

SCIENCE

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CONTENTS:

<i>The Mathematical Theory of the Top</i> : PROFESSOR CARL BARUS.....	469
<i>The Transmission of Radiant Heat by Gases at Varying Pressures</i> : CHARLES F. BRUSH.....	474
<i>The Breeding of Animals at Woods Holl during the Month of March, 1898</i> : PROFESSOR H. C. BUMPUS.....	485
<i>The Anniversary Meeting of the American Association for the Advancement of Science</i>	487
<i>Current Notes on Physiography</i> :— <i>Waterfall Lakes in Central New York; Eskers in Ireland; Desert Conditions in Britain</i> : PROFESSOR W. M. DAVIS.....	489
<i>Current Notes on Anthropology</i> :— <i>Ontario Archæological Report; The Pueblo of Taos</i> : PROFESSOR D. G. BRINTON.....	491
<i>Notes on Inorganic Chemistry</i> : J. L. H.....	491
<i>Scientific Notes and News</i>	492
<i>University and Educational News</i>	495
<i>Scientific Literature</i> :— <i>Living Plants and their Properties</i> : PROFESSOR CHARLES E. BESSEY. <i>Scudder's Revision of the Orthopteran Group Melanopoli (Acrididæ)</i> : SAMUEL HENSHAW. <i>Roth's Ethnological Studies in Queensland</i> : PROFESSOR D. G. BRINTON. <i>Norton on Artesian Wells in Iowa</i> : PROFESSOR W. HALLOCK. <i>Thompson on the Mystery and Romance of Alchemy and Pharmacy</i> : DR. H. CARRINGTON BOLTON.....	496
<i>Scientific Journals</i>	500
<i>Societies and Academies</i> :— <i>Biological Society of Washington</i> : F. A. LUCAS. <i>Geological Society of Washington</i> : DR. W. F. MOSELL. <i>Philosophical Society of Washington</i> : E. D. PRESTON. <i>Engelmann Botanical Club</i> : HERMANN VON SCHRENK. <i>New York Academy of Sciences, Section of Geology and Mineralogy</i> : PROFESSOR RICHARD E. DODGE. <i>New York Section of the American Chemical Society</i> : DR. DURAND WOODMAN. <i>Alabama Industrial and Scientific Society</i> : PROFESSOR EUGENE A. SMITH.....	501

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THE MATHEMATICAL THEORY OF THE TOP.*

Looking over such famous old books as Montmort's 'Analyse des jeux de hasard' or Moivre's 'Doctrine of Chances' one regrets that so much excellent mathematics should have been wasted on games most of which are wholly obsolete. Coriolus in his 'Jeu de billard' (1835) fared better, for the game is still very much alive and its dynamical terrors unsubdued. In even greater measure is this true of the top. The top has been everybody's toy and must, therefore, at one time or another have piqued everybody's curiosity. Lagrange, Poinso, Jacobi, not to mention other great names, have in their turn paid tribute; yet the top may be set spinning to-day, unhampered by a completed theory to account for its evolutions.

Among recent contributions we may refer in particular to Professor A. G. Greenhill's† noteworthy papers, in which the algebraically accessible or pseudo-elliptic cases, such in which the integrations are possible in terms of circular functions, are worked out in full. Physicists will be grateful to Professor Greenhill for the concrete exhibition given of this complex motion. The

* Lectures delivered on the occasion of the sesquicentennial celebration of Princeton University, by Felix Klein, pp. 1-74, edited by Professor H. B. Fine. New York, Charles Scribner's Sons, 1897.

† Greenhill: Applications Elliptic Functions, Proc. Lond. Math. Soc., 1895, 1896; *Engineering*, July, 1896.