CSHPM SCHPM

Annual Meeting of the Canadian Society for History and Philosophy of Mathematics / Société canadienne d'histoire et de philosophie des mathématiques

3rd Joint Meeting with the Canadian Mathematical Society
Memorial University
St. John's, Newfoundland
6-8 June 2009

Saturday June 6, 2009

9:45-10:30 CSHPM / SCHPM Executive Council Meeting in A-1046

General Session – Arts and Administration Building A-1046

10:30 - 10:55 Gregg de Young
Ziyādāt Literature: An Early Form of Commentary in the Arabic Euclidean Tradition

11:00 - 11:25 Charlotte Simmons
Benjamin Gompertz: Pioneer of Actuarial Science

11:30 - 11:55 Bruce Petrie
Why Euler Didn't Prove the Irrationality of π: A Chapter in the History of Transcendence

12:00-2:00 CSHPM / SCHPM Annual General Meeting in A-1046

General Session – Arts and Administration Building A-1046

2:00 - 2:25 J.J. Tattersall
A Late Nineteenth Century Mathematical Subculture

2:30 - 2:55 Maria Zack
Robert Hooke and an Attempt to Prove the Motion of the Earth from Observations

4:15 - 4:40 Byron Wall
Some 19th century arguments for the rational assignment of probabilities for possible events in Nature

4:45 - 5:10 Andrew Perry
Isaac Greenwood and the Earliest American Textbooks

5:15 - 5:40 Roger Godard
Some examples of eigenvalue problems in mathematical physics

Sunday, June 7, 2009

General Session – Arts and Administration Building A-1046

8:30 - 8:55 Bruce Burdick
Mathematics and Astrology in the Printed Works of the Americas before 1700

Special Session – Arts and Administration Building A-1046
History of the Relationship Between Mathematics and the Physical Sciences

9:00 - 9:25 David Orenstein
Helen Hogg's Mathematical Methods for Variable Star Light Curves, in the Hercules Cluster, M13

9:30 - 9:55 Amy Ackerberg-Hastings
John Playfair in the Natural Philosophy Classroom

Kenneth O. May Lecture – Inco Innovation Centre IIC-2001

10:30 - 11:15 Jeremy Gray
Mathematics, motion, and truth: the Earth goes round the Sun

Special Session – Arts and Administration Building A-1046
History of the Relationship Between Mathematics and the Physical Sciences

2:00 - 2:25 Josipa Petrunic
P. G. Tait's Engagements with Quaternion Analysis, 1880 to 1900

2:30 - 2:55 Robert Moir
The Conversion of Phenomena to Theory: Lessons on Applicability from the Early Development of Electromagnetism

4:15 - 4:40 Menolly Lysne
Patronage and Laplace's Early Career

4:45 - 5:10 Tom Archibald
Henri Poincaré and the Rings of Saturn

Monday, June 8, 2009

General Session – Arts and Administration Building A-1046

8:00 - 8:25 Michael Molinsky
The Mathematical Education of a Founding Father: John Adams

8:30 - 8:55 Marina Vulis
Early Mathematics Russian Mathematics Textbooks

9:00 - 9:25 Hardy Grant
Eighteenth-century mathematics: the naysayers

2:00 - 2:25 V. Frederick Rickey
Choosing Department Heads at West Point

2:30 - 2:55 Joel Silverberg
Nathaniel Torporley and his Diclides Coelometricae (1602) - A Preliminary Investigation

3:00 - 3:25 W. Jim Jordan
Structuralist Mirages on the Road from Antiquity: Why the Ancient Greek Mathematicians Were Not Mathematical Structuralists

3:30 - 3:55 Gregory Lavers
Frege the conventionalist and Carnap the Fregean

Abstracts – Alphabetical by Author
CSHPM Annual Meeting
June 6-8, 2009

AMY ACKERBERG-HASTINGS, University of Maryland, University College, Adelphi, MD, USA
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 Chandrasekhar'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.

BRUCE BURDICK, Roger Williams University, Bristol, RI 02809, USA
Mathematics and Astrology in the Printed Works of the Americas before 1700

The talk will explore how the popularity of astrology before 1700 led mathematically trained authors in the New World to publish locally printed books in that field to supplement what was available from Europe. Such authors often were able to include mathematical exposition at a level that would not be associated with popular astrology today. Examples will include an astrologically motivated history from Mexico, an astrology text from Peru, and almanacs from British North America.

