

Fonscolombe, Say, Rambur, Hagen, de Selys and the others! All this might be thrown away, were there any compensating gain, but so far as I can see, there is only loss. It is not easier to remember numbers than names; on the contrary, they are much more readily forgotten, transposed or misprinted, and when mixed up they contain no clue to enable us to set them right.

I have worked many years at different branches of zoology and botany, and venture to affirm that it is easier to remember names than species. The names which come before us as a chaotic multitude, menacing and incomprehensible, *are those of things we do not know*. To me, even these names have a sort of charm, like that of unknown people passing in the street, each one a little mystery, with wonderful if unknown history and meaning. A high degree of complexity in nomenclature is reached when we attempt to indicate all sorts of minor categories, subgenera, subspecies and the like, but all this is for the purpose of reflecting in some poor way the real complexity of nature. The mind can not grasp it all, but it is possible to attain a reasonable comprehension of parts, and for this it seems to me that nomenclature (not numeration) is a useful tool. I am the more convinced that we are on the whole doing well, from the fact that in practically every group which I have studied, the path of the student is far easier to-day than it was twenty years ago.

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SCIENTIFIC BOOKS

Studien ueber die Bestimmung des weiblichen Geschlechtes. Dr. ACHILLE RUSSO. Pp. iv + 105; 32 figures. Jena, Gustav Fischer. 1909.

In this brochure Professor Russo, of the Imperial University of Catania, has presented in German a compilation of the results that he has already announced in Italian publications, together with abstracts of more recent and unpublished work. The title of the present paper would indicate that its author has dealt only with the determination of the fe-

male sex, but as a matter of fact he outlines a series of experiments designed to show that sex is a question of maternal metabolism and that Mendelian dominance is similarly dependent upon conditions of nutrition in the mother. It is apparent, therefore, that the conclusions of Professor Russo upon the subjects of sex determination and Mendelian inheritance are widely at variance with those held by the majority of his fellow workers in these lines of investigation. Should he be found correct, much of the work of cytologists and experimental breeders of the last ten years is seriously in error. For this reason his data should be carefully considered in order to determine whether he is justified in opposing the prevailing opinions regarding the subjects he discusses.

The material is presented under three headings: I., General Part, wherein the author gives his conclusions and a summary of his results; II., Analytical Part, in which is considered the function of the epithelium of the rabbit ovary and the experimental proof to show that this is under control by artificial means; III., Experimental Part, where the results of the breeding trials are given and criticisms of the work of other investigators following his methods are presented. The line of reasoning pursued by Professor Russo is, in brief, this: Sex and the characters of the soma in the offspring, at least so far as pigmentation is concerned, are the result of the metabolism in the mother at the time the eggs are produced and made ready for fertilization. The maternal condition impresses itself upon the egg through the medium of the epithelium of the ovary. Preponderant anabolism results in the production of large proportions of females, while the opposite condition favors the production of males. Likewise favorable conditions of nutrition in the mother reverse the factors of dominance in Mendelian inheritance. So far as the matter of sex determination is concerned it is apparent that we have here a revival of the epigamous theory so thoroughly and ably presented by Geddes and Thompson. The modification of Mendelian characters is, however, something en-

tirely new and directly opposed to the results attained by all experimental breeders.

The method of controlling the maternal metabolism is through the injection of lecithin subcutaneously and intraperitoneally or even by feeding. According to Professor Russo the ovaries of such artificially nourished rabbits are very much larger than normal ones, and the mechanism of this transfer of the food material (lecithin) from the peritoneal cavity is traceable through the germinal epithelium into the ovary, past the stroma to the stratum granulosum of the Graafian follicles, through this and the cells of the corona radiata and finally into the ovum. He detects two general classes of eggs in the ovary; those with large deutoplasmic content and others having little or no food material. The former class is greatly increased by the use of lecithin, and such females as have been thus artificially nourished are said to produce females exclusively or in relatively large numbers. Also the author claims that the young of such mothers reproduce her characters of pigmentation even though they be recessive and in the presence of dominant characters introduced by breeding her with a dominant bearing male. In the last analysis therefore, according to Professor Russo, sex and somatic structure are determined by the nutrition of the mother acting through the medium of the ovary upon the eggs.

