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.

CHARLES C. ABBOTT, M.D.

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,

this is a very useful and much-needed text-book, and will exert a strong influence to extend the knowledge of the correct method of the comparison and combination of observations, which is so essential, not only to the progress of astronomy and geodesy, but to physics and chemistry as well, and to every branch of science which deals with refined measurements of quantity of any kind by the help of instruments of precision.

THE SOCIETY FOR PSYCHICAL RESEARCH.

Proceedings of the Society for psychical research. Vol. i. (containing parts i.–iv.). London, *Trübner & Co.*, 1883. 337 p. 8°.

The four reports of the Society for psychical research which have been issued at intervals during 1882 and 1883 have now appeared in the form of a handsome volume, and it cannot be denied that they constitute a formidable body of evidence in favor of certain beliefs which have hitherto been looked upon with peculiar suspicion and distrust. A brief *résumé* of the testimony does not do it justice, for it derives its weight from the cumulative effect of its large amount. No one who is interested in bringing fresh regions of ignorance under the domain of scientific investigation should fail to read the proceedings for himself.

The society was organized on Feb. 20, 1882; but several of its members had been engaged in private research in the same direction for some years before. Its object was stated to be the investigation of an important body of remarkable phenomena, resting upon the testimony of many competent witnesses, including observations recently made by scientific men of eminence in various countries, and *primâ facie* inexplicable on any generally recognized hypothesis. The distinction of its founders is such as to completely dissociate it from the race of the long-haired, and to insure at once respectful consideration for whatever facts it vouches for. They include such names as Balfour Stewart, Arthur Balfour, Professor Barrett, Edmund Gurney, F. W. H. Myers, Archbishop French, and Professor Henry Sidgwick (the president). The members are not committed to any theory, and are not advocates of any cause. It is their intention to remove, if possible, what they justly say is a great scandal, — the existing state of absolute doubt as to whether phenomena testified to by a large number of generally credible witnesses, and of great scientific importance if true, can be properly authenticated or not. Their experiments are conducted with the most rigid precautions against deception and mistake, and, what is equally important, recorded with scientific precision. Six committees were formed for the consideration respectively of thought-reading, mesmerism, Reichenbach's experiments in regard to a peculiar sensitiveness to electric currents, apparitions and haunted houses, physical phenomena, and the collection and collation of existing materials bearing on the history of these subjects. Of their several reports, those of the committee on thought-reading, or thought-transferrence, as they call it later, are the most striking. The signification of the term 'thought-transferrence' is limited to the communication of a vivid impression or a distinct idea from one mind to another, without the intervening help of the recognized organs of sensation. No account is taken, very naturally, of experiments in which there is physical contact between the persons concerned, or in which there is the slightest possibility of conveying information by sight or hearing. The extreme perfection to which a code of signals may be brought leads the committee to distrust all observations where two particular persons are necessary for the results obtained. Their most remarkable subjects for thought-transferrence have been found in a family in Derbyshire, that of Mr. Creery, a clergyman of high character, whose integrity has, as it happens, been exceptionally tested. He has five daughters, of ages between eleven and eighteen, all thoroughly healthy, and as free as possible from morbid or hysterical symptoms. All of these children except the youngest are able to designate correctly, without contact or sign, an object fixed on in the child's absence, — not, indeed, every time, but far more frequently than probability would allow as the result of chance. The child, on returning to the room, stands close to the door, amid absolute silence, with her eyes on the ground: often she does not return, but guesses from the adjoining room, with the door closed. The children have been experimented upon at their home by the committee, by Professor Barrett, by Mr. and Mrs. Sidgwick, and by Professor Balfour Stewart, as well as at the houses of different members of the committee at Cambridge and at Dublin. The objects guessed have been chiefly cards from a full pack, and numbers between ten and one hundred; but remarkable success has been obtained, also, in guessing names chosen at random, as in the following list: —