GREGG DE YOUNG, The American University in Cairo, Cairo, Egypt
Ziyādāt Literature: An Early Form of Commentary in the Arabic Euclidean Tradition

The use of *ziyādāt* (additions of propositions) is one of several forms that commentary on the medieval Arabic Euclidean corpus could assume. Like many genres of Euclidean commentary, its boundaries are not sharply and clearly delineated. Sometimes these additions occur individually, at other times they occur in blocks, almost as a separate sub-unit in the Euclidean tradition. These propositions are usually introduced either to fill a perceived logical lacuna in the Euclidean text or to complete a topic that Euclid did not, apparently, judge to be essential to his mathematical argument. For purposes of this paper, I shall confine myself to blocks of propositions which were specifically identified as additions. The best-known *ziyādāt* are those ascribed to al-Jawharī (fl. 3rd century AH / AD 9th century) and to Abū Sahl al-Qūhī (fl. early 4th century AH / AD 10th century). This paper uses these early *ziyādāt*, along with a block of newly analyzed propositions added to Book VI by al-Antākī (died 376 AH / AD 987) in his now incomplete Arabic commentary on the *Elements*, to introduce the general characteristics of *ziyādāt* literature. I argue that these *ziyādāt*, although one of the less studied forms of Euclidean commentary in Arabic tradition, offer insight into the concerns of early Islamic mathematicians as they encounter the Euclidean corpus.

ROGER GODARD, RMC, 92 Florence Street, Kingston, ON, K7M 1Y6
Some examples of eigenvalue problems in mathematical physics

In his 1834 "Essay on the Philosophy of Sciences", André-Marie Ampère made the distinction between the elementary general physics and the mathematical physics. The first branch of physics was related to observations and experiments. The second branch considered physical laws, correlations with experiments, the explanation of phenomena. Among these problems of mathematical physics, the eigenvalue problems and the Helmholtz equation are fundamental. In this work, we comment on a important and thick memoir written by Siméon Denis Poisson in 1829, "Sur l'équilibre et le mouvement des corps élastiques", Lord Rayleigh's influence on Irwin Schrödinger, and finally the first attempts of the numerical solutions of the Helmholtz equation with Runge, Liebmann, and R. G. D. Richardson.

HARDY GRANT, York University, Toronto
Eighteenth-century mathematics: the naysayers

Some skepticism attended the dramatic Enlightenment progress made in mathematics and in its applications. The most interesting dissent came from certain observers who could claim to be well informed and even sympathetic. Diderot and Buffon urged that mathematics is too tautologous and abstract to have more than a limited role in natural philosophy, and that its study was therefore destined to become increasingly marginal. I shall try to set these assertions in context, and I shall cite another famous figure of that age who countered them-cogently, as history would prove.

JEREMY GRAY, Open University, Milton Keynes, MK7 6AA, UK
Mathematics, motion, and truth: the Earth goes round the Sun

The reality of the Earth's motion, as proclaimed by Copernicus, quickly proved contentious. Accepted by Kepler, disputed by theologians (Lutheran and Catholic alike), veiled in suggestions of mere convenience, adopted and explained by Newton as a consequence of universal gravitation, parent of the notion of force-what is involved in accepting as true that the Earth goes round the Sun? This talk traces these debates from the early 1600s to the time of Poincaré.

W. JIM JORDAN, University of Waterloo, 200 University Avenue W., Waterloo, ON, N2L 3G1
Structuralist Mirages on the Road from Antiquity: Why the Ancient Greek Mathematicians Were Not Mathematical Structuralists

H. G. Zeuthen and B. L. van der Waerden understand ancient Greek mathematics to be purely algebraic, even the vast body of geometrical work within it. Ian Mueller, through an examination of Euclid's Elements, shows that Euclid, at least, did not have anything resembling modern algebra and algebraic structure in view when he set down his principles and demonstrations. I give some examples of how a structuralist interpretation of Euclid could possibly be discerned. I then show that Euclid, though he had a structure to his work, likely did not do his work within a modern mathematical structuralist framework. I continue with an examination of three later ancient mathematicians (Nicomachus, Diophantus, and Pappus), and show that, like Euclid, they did not reveal any structuralist understanding in their works. I conclude that the attribution of mathematical structuralism as an intentional aspect of ancient Greek mathematics is mistaken.

GREGORY LAVERS, Concordia University
Frege the conventionalist and Carnap the Fregean

I begin by identifying passages in Frege's work that count against the standard interpretation of Frege as being a platonist of the most extreme sort. The goal is not to argue that Frege was not a platonist, but that there are at least some conventionalist tendencies in Frege's work. I then outline Carnap's position on matters in the foundations of logic and mathematics. I argue that the differences between the positions of these two philosophers can be traced to a disagreement about just a few theses. I point out that given technical developments between Frege and Carnap's time, Frege's position on these points becomes untenable. In this sense we can see Carnap as holding a maximally Fregean position on the nature of logical and mathematical knowledge.

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.