It is essential to Professor Russo's contention to prove that the ovary is really an organ of absorption and that it is capable of being influenced by the soma. To this part of his subject he devotes 68 out of the 105 pages of the paper. He presents the evidence from a study of normal ovaries in rabbits of various ages from two months to maturity and in different degrees of reproductive activity, and adds to this results derived from the study of artificially nourished ovaries. Gonads from starved females were also studied. The character of the germinal epithelium, of the stroma, of the stratum granulosum and liquor folliculi and of the zona pellucida under the various conditions of the experiments is described.

A detailed consideration of the extra nuclear bodies and their chemical and morphological natures follows. The author's purpose in this second part is indicated in the following passages:

Auf diesen, fuer die gegenwaertigen Untersuchungen fundamental wichtigen Punkt muss ich entschieden beharren, dann wenn auch einige in der Organismus eingefuehrte Stoffe sich als unwirksam, mitunter auch als schaedlich sich erwiesen, werden andere dagegen vom Eierstock aufgesogen und somit durch ihr Eindringen in denselben im deutoplasmatischen Material verwandelt. . . . Der Zweck dieses zweiten (II.) Teils findet weiter auch darin seinen Grund: den Beweis zu erbringen, dass der Eierstock der Saegetiere, im Gegensatz zur allgemein herrschenden Ansicht, nach welcher er, weil tief im Soma gelegen, den experimentellen Angriff gegenueber unverletzlich sei, in seiner innersten Struktur durch verschiedenartig Mittel modifiziert kann.

In the final section of the work there is presented the results of a series of breedings between rabbits of different races intended to show that characters in new races, ordinarily recessive, may, under conditions of over nutrition, be made dominant. The experiments to show the effect of nutrition upon the proportions of the sexes, together with a consideration of the normal ratios of the sexes in rabbits, are also outlined here. Finally, the technical methods of administering the artificial food products and of preparing the material for study are given.

Comment.—It is perhaps a little unfair to judge an investigator's work by such a compilation of it as Professor Russo presents in this publication, but since he has prepared it specifically for the purpose of representing his exact attitude in respect to the subjects of sex determination and Mendelian inheritance it will be necessary to judge his work and opinions by this presentation of it. A general consideration of the paper gives one the impression that its author has not been thoroughly critical in his methods, and this feeling is intensified as details are studied. The Experimental Part, for instance, contains only about eight pages, largely illustrations, of experimental results, while the Analytical Part

is mainly occupied with the results of experiments. Further instances of this lack of discrimination will appear in the consideration of the various topics discussed. The bibliographies are extensive, but the references to them are comparatively few. The large amount of recent work upon sex determination by cytologists and experimental breeders receives but slight mention and, when referred to, is apparently not correctly understood. Professor Russo promises, however, an early consideration of this part of his subject and it is to be hoped that he will then make some effort to show the errors of those who find sex independent of external conditions. In commenting upon the details of Professor Russo's investigations it will be convenient to ask certain questions and to examine the evidence which he adduces in his replies to these.

First it may be asked if there are two recognizably distinct types of eggs in the rabbit ovary. An answer to this question can hardly be given justly from a mere inspection of the evidence in the paper. The figures presented are few and apparently indicate a morphological difference between the eggs, but there is no attempt made to determine the relative numbers of these under normal conditions or to show that there is a lessening of one type to accompany the increase of the other under the conditions of the experiment. It must also be recalled that experienced investigators like Heape¹ not only fail to find two types of normal eggs, but regard the supposedly male-producing eggs of Russo as those in process of degeneration. It can at least be said that the great importance attached to this part of his work by the author would require his determinations to be made more exact if they are to be effective as an argument in the minds of those familiar with ovarian histology.

Also it may be asked, if there are two normal types of eggs, whether it is possible to change one into the other by external influences. Russo's theory requires that this be done, but the evidence that he brings forward in support of his contention that this has

been done is far from conclusive. Having artificially nourished female rabbits with lecithin, he kills them and studies the ovaries and reports that the proportion of fat containing eggs has been greatly raised. Similarly treated rabbits are bred and the proportion of females is said to be much increased. It is, therefore, concluded that one type of egg has been changed into the other. In addition to this evidence, which is all that there is to connect form variation of eggs with sexual characters, Russo presents the results of experiments upon fasting rabbits to show that the fat within the eggs disappears completely, and also those upon lecithin treated young to demonstrate that the fat is here brought into existence in eggs that normally do not acquire it until much later. None of this evidence proves that one kind of egg is changed into the other, but only that the food material may be increased or diminished by feeding and starving. So far as the histological part of the work is concerned, therefore, it may be said that the evidence brought forward seems to indicate that injections of lecithin may affect the metabolism of the ovary and its germ cells, but that there is no proof of the view that such treatment is effective in transforming one kind of egg into another.

