economic work to devote a year to pure research. The results would extend far beyond the single year or the single individual. If the Carnegie Institution can arrange to pay half the salary of an investigator, giving him at the same time the best facilities for research at Washington, at one of our well-equipped universities or abroad, requiring the institution with which he is connected to pay the other half, its funds would be spent wisely and economically.

There are certain men of genius or talent who for one reason or another have not been able to find a place in our organized social machinery. Such men might perform work of value if given the opportunity, and the Carnegie Institution could here assist in a way that is not possible for any other institution.

The two general principles which I have kept in mind in writing the above are that the Carnegie Institution should do (1) what it only can do, working whenever possible with existing institutions; and (2) should aim to increase the influence of men of science, working with them and through them.

The executive committee and the trustees of the Carnegie Institution will have before them reports prepared by those most competent to give advice, and their final decisions will be better considered than the views of any individual. I have ventured to print these remarks, based chiefly on the science with which I am engaged and the institutions with which I am more or less familiar, on the supposition that suggestions from all quarters will be welcomed by the officers of the institution. I have of course expressed only my individual opinions and have in no wise attempted to represent the policy of the journal in which they happen to appear. As responsible editor of this journal, however, I urge men of science to join in a discussion of the problem as to how endowments for research, and especially the great endowment of the Carnegie Institution, can best be used for the advancement of science.

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## SCIENTIFIC BOOKS.

*Lehrbuch der Combinatorik.* Von DR. EUGEN NETTO. Leipzig. B. G. Teubner. 1901. Pp. viii + 260.

At the present time neither European nor American universities offer lecture courses on the subject of combinatorial analysis. This fact is the more noteworthy when we remember that during the first quarter of the nineteenth century nearly every mathematical chair in Germany was occupied by a specialist in that field. This Combinatorial School of Germany has passed into deserved oblivion. Under the leadership of C. F. Hindenburg it represents the culmination of an unfortunate tendency of eighteenth century mathematicians to develop analysis, particularly the subject of infinite series, with reference to form only, and to pay little or no attention to the actual contents of formulæ. The polynomial theorem was hailed as 'the most important theorem of all analysis.' In combinatorial analysis (combinatoric) the German school was contented with the deduction of rules for the writing down of all the combinations and permutations that are possible under given restrictions. The simple fact that the able and fairly complete treatise now under review hardly mentions the work of Hindenburg shows that what are now considered the substantial parts of combinatoric have been developed outside of the German Combinatorial School. Associated with the early development are the great names of Pascal, Leibnitz, Wallis, James Bernoulli and De Moivre.

While combinatoric is not now made the subject of lectures in our universities, it is nevertheless of importance. The student acquires much of it during the pursuit of other branches. It is touched upon in the study

of ordinary algebra, of determinants, of substitution and group theory, of the theory of numbers, and of the theory of probability. Netto's book is of value as a reference book, especially as no text of importance on combinatoric has been published for sixty-five years. In arrangement and selection of material it resembles somewhat Netto's brief article 'Kombinatorik' in the 'Encyklopädie der Mathematischen Wissenschaften.' The book takes notice of researches of recent date, including several papers by American authors. Starting out with the fundamental definitions the author treats of combinations, permutations, and variations under different limiting conditions, leading up to various problems, as, for instance, Tait's problem of knots. Combinations and variations are considered under the restriction of a definite sum or a definite product of the elements. The partition of numbers and Durfee's graphs are taken up. In the course of further combinatorial operations the author studies systems of triads arising in connection with Kirkmann's and Steiner's problems. Steiner's queries have not yet been fully answered. Kirkmann's is the 'Fifteen School Girl Problem': 'To walk out fifteen girls by threes, daily for a week, without ever having the same two together.' In the discussion of this it is to be regretted that Netto overlooked E. W. Davis's pretty 'geometric picture,' given in the *Annals of Mathematics*, Vol. XI., 1897, where a one-to-one correspondence is established between the fifteen girls and fifteen points on a cube; eight points at the corners, six at the mid-points of the faces, one at the cube-center; the thirty-five triads are then easily found.

Netto's book is substantial food for the average reader. Yet some topics in combinatoric were originally suggested by questions propounded for amusement. The 'problem of the eight queens' is of this nature. Eight queens are to be placed upon a chessboard so that none of them can capture any other. It was first propounded in Berlin in 1848 and has 92 solutions. J. Bernoulli, in his 'Ars Conjectandi' (1713), gives certain hexameter lines in which the words were to be changed about in every possible way, yet so that every new arrangement still conformed to the laws of verse. Thus the hexameter,

Tot tibi sunt dotes, Virgo, quot sidera cœlo,

studied by several pious mathematicians, admits, according to Bernoulli, of 3,312 such arrangements. An interesting recent book, taking up combinatorial and other mathematical topics for the purpose of recreation, is W. Ahrens' 'Mathematische Unterhaltungen und Spiele' (Teubner, 1901).

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## *Discussion and Correspondence.*

### The Opportunity for Further Study of Volcanic Phenomena.

To the Editor of Science: It has been just four months to-day since the terrible calamity at St. Pierre occurred. Much has been written and said concerning it. Many able scientific men—French, British and American—have examined the locality and published thereon, but so far as I am aware their observations and conclusions only point to one deduction—that the terrible secret of Pelée's destructive clouds is still unsolved, and that the volcano still exhibits a deadly unexplained force, as attested by two thousand additional victims last week.

I think I may speak correctly, when I say that all the visiting geologists agree upon the major geological facts and only diverge seriously when they reach the field of speculation concerning the nature and behavior of the mysterious gases and clouds of lapilli, which descend instead of arising, which developed marvelous electric effects, after passing away from the crater, and which create powerful destructive forces.

So far as I am aware there was not a single member of the American scientific corps who did not leave the scene with a knowledge of the incompleteness of his studies and the lack of facilities for study during the brief time he was there. One of these, Professor Heilprin, has returned to the scene at his own expense, but, alas, even if he has survived