MICHAEL MOLINSKY, University of Maine at Farmington
The Mathematical Education of a Founding Father: John Adams

Although John Adams made no significant contributions to the field of mathematics, his life provides an opportunity to investigate the study of mathematics at the time of the American Revolution. This talk will examine Adams' education, explore some of the mathematical works in his personal library, and present several recreational mathematics problems found in his journals.

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 Dunlap 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.

ANDREW PERRY, Springfield College
Isaac Greenwood and the Earliest American Textbooks

Isaac Greenwood's "Arithmetick Vulgar and Decimal: with the Application thereof to a Variety of Cases in Trade and Commerce" (1729) is now thought to be the oldest mathematics textbook written by an American. Apparently, Greenwood's book was quickly forgotten by Americans, since Nicolas Pike's "A New and Complete System of Arithmetic, Composed for the Use of Citizens of the United States" (1788) was also thought to be the first American textbook at it time of publication. We will consider Greenwood's text in the context of similar volumes of its era.

BRUCE PETRIE, Institute for the History and Philosophy of Science and Technology at the University of Toronto, Toronto, Ontario
Why Euler Didn't Prove the Irrationality of π: A Chapter in the History of Transcendence

This paper is part of an ongoing study by the author to determine whether Leonhard Euler considered the irrationality of π adequately demonstrated or if he believed that the problem required new tools or methods. Using Euler's criteria of rigor evident in his proof that e is irrational, as set out in his *Introductio* (1748) and documented by Ed Sandifer (2006), the paper shows that previous proofs of π's irrationality by William Brouncker, John Wallis, and Euler himself failed to satisfy these rigorous standards. A fully satisfactory proof of the irrationality of π was obtained by Johann Lambert in 1768 using new methods devised for this purpose. In his investigation Lambert relied heavily on Euler's exposition of continued fractions. The paper examines the state of Euler's work on the problem in relation to these contemporary researches of Lambert.

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.

V. FREDERICK RICKEY, West Point, West Point, NY 10996, USA
Choosing Department Heads at West Point

If you were looking to hire a mathematician to teach at your institution around 1800, who would you hire and why? Even though this was a Presidential appointment, why would Lagrange or Lacroix move from cosmopolitan Paris to West Point, New York, an isolated outpost on the Hudson River ninety kilometers north of New York City? There was an aversion in the United States army against hiring anyone French. Gauss was famous for discovering Ceres, but not yet for his mathematics. An English speaker was needed, but it was not considered fair to steal a faculty member from another school even by the President. This problem has arisen and has been solved 21 times since the Military Academy was founded in 1802. Were the methods of solution all the same or has the hiring process changed over time? Our purpose here is to illustrate the dramas involved: sometimes the mathematician had a connection with the U.S. President, sometimes there was family connection, and on occasion the person selected was the most qualified army officer for the job. The most interesting case was when a national search was conducted, a search that included some prominent civilian mathematicians.

JOEL SILVERBERG, Roger Williams University, Bristol, Rhode Island, USA
Nathaniel Torporley and his Diclides Coelometricae (1602)-A Preliminary Investigation

Torporley is perhaps one of the more interesting and enigmatic mathematical figures of 15th and 16th century England. Attracting the patronage of Henry Percy, ninth Earl of Northumberland, Torporley served as personal secretary to François Viète, and was a mathematical colleague and trusted friend of Thomas Harriot. He was chosen by Harriot to prepare his manuscripts for posthumous publication.

Yet he was also a figure of controversy. Delambre in his *Astronomie Moderne* (1821) refers to the tables presented in *Diclides* as "the most obscure and incommodious that ever were made". Two decades later Augustus De Morgan in *The Penny Cyclopedia* (1838) and again in a note to the *Philosophical Magazine and Journal* (1843) both praises and condemns *Diclides,* giving the work credit for discovering the essence of Napier's Rules twelve years before Napier, while at

the same time describing it as "the greatest burlesque on mnemonics we ever saw".

The language, forms of expression and the Latin usage are indeed close to impenetrable. Even the title of the work is obscure and the mathematics filled with everything from rebuses to verse. De Morgan abandoned his attempt to explain this work with the comment that "those who like such questions may find out the meanings of the other parts of the tables". I will describe the nature of this enigmatic work and share such progress in deciphering and decoding the *Diclides* as I have made at this time.

CHARLOTTE SIMMONS, University of Central Oklahoma, 100 N. University, Box 129, Edmond, OK 73012
Benjamin Gompertz: Pioneer of Actuarial Science

In this talk, we investigate the contributions of actuarial pioneer Benjamin Gompertz, known for his capacity to sustain the complex computation required to generate "tables of lives and tables of stars", to the field of actuarial science. Gompertz is best known today for his Law of Mortality, an extremely powerful tool in the study of mortality and the creation of life tables for actuaries. The significance of this law will be examined. Additionally, we will discuss the contributions of friend and staunch supporter, Augustus De Morgan, to the field, both direct (via his own work) and indirect (via his defense of Gompertz during the Edmonds-Gompertz controversy). Because of De Morgan's efforts, Edmonds is "now remembered only for the disparagement of the work of a man of genius", while Gompertz is remembered "because his outstanding brilliance as a mathematician was equalled by his modesty and generosity".

