frequenting the same stream, may simply congregate about some bubbling spring, that, issuing from the bed of the pond or creek, tempers the surrounding waters, and renders it habitable during the severest weather. This, it seems to me, is a marked instance of the exercise of choice on the part of fishes, and has an important bearing on the question of their intelligence; and it is, furthermore, corroborative of the statement, made at the commencement of our former article, that hibernation is a faculty which many animals possess, the exercise of which is largely, if not wholly, optional.

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TAIT'S HEAT.

Heat. By P. G. TAIT. London, *Macmillan*, 1884. 368 p. 8°.

THE author says in his preface, "Clerk Maxwell's work is on the theory of heat, and is specially fitted for the study; that of Stewart is rather for the physical laboratory: so that there still remains an opening for a work suited to the lecture-room."

The book before us is the best text-book for a student who is beginning the study of heat that we have seen. The author begins by giving the reader a good idea of force and energy, of the nature of heat, and of the difference between heat and temperature. Heat is a form of energy: temperature must at first be looked on "as a mere condition which determines which of two bodies, put in contact, shall part with heat to the other."

We do not, however, think that a student can get a clear idea of the second law of thermodynamics, and of absolute temperature, from the brief sketch given in chap. iv. In order to have confidence in the deductions from Carnot's cycle, a much more thorough study of thermodynamics is necessary. Chap. xi., on thermoelectricity, contains a very good account of the theory and of the experimental part of the subject. The results of Tait's experiments upon the form of the thermo-electric lines at high temperatures are given, and also a table of the calculated specific heats of electricity for many metals.

The chapter upon combination and dissociation, showing the application of the two laws of thermo-dynamics to chemical combination, is valuable, as such a discussion is not often to be found in text-books.

This book is not everywhere easy reading. Though by far the greater part can be understood by a student who has no knowledge of differential calculus, yet there are certain parts — as in the application of Fourier's method to determine the temperature of the earth's crust, and in chap. xxi., on the elements of thermodynamics — where a knowledge of calculus is necessary.

MERRIMAN'S METHOD OF LEAST SQUARES.

A text-book on the method of least squares. By MANSFIELD MERRIMAN. New York, *Wiley*, 1884. 8+194 p. 8°.

THIS author published his Elements of the method of least squares in 1877. It was favorably received; and, the edition having been exhausted, the work has been now recast, and republished under the above title. In the original work the author attempted, in the first part, to explain the method, and its application to the combination of observations, and, in the second part, to establish analytically the mathematical principles of the subject. In the present work the principles are first developed, and the applications follow: this order of arrangement must, on the whole, be better than the other. The endeavor to have the reader become practically acquainted with the subject before he makes any extended analytical study of it, may possibly enable the student who is somewhat deficient in his mathematical training to obtain a command of the method when otherwise it would be beyond his reach; but it does not seem worth while to assume that those who are to use this method are such poor mathematicians that the work should be modified in this way for their benefit. The author has done well in this new work in making a straightforward, logical development of the method and its applications. In a cursory examination of the work, it does not appear that the author has, in general, enlarged the book by materially adding to the theoretical part, which was already sufficient for the purposes in view. The additions are found in the practical portion of the work, and are of a nature to considerably enhance its value to the civil engineer, for whom the book is primarily intended.

It has seemed to the writer that the introductory chapter, which treats of the general principles of probability, might have been enlarged to advantage, or at least that the reader should have been referred to some good source of information, such as the excellent little book of Whitworth on choice and chance; as this is a subject respecting which he probably has little or no previous knowledge. Taken as a whole,