

**THE INTERNATIONAL
SCIENTIFIC SERIES. VOL.
VII. THE CONSERVATION
OF ENERGY**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649555000

The International Scientific Series. Vol. VII. The Conservation of Energy by Balfour Stewart

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

www.triestepublishing.com

BALFOUR STEWART

**THE INTERNATIONAL
SCIENTIFIC SERIES. VOL.
VII. THE CONSERVATION
OF ENERGY**

THE INTERNATIONAL SCIENTIFIC SERIES.

VOL. VII.

THE INTERNATIONAL SCIENTIFIC SERIES.

Works already Published.

- I. THE FORMS OF WATER IN RAIN AND RIVERS, ICE AND GLACIERS. By J. TYNDALL, LL.D., F. R. S. With 26 Illustrations. Price, \$1.50.
- II. PHYSICS AND POLITICS; OR, THOUGHTS ON THE APPLICATION OF THE PRINCIPLES OF "NATURAL SELECTION" AND "INHERITANCE" TO POLITICAL SOCIETY. By WALTER BAGHOT. Price, \$1.50.
- III. FOODS. By DR. EDWARD SMITH. Illustrated. Price, \$1.75.
- IV. MIND AND BODY: THE THEORIES OF THEIR RELATIONS. By ALEXANDER BAIN, LL.D. Price, \$1.50.
- V. THE STUDY OF SOCIOLOGY. By HERBERT SPENCER. Price, \$1.50.
- VI. THE NEW CHEMISTRY. By PROFESSOR JOSIAH P. COOKE, of Harvard University. Illustrated. Price, \$2.00.
- VII. ON THE CONSERVATION OF ENERGY. By PROFESSOR DALFOUR STEWART. Fourteen Engravings. Price, \$2.50.
- VIII. ANIMAL LOCOMOTION; OR, WALKING, SWIMMING, AND FLYING. By Dr. J. B. PETTIGREW, M. D., F. R. S. 119 Illustrations. Price, \$1.75.
- IX. RESPONSIBILITY IN MENTAL DISEASE. By DR. HENRY MAUDSLEY. Price, \$1.50.
- X. THE SCIENCE OF LAW. By PROFESSOR SHELDON AMOS. Price, \$1.75.
- XI. ANIMAL MECHANISM; OR, AERIAL AND TERRESTRIAL LOCOMOTION. By C. J. MAREY, Professor of the College of France; Member of the Academy of Medicine, Paris. 117 Engravings. Price, \$1.75.

THE INTERNATIONAL SCIENTIFIC SERIES.

THE
CONSERVATION OF ENERGY.



BY

BALFOUR STEWART, LL. D., F. R. S.,

PROFESSOR OF NATURAL PHILOSOPHY AT THE OWENS COLLEGE, MANCHESTER.

WITH AN APPENDIX,

TREATING OF THE VITAL AND MENTAL APPLICATIONS OF THE
DOCTRINE.

NEW YORK:
D. APPLETON AND COMPANY,
549 & 551 BROADWAY.
1875.

Entered, according to Act of Congress, in the year 1874, by
D. APPLETON & COMPANY,
In the Office of the Librarian of Congress, at Washington.

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.