History of the Relationship Between Mathematics and the Physical Sciences (CSHPM)
Liens historiques entre mathématiques et sciences physiques (SCHPM)

(Org: **Tom Archibald** (SFU))

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John Playfair in the Natural Philosophy Classroom

While textbooks are deservedly considered valuable and interesting primary sources by mathematicians as well as by historians of mathematics education, these materials generally provide little insight into how classes were conducted each day or into what students actually learned. To develop a more complete picture of educational practice, textbooks must be combined with information gleaned from administrative records, student notebooks, student reminiscences, obituaries, and the like. Unearthing that sort of documentation, though, often depends as much on serendipity as on systematic research. John Playfair (1748–1819) served as professor of mathematics and then of natural philosophy at the University of Edinburgh. In addition to *Elements of Geometry* and *Illustrations of the Huttonian Theory of the Earth*, the books for which he is best known, he organized his lectures into *Outlines of Natural Philosophy* (2 vols., Edinburgh, 1812–1814). There are also at least five extant sets of notes taken by students who attended his natural philosophy course.

This paper will analyze as many of these notes as possible, focusing especially on the following questions: How closely do the notes conform to each other and to the textbook? Did the material Playfair covered change over time, such as before and after *Outlines* was published or when he revised the textbook in 1816 and 1819? Did the fact that he was primarily a mathematician early in his career inform his choice of topics and the manner in which he presented them? Were there aspects of the course that were uniquely Scottish?

TOM ARCHIBALD, Simon Fraser University

Henri Poincaré and the Rings of Saturn

Poincaré's interest in the equilibrium shape of rotating fluids under gravitation probably dated to his early studies of celestial mechanics, with significant discoveries of bifurcation points in the Jacobian series of equilibrium figures published in 1885. This led him to a conjecture that the bifurcations associated with the sequence of zonal harmonics led to systems of a planet with increasingly many moons. this conjecture was, in Chadrasekhar's words, "so intoxicating that those who followed Poincaré were not able to recover from its pursuit". Be that as it may, this interest motivated a course at the Sorbonne in 1900, and the culmination of this course was a discussion of the rings of Saturn. Basing his discussion on work of both Kovalevskaya and Maxwell, he argued that the rings could not be solid or liquid. In this paper we give an outline of these developments and the reasons why the question was considered important.

MENOLLY LYSNE, Simon Fraser University

Patronage and Laplace's Early Career.

Pierre Simon Laplace arrived in Paris in 1769 and immediately made the acquaintance of one of the most powerful mathematical figures in France, Jean Le Rond d'Alembert. Through mathematical ability and this powerful patron, Laplace was able to quickly obtain employment and even membership in the Academy of Science. In this talk I will investigate Laplace's early career and how the memoir "Sur le principe de la gravitation universelle et sur les inégalités séculaire des planètes qui en dépendent" demonstrates how his academic career was shaped with the help of the leading figures of the day.

ROBERT MOIR, University of Western Ontario

The Conversion of Phenomena to Theory: Lessons on Applicability from the Early Development of Electromagnetism

Many considerations of the problem of the applicability of mathematics, focusing on 20th century physics, have found the successful application of abstract mathematics to physical theory in that century mysterious. A notable example is Mark Steiner who has argued that the success of the forms of argumentation used to develop quantum theories, many of which are kinds of mathematical analogy, apparently defies naturalistic explanation. Insight into the reasons for the successful application of mathematics can be gained, however, through an examination of the development of earlier theories. The consideration of 19th-century physics is of particular interest since not only is this the century that saw the rise of many of the theories that would form the foundation for the development of 20th-century physics, but it is in this century that physicists began to understand how to use mathematics to understand what the world is like underneath the phenomena of experience. In this paper I will examine a key period in the early development of electromagnetic theory, namely the conversion of the available knowledge of the phenomena, knowledge developed in large measure by Faraday, into a mathematical theory, primarily in the work of William Thomson and Maxwell. An examination of this episode clarifies how knowledge of phenomena is converted into a crystallized mathematical form, which provides clues as to how to account for the apparently mysterious success of mathematics as applied to 20th-century physics.

DAVID ORENSTEIN, Toronto

Helen Hogg's Mathematical Methods for Variable Star Light Curves, in the Hercules Cluster, M13

Helen Hogg (1904–1993) worked at the University of Toronto's David Dunalp Observatory from its opening in 1935 into her emerita years, maintaining a leadership in the variable stars of globular clusters. Her mid-20th century mathematical methods are revealed by a detailed study of her research file on M13 (NGC 6205) now held by the University of Toronto Archives.

JOSIPA PETRUNIC, University College London

P. G. Tait's Engagements with Quaternion Analysis, 1880 to 1900

In the preface to his Scientific Papers (1898), Tait contends that his early quaternion publications were mostly composed on his own, prior to any significant correspondence with Hamilton. Tait states: "These were written while I was endeavouring to familiarise myself with the new calculus, and were, in great part, worked out before I had any communication with Sir W. R. Hamilton except through his Lectures ; a fascinating book, ... When I made Hamilton's acquaintance a year or two later, . . . I submitted to him some of the more formidable difficulties which I had met in the study of his great work, and the hints I thus obtained were of much use to me in finally preparing these papers for publication" (Tait 1898: v). There is reason to argue, however, that Tait's rendering of his engagement with quaternions is questionable. His correspondence with Hamilton from 1858 to 1860 indicates that more than just a "few hints" were passed from Hamilton to Tait. Indeed, the two mathematicians relied heavily upon one another to legitimate their developing ideas. Tait's claim in 1898 that he had worked solo should, therefore, be read as part of his own legitimation efforts—efforts coloured by the fact that Tait was engaged in debates with Gibbs and Heaviside over their respective development of vector analysis (which ignored aspects of the quaternion system). Tait's account of his engagement with Hamilton is meant to recollect the past to situate himself at the forefront of quaternion research as it had unfolded in the middle of the century.

In this paper, I will explore Tait's engagements with quaternion analysis from 1880 to 1900—a time when he perceived himself to be in a battle for priority and primacy in the development of vector analysis. I will argue that his reconstructions of the past are romanticized and inaccurate accounts of how Tait initially engaged with quaternions from 1858 to 1870—accounts that he produced in order to legitimate his continued role in the development of quaternion mathematics.