

**THE CONSERVATION OF ENERGY;
WITH AN APPENDIX TREATING
OF THE VITAL AND MENTAL
APPLICATIONS OF THE DOCTRINE**

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The conservation of energy; with an appendix treating of the vital and mental applications of the doctrine by Balfour Stewart & Joseph Le Conte & Alexander Bain

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BALFOUR STEWART & JOSEPH LE CONTE & ALEXANDER BAIN

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Sci.

THE INTERNATIONAL SCIENTIFIC SERIES.

THE

CONSERVATION OF ENERGY.

BY

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PROFESSOR OF NATURAL PHILOSOPHY AT THE OWENS COLLEGE, MANCHESTER.

WITH AN APPENDIX,

TREATING OF THE VITAL AND MENTAL APPLICATIONS OF THE
DOCTRINE.

NEW YORK:
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1888.

NOTE TO THE AMERICAN EDITION.

THE great prominence which the modern doctrine of the Conservation of Energy or Correlation of Forces has lately assumed in the world of thought, has made a simple and popular explanation of the subject very desirable. The present work of Dr. Balfour Stewart, contributed to the International Scientific Series, fully meets this requirement, as it is probably the clearest and most elementary statement of the question that has yet been attempted. Simple in language, copious and familiar in illustration, and remarkably lucid in the presentation of facts and principles, his little treatise forms just the introduction to the great problem of the interaction of natural forces that is required by general readers. But Professor Stewart having confined himself mainly to the physical aspects of the subject, it was desirable that his views should be supplemented by a statement of the operation of the principle in the spheres of life and mind. An Appendix has, accordingly, been added to the American edition of Dr. Stew-

art's work, in which these applications of the law are considered.

Professor Joseph Le Conte published a very able essay fourteen years ago on the Correlation of the Physical and Vital Forces, which was extensively reprinted abroad, and placed the name of the author among the leading interpreters of the subject. His mode of presenting it was regarded as peculiarly happy, and was widely adopted by other writers. After further investigations and more mature reflection, he has recently restated his views, and has kindly furnished the revised essay for insertion in this volume.

Professor A. Bain, the celebrated Psychologist of Aberdeen, who has done so much to advance the study of mind in its physiological relations, prepared an interesting lecture not long ago on the "Correlation of the Nervous and Mental Forces," which was read with much interest at the time of its publication, and is now reprinted as a suitable exposition of that branch of the subject. These two essays, by carrying out the principle in the field of vital and mental phenomena, will serve to give completeness and much greater value to the present volume.

New York, *December*, 1873.

P R E F A C E.

WE may regard the Universe in the light of a vast physical machine, and our knowledge of it may be conveniently divided into two branches.

The one of these embraces what we know regarding the structure of the machine itself, and the other what we know regarding its method of working.

It has appeared to the author that, in a treatise like this, these two branches of knowledge ought as much as possible to be studied together, and he has therefore endeavored to adopt this course in the following pages. He has regarded a universe composed of atoms with some sort of medium between them as the machine, and the laws of energy as the laws of working of this machine.

The first chapter embraces what we know regarding atoms, and gives also a definition of Energy. The various forces and energies of Nature are thereafter enumerated, and the law of Conservation is stated. Then follow the various transmutations of Energy, according to a list, for which the author is indebted to Prof. Tait. The fifth chapter gives a short historical sketch of the subject, ending with the law of Dissipation; while the sixth and last chapter gives some account of the position of living beings in this universe of Energy. B. S.

*The Owens College, Manchester,
August, 1873.*

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