J. J. TATTERSALL, Providence College, Providence, RI 02918, USA
A Late Nineteenth Century Mathematical Subculture

In the second half of the nineteenth century, in an attempt to promote mathematics, a number of recreational mathematicians published mathematical journals and edited mathematical columns. The most prominent among them was William J. C. Miller who edited a mathematics column in the Educational Times and published Mathematical Questions and Their Solutions from the Educational Times in London. In America, Artemas Martin published the Mathematical Visitor and Mathematical Magazine, J. E. Hendricks published The Analyst: A Journal of Pure and Applied Mathematics, and Benjamin Finkel the American Mathematical Monthly. Mathematical columns were edited by William Hoover in the Wittenburger, Samuel Hart Wright in the Yates County Chronicle, W. D. Henkle in the Educational Notes and Queries: A Medium of Intercommunications for Teachers, H. A. Wood in the National Educator, E. T. Quimby in the New England Journal of Education, and Archibald

MacMurchy in the Canada Educational Monthly and School Chronicle. These publications consist mainly of articles, brief biographies of the contributors, obituaries, and mathematical problems for solution. We discuss a few of the publications, their editors, their contributors, and problems that appeared in them.

MARINA VULIS, Norwalk Community College
Early Mathematics Russian Mathematics Textbooks

In 1703, Leontiy Magnitskiy published *Arifmetika*, the first Russian mathematics textbook. Magnitsky taught mathematics at the Mathematics and Navigation School, the first school in Russia in which mathematics was an important subject. *Arifmetika* was the first mathematics textbook written by a Russian author in Russian. It was a comprehensive mathematics textbook, and contained material on arithmetic, algebra, geometry, trigonometry, and navigation.

Arifmetika was an important book in developing mathematics education in Russia. We will discuss the teaching career of Leontiy Magnitskiy and the contents of his *Arifmetika*.

BYRON WALL, York University, 4700 Keele St., Toronto, ON, M3J 1P3
Some 19th century arguments for the rational assignment of probabilities for possible events in Nature

Countless decisions are made every day by each of us individually and collectively through our governments and other institutions, about what actions to take in the present in order to optimize a future in which many possible outcomes are more than moderately uncertain. At a personal level, we make these decisions intuitively, based on past experience. At the institutional and government level, we increasingly rely upon quantitative statistical projections and risk assessments. A great deal of interesting and well-worked out mathematics goes into these projections. Most of the mathematics is based upon models in which probabilities can be specified with precision. But the usefulness and reliability of these models depends crucially upon how well the tidy world of the model compares to an incompletely understood nature.

The history of probability and statistics is peppered with arguments, sometimes vociferous, over the assignment of a probability to events in nature, both those that are agreed to be highly probable, such as whether the sun will rise tomorrow, and those that are deemed highly improbable, such as what the chances are of snow in July, or living to the age of 200, or invasion from outer space. In the late 19th century, these arguments were carried on by respectable mathematicians and philosophers who were seeking to find solid ground for inference from incomplete information, the basis of statistics. This talk will explore some of that debate.

MARIA ZACK, Point Loma Nazarene University
Robert Hooke and an Attempt to Prove the Motion of the Earth from Observations

After the Great London Fire of 1666, Robert Hooke was appointed to work in the office of the City Surveyor of London. With that appointment, a scientist best known as the Curator of Experiments for the Royal Society whose research encompassed both the microscopic (Micrographia) and the astronomical, embarked on a second career as an architect and surveyor. For the next several decades the massive effort to reconstruct London was lead by Hooke and his long-time friend, fellow scientist and co-founder of the Royal Society, Christopher Wren.

Hooke was involved extensively in all aspects of the rebuilding of London, both the mundane (widening streets and establishing property boundaries) and the creative (designing churches and civic buildings). One of Hooke's few surviving buildings is the column that is the Monument to the Great Fire. This ingenious building is an excellent example of the intersection between Hooke's architectural and scientific work.

At the time of the Monument to the Great Fire's design, Hooke was conducting experiments on both the motion of the earth which he describes in An Attempt to Prove the Motion of the Earth from Observations. Hooke was particularly interested in using the measurement of the parallax to prove that earth revolved around the sun and the Monument was designed to be a zenith telescope to further that research. This talk will discuss Hooke's paper, the history of attempts to measure the parallax and how this scientific work influenced the design and construction of the Monument.