mutant in question. The metathorax of this mutant has apparently reverted to a condition approximating that occurring in the ancestors of the Diptera, in having a well-developed metanotum and other metathoracic sclerites, while the wings of this segment of the thorax, instead of being mere knobbed threads as in practically all Diptera, have become developed as comparatively broad wings, with a well-defined venation. I am hoping to be able to make a careful anatomical study of the thoracic structures of this mutant in the near future, and have offered this brief account merely as a preliminary note of an investigation which will be given more in detail in a later publication.

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SCIENTIFIC BOOKS

JONSTON'S NATURAL HISTORY OF FISHES

Through the courtesy of Mr. Carl L. Hubbs of the University of Michigan, I have been able to examine a very rare book, seldom recorded in bibliography, the particular edition apparently not at all.

Its author is John Jonston, or as he writes it, Johannes Jonstonus, M.D., and its title page reads:

> Johann Jonstoni | Historiae Naturalis | de | Piscibus | et Cetis | Libri V | tabulis quadraginta septem | ab illo celeberrimo | Mathia Meriano | aeri incisis ornata | ex scriptoribus tam antiquis | quam recentioribus | maxima cura collecti | quos | ob raritatum denuo | imprimendos suscepit. Franciscus Josephus Eckerbrecht | Bibliopola Heilbrunnensis | MDCCLXVII.

Following this and bound with it is another volume, with the same title except for the words "de Exangibus Aquatilis Libri IV., tabulis viginti." This treats of invertebrates.

As this work bears the nominal date of 1767, subsequent to the "Systema Naturæ," it merits consideration in the interests of stable nomenclature.

I find that it is throughout a compilation from earlier authors, the latest of which is Piso's edition of Marcgrave's "Historia Naturalis Brasiliæ," printed at Leyden in 1648. The sources of information are carefully and apparently accurately given in side-headings. There is some evidence of a system of classification. Book first, for example, treats of marine fishes. Title of those which are pelagic, Heading 1, of scaly pelagic fishes, and Article 1, "de Asellis" of various "cods." Most of the forms mentioned are indicated by Latin nouns, the Greek form often added, and occasionally a descriptive adjective gives a binomial form. I find, however, no trace of a binomial system of naming; the word species I have not noticed and the word genus, occasionally used, has no technical significance, meaning merely "kind."

The names used by Jonston could not enter scientific nomenclature even if the date of the publication were subsequent to 1758, a matter which may be open to doubt.

In Bosgoed's "Bibliotheca Ichthyologia et Piscatoria," 1874, page 9, is recorded a treatise by J. Jonston, with a similar but more extended title, said to be in five parts in two divisions ("dln.") with the dates 1650 to 1653, issued at Frankfort on the Main.

Apparently the volume before me is a reprint of the second "dealing" of this general work, as it bears a different date and the name of a different publisher. Bosgoed speaks of a new edition in Amsterdam in 1718, and an edition in Dutch in Amsterdam in 1660, translated from the Latin by M. Grausius. In advance proof sheets of the second edition of Dean's "Bibliography of Fishes," references are given to about a dozen editions in Latin or Dutch. One of these is dated 1677, but none 1767.

It may be questioned whether the date "MDCCLXVII" given on Libri IV. and V. alike is not a misprint for MDCLXVII. The appearance of the book and the absence of reference to any author later than 1648, would point in this direction. In any event, the names merit no consideration from systematists as, if really issued in 1767, it is merely an unmodified reprint of a pre-Linnæan,

non-binomial, unsystematic popular compilation.

The volume is effusively dedicated to "Wilhelmo VI Hessio Landgravio," whose titles and virtues his "devotus cliens" expounds at length.

DAVID STARR JORDAN

SPECIAL ARTICLES

ON A METHOD OF ESTIMATING THE NUMBER OF GENETIC FACTORS CONCERNED IN CASES OF BLENDING INHERITANCE

IN the early days of rediscovered Mendelism Bâteson[1] suggested the idea that what was then known as blending inheritance might be a variety of Mendelism in which dominance was wanting, but in which several or many independent factors were involved. This suggestion was found to be in good agreement with much experimental work on quantitative characters subsequently carried on by Nilsson-Ehle, Tammes, Emerson and East, and others. It is now generally accepted as the most probably correct explanation of all varieties of intermediate or blending inheritance. Accepting this as a working hypothesis, have we any means of discovering *how many* factors are involved in cases of blending inheritance? Surely the number must be very different in different cases.

Noteworthy features of blending inheritance are the following: (1) F_1 is intermediate between the pure parental races, but not more variable than the more variable parent. (2) F_2 is likewise intermediate in character but is *more variable* than F_1 or either parent. (3) In F_3 and subsequent generations the variability decreases from the maximum suddenly attained in F_2.

In all varieties of inheritance, whether typically Mendelian or blending, the maximum variability is to be found in the F_2 generation. In ordinary Mendelian inheritance we are able to detect the number of genetic factors concerned by the number of phenotypes which are distinguishable in F_2 and by their numerical proportions. The F_1 generation is in strong contrast with the F_2 generation to which it gives rise, for F_1 is of a single type, if the parent races were pure.

In blending inheritance also, it is the F_2 generation which affords a clue to how many genetic factors are involved, not by the formation of clearly distinguishable types (for there is but one), but *by the amount of the variability of that single type in F_2 as compared with F_1.*

To make this clear, let us consider the numerical series commonly employed, by expositors of the multiple factor hypothesis, for explaining the increased variability of F_2 in blending inheritance. If two pure races differ from each other by a single genetic factor (which does not show the phenomenon of dominance), and if these two pure races are crossed, F_1 will be intermediate. F_2 will also be intermediate in part, but the parental classes will also reappear, and there will thus be three distinguishable classes in F_2, which correspond with the two parental types and the F_1 type respectively. The classes will be numerically as 1 : 2 : 1, as in the familiar case of the blue Andalusian fowl.

Now suppose that the pure parent races dif-

TABLE I

F_2 Distributions in Size Classes, when Inheritance is Blending and Involves from One to Six Independent and Equivalent Factors

Factors	Class Magnitudes (Top Row) and Frequencies (Below)													Standard Deviation
	1	2	3	4	5	6	7	8	9	10	11	12	13	
1	1						2						1	$\sqrt{18}$
2	1			4			6			4			1	$\sqrt{9}$
3	1		6		15		20		15		6		1	$\sqrt{6}$
6	1	12	66	220	495	792	924	792	495	220	66	12	1	$\sqrt{3}$

[1] Report I. to the Evolution Committee of the Royal Society, London, 1902.