail of observation coupled with such explicitness of statement through so many pages, concerning objects which so many other able astronomers claim are either nearly invisible or totally non-existent. The writer of this review is as ignorant as any astronomer can well be of the objectivity of all these claimed observances on the face of our neighboring planet. During seventeen years' experience as an observational astronomer he has never had an opportunity of seeing Mars through a larger aperture than 4″.5. That he was requested

to write this review for SCIENCE was, therefore, probably due to this qualification as most likely to produce an unbiased summary of the book.

With this explanation, he will proceed to point out what seem to be the strongest points and best features of this Volume III. of the *Annals of the Lowell Observatory,* besides those already mentioned above.

Results secured at the opposition of 1894: At Flagstaff 116 new canals were discovered, 44 in the dark regions and 72 in the light: reobservation was made of 67 out of 79 of Schiaparelli's earlier discoveries, which verified the fixity both of existence and of position (though not the continuous visibility) of the canals: seasonal changes were disclosed by observed changes in the markings: new knots at intersections of canals were discovered, in the dark regions as well as in the light, thus incidentally exploding the supposition that they are seas, but giving them rather the character of oases: discovery of the so-called carets, where the canals debouched.

Ever bearing in his mind the degree of incredibility attached to these announcements by most astronomers, the author points out that the times of nearest approach of Mars through the epoch most usual for observing may not be always the most propitious season for multiplicity of detail. He also expresses the opinion that the failure of others to see the canals may be due to their looking at a "featureless face" (page 7). On page 4, he also points out a wide distinction between "sensitive eyes" and "acute eyes" and shows that a high ability to detect faint stars or satellites may be the very criterion which would presumptively preclude its possessor from the securing of a retinal impression of such surface features as Martian canals, etc. This opposition was observed with an eighteen-inch Brashear objective, usually with a power of 320.

At the opposition of 1896, a Clark objective of twenty-four inches was used. At first, for about three months at Flagstaff, and afterwards at Tacubaya, Mexico, the powers used ranged from 163 to 528. Three hundred and forty-one drawings of the complete disk were made at this opposition. As results, the enumeration includes many double canals—some being always double, others only at certain seasons of the Martian year. Evidence of the canals in the dark regions as well as in the light; and the subjective discovery that the detail of canals and oases came out finer and more minute as experience grew; and that many apparent changes in appearances arose "not because of change in them, but because of growing aptitude in the observer."

At the opposition of 1900, some canals were seen still always double: and that, too, independently of the apertures of the telescope objective or of the optical interference bands. Discovery was also made of bright spots in various parts of the planet, and at times difficult to explain. Though seemingly fixed in location, they were subsequently regarded as Martian clouds.

The opposition of 1903 was observed continuously for seven months while the tilt of the planet's north pole towards us was nearly at its greatest possible angle. The main results were noting the connection between the oases and the double canals, the oases being exactly embraced by the two arms of the double, and the oases were round and the canals tangent at the extremities of a diameter. Also the observer noted an apparent contradiction of Schiaparelli's announcement in 1888 of a change of longitude of Lucus Ismenius. Changes of color were noted, and a semi-annual flux in the development of canals, together with a complete confirmation of the objectivity of the canal gemination, and much additional information was gained as to the nature of that gemination.

In the Supplement, page 53, the author calls particular attention to Mr. Douglass's remarkable set of observations on the "projection" of December 7–8, 1900, and affirms that his observations and drawings showed conclusively that the successive appearances could be explained only by *clouds,* and were perfectly satisfied by that explanation.

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