two formidable objections which he foresaw would be brought against them, namely, the improbability of two bodies endowed with enormous energy in the form of rapid motion coming into actual collision with one another, and secondly, the want of experience of like movements in the universe. It is but seldom that a theory, however ingenious, can be upheld against *two* antecedent improbabilities, but granting Dr. Croll all he asks, even to the existence of non-luminous bodies moving through space with a velocity of 1,700 miles per second, there may still be brought more serious objections than either of the above. Our knowledge of the actual motions of the stars in space has recently been greatly extended, and it is now well known that proper motions exceeding thirty miles per second are very rare, and that probably there is no well-authenticated case of a velocity greater than forty miles per second. It has long since been ascertained also that the proper motion of our own sun in space is at the rate of four miles per second only. It is, of course, possible or fortunate that the two bodies from whose collision the solar nebula originally derived its vast stores of heat might be of such equal masses and velocities that the motion of translation should be so nearly destroyed, and the whole converted into heat, but it is inconceivable that amid all the diversity of dimensions of the heavenly bodies it should invariably happen that the resultant movement of the combined masses should be reduced to such insignificant figures as the above.

It is strange that it should not have occurred to Dr. Croll that the heat generated by the impact of two bodies in such rapid motion cannot be considered as remaining constant for nearly the length of time he computes, because the rate of radiation from so intensely heated a sun will be enormously greater than it is now. Indeed the origin of the solar heat does not materially affect the question at issue, which is rather of the means of continuous and equable supply than of the primary source. The contraction theory of Helmholtz addresses itself to meet this difficulty, but alone it is probably insufficient. In the *Popular Science Review* of January, 1875, I have directed attention to other possible and supplementary means of heat supply, which, being continuous, will tend to prolong the period during which the radiation of heat from the sun shall be nearly constant, and hence favourable to the development of organic life. Without advocating any peculiar views of my own which recent discoveries have necessarily somewhat modified, I content myself with pointing out what appear to me to be grave difficulties in the way of accepting the theories and explanations of Dr. Croll.

JOHN I. PLUMMER

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Faraday's "Experimental Researches"

DOUBTLESS many of your readers will have observed an advertisement of a well-known antiquarian bookseller professing to be able to supply "a perfect copy" of Faraday's "Experimental Researches" at a price not too exorbitant for a complete original copy of that priceless work.

Any who may have applied for the work will, perhaps, share with me the indignation with which they discover that the so-called *perfect copy* is only such in virtue of being a "facsimile reprint" (*sic*) not twelve months old, though dated on the title-page 1839. But perhaps scientific men are too innocent of the ways of antiquarian caterers to receive with calm contentment the assurance that they have not been deceived.

SILVANUS P. THOMPSON

University College, Bristol, February 5

CLAUDE BERNARD

IN rapid succession we are compelled to chronicle the recent serious losses by death to French science. To the names of Leverrier, Becquerel, and Regnault, we regret to add that of the equally famous physiologist, Prof. Claude Bernard, who died in Paris on the evening of February 11. He was born at St. Julien, near Villefranche, in the Rhône department, July 12, 1813. After completing a course of study in the Paris faculty of medicine he was appointed hospital-surgeon in 1839. Two years later he became assistant to the well-known physiologist, Prof. Magendie, in the Collége de France, and continued in close connection with him for thirteen years, during the last half of this time lecturing himself as *privat-docent*. A series of notable discoveries made during this period caused his election, in 1854, to the Academy of Sciences, and his appointment to the newly-founded professorship of general physiology in the Collége de France. This he exchanged in the following year for the chair of experimental physiology, a position which he occupied up to the time of his death.

As an original investigator, Bernard stands among the foremost of the century. He entered upon his career at the epoch when Magendie, the chief founder of the modern French school of physiology, had completely altered the character of this study by the introduction of a variety of experiments on living animals, such as the action of the alkaloids, &c. Bernard entered with enthusiasm on the new field of experimental activity opened up by his master, and by a swift succession of remarkable discoveries with regard to the changes taking place in the human organism, guided the young science into a completely new channel. Of these the most important were connected with the phenomena of digestion, and especially the relation of the nerves to these processes. Perhaps the most valuable was the exhaustive investigation into the functions of the pancreatic juice (in 1850), in which he showed that this fluid was the only one in the digestive apparatus capable of so modifying fatty matter that it can be absorbed by the chyle ducts, and that the digestion of this portion of the nourishment introduced into the system was its sole purpose in the animal economy. Another discovery at this period, which attracted universal attention, was that of the saccharine formation in the liver. Bernard found that not only was sugar a normal constituent of the liver, but that while the blood, on entering into this organ, was completely free from saccharine matter, large amounts of the latter could be detected after it left the liver to pursue its way to the heart. Interesting as this fact was, it was eclipsed by the discovery of the two remarkable connections between this function of the liver and the nervous system.

It was ascertained, first that this normal formation of sugar in the liver could be totally interrupted by severing the pneumo-gastric nerve in the neighbourhood of the heart; and secondly, that by wounding a certain place on the fourth ventricle of the brain, near the origin of the eighth pair of nerves, it was possible to cause such an abnormal formation of sugar that an animal within two hours after such an operation showed all the symptoms of diabetes. In recognition of these brilliant experiments the physiological prizes of the French Academy were bestowed upon Bernard in 1851 and 1853. In a continuation of this line of research in 1859 he made the important discovery that the sugar for the embryo is prepared in the placenta, and not in the liver. Shortly previous to this time he published the results of extensive observations on the temperature of the blood, in which he showed that remarkable alterations in the degree of warmth take place on the passage of the blood from one organ to another, especially in the different parts of the digestive and respiratory systems. The absorption of oxygen by the blood formed the subject of a memoir in 1858, from which it appears that the coefficient of absorption diminishes gradually with an increase of temperature, and becomes zero at 38°—40° C. in the case of mammals, and 40°—44° C. in the case of birds, viz., at the temperatures at which death sets in. The respective amounts of oxygen in the arterial blood, and red and black venous blood were likewise carefully estimated, and the chemical causes for the differences in colour revealed. Among the other leading researches of Bernard must be mentioned those on the comparative properties of the opium alkaloids; on the poisonous properties of curarine; on the sympathetic nerves in general; as well as numerous investigations on the individual processes in the act of digestion. Many of these discoveries, as well as the results deduced from them, have formed subjects for long-continued controversies. With rare exceptions, however, not only