The question may next be asked: Does the treatment of the maternal parent by the injection of lecithin alter the proportion of the sexes? Russo says very positively that it does and that the proportion of females may be raised from approximately 50 per cent. to a very much higher one, even to 100 per cent. in individual cases. Such results as these seem unequivocal enough, but the same experiments have been repeated by Basile² and by Punnett³ and these investigators fail entirely to substantiate the claims made by Russo for his methods. It is pointed out by them and more recently by Castle⁴ that Russo gave only selected results and failed

² Basile, C., *Atti Acad. Lincei*, Vol. 17, 1908.

³ Punnett, R. C., *Proc. Cambridge Phil. Soc.*, Vol. 15, 1909.

⁴ *The American Naturalist*, Vol. 44, No. 523, 1910.

¹ Heape, W., *Proc. Cambridge Phil. Soc.*, Vol. 14, 1908, p. 609.

to present the whole series of experiments from which he drew his conclusions, while in the repeated experiments of Basile and Punnett all results were tabulated. This unscientific attitude seems to pervade the whole of Russo's work, and so long as his methods are thus at fault, it is not worth while to consider the bearing of his results, particularly in the face of direct contradiction by other investigators going over the same ground.

Finally the enquiry concerning the possibility of reversing the operation of Mendelian dominance in cross breedings may be considered. Here again we have to do with faulty experimental methods. Russo claims to be able to make white dominant over black in the first generation of hybrids by treating the white mother with lecithin injections before breeding, but practically no attempt is made to analyze the racial composition of the animals used in breeding. Such experiments as he presents in support of this contention would have no standing whatever with experienced breeders and it may be said without any exaggeration that in such a presentation of his case he has forfeited entirely the serious consideration of his work. A detailed analysis of this part of his studies has been recently given by Castle⁵ and will not be repeated here. It is much to be regretted that an extended investigation like this of Russo's should be vitiated by untrustworthy methods, for such lines of work need following out and are extremely valuable in furthering an analysis of the relations existing between the germ cells and the parental bodies. That the author will present his work purged of the serious errors it now contains must be the hope of all his fellow workers.

C. E. McCLUNG

Factor Tables for the First Ten Millions, containing the smallest factor of every number not divisible by 2, 3, 5 or 7 between the limits 0 and 10,017,000. By DERRICK NORMAN LEHMER. Washington, D. C., Carnegie Institution of Washington, Publication No. 105. 1909. Pp. xvi + 476. Price \$20.

The publication of the best and most extensive work in any language, on an old and

important subject, is eminently worthy of recognition, especially when the preparation of such a work demanded the most painstaking care and unselfish devotion to the interests of science. Prime numbers and factors of composite numbers are among the oldest as well as among the newest objects of study in mathematics. The perennial interest in these subjects bears testimony to their importance and helpfulness in our efforts towards stronger instruments of thought and towards a more rational intellectual penetration into the physical laws which we encounter on all sides.

While it may be true that integral numbers do not occupy comparatively as large a place in our present mathematical thinking as they once did, they still constitute, according to Minkowski, "the fountain-head of all mathematics" and they enter prominently into many of our mental processes. We are not infrequently brought to questions whose solutions are expedited by a knowledge of the existence of primes or of the factors of large composite numbers. Under such circumstances one will naturally turn hereafter to the tables before us with an unusual confidence in their correctness and a high appreciation of their great extent.

The pages of the present table are very large—about sixteen inches long and twelve inches wide. "Each horizontal line of the table covers 210 numbers. The multiples of 2, 3, 5 and 7 are not listed. As there are 100 lines on each page it follows that each page will serve to find the smallest factor of 21,000 consecutive numbers. The largest and smallest of these are given at the top of the page. These numbers then indicate at a glance the page that contains the smallest divisor of the given number." To find the smallest factor of a given number without the aid of an auxiliary table, it is necessary to divide the number by 210 and to locate the quotient and the remainder in the table. By means of these two numbers it is very easy to find the smallest factor of the number in question, if it is composite but not divisible by 2, 3, 5 or 7. The division by 210 may be avoided by means of an auxiliary table.

In his preface the author states that "The

⁵ *Loc. cit.*