

**Canadian Society for the
History and Philosophy
of Science Annual
Conference / Congrès
annuel de la Société
canadienne d'histoire et
de philosophie des
sciences**

PROGRAMME

28-30/5/2016

**University of Calgary
Calgary, Alberta
Canada**

Part of the Congress of the Humanities and Social
Sciences / dans le cadre du Congrès des sciences
humaines

**2016
SHPS
SHPS**

FRIDAY MAY 27

18:00 - 20:00 Executive Meeting / Réunion du Comité Exécutif

SATURDAY MAY 28

8:45 - 10:15
ICT 114

RACE AND GENDER

Chair: Eleanor Louson, York University

[Color Struck: Dermatology and Melanin Sciences as Liberationist Tools](#)

J. Cecilia Cárdenas-Navia Yale University

[Émergence d'une « physiologie critique » dans le milieu universitaire états-unien de l'après 1968 : repères historiques et implications épistémologiques](#)

Mathieu Arminjon Université de Genève

[The Biological Reality of Race does not underwrite the Social Reality of Race: A Response to Spencer](#)

Kamuran Osmanoglu University of Kansas

8:45 - 10:15
ICT 116

SCIENTIFIC EXPLANATION

Chair: Kirsten Walsh, University of Bucharest

[Getting the picture: Towards a new account of scientific understanding](#)

Letitia Meynell Dalhousie University

[Explanatory Understanding in Systems Biology without Mechanistic Explanation](#)

Ingo Brigandt University of Alberta

[Unification by Counterfactual Dependency Relations](#)

Corey Sawkins University of Guelph

8:45 - 10:15
ICT 121

MEDICAL TECHNOLOGY AND EDUCATION

Chair: Susan Lamb, University of Ottawa

["By Means of X-Ray Shadows:" X-Ray Technology in the Curriculum at Queen's-Affiliated Medical Colleges](#)

James McNutt Queen's University

[Clodomiro Picado Twight - découvreur de la pénicilline \(?\) et « Benemérito de la Patria »](#)

James Crombie Université Sainte-Anne

["Of course, the microscopic work must be taken on trust": Educating the Blind in Victorian-Era Science](#)

Joanna L. Pearce York University

10:15 - 10:30

COFFEE BREAK

10:30 - 12:00
ICT 114

SEX, ART, AND ESSENTIALISM: NEW PERSPECTIVES ON HPC KINDS

Chair: Ingo Brigandt, University of Alberta

[Aristotle and the Essentialism Story](#)

Justin Bzovy University of Western Ontario

[Sexed Kinds and Sex Concepts](#)

Esther Rosario University of Alberta

[Art as a Social Kind](#)

Emine Hande Tuna University of Alberta

10:30 - 12:00
ICT 116

SCIENTIFIC MODELS

Chair: Isaac Record, Michigan State University

[Can Scientific Models Explain?](#)

Erlantz Etxeberria University of Western Ontario

[Chunk and Permeate Inferences in Regional Climate Models](#)

Bryson Brown University of Lethbridge

[What do scientific models represent? A Peircean response](#)

Sergio A. Gallegos Metropolitan State University of Denver

10:30 - 12:00
ICT 121

DISEASES AND DISEASE CONCEPTS IN HISTORY

Chair: Jacalyn Duffin, Queen's University

[Are diseases "entities" or "processes"? Narratives and disease concepts in twentieth-century medical history](#)

Pierre-Olivier Méthot Université Laval

[In reality diseases do not exist, sick people do!" – Ludwik Fleck on the concept of "disease entities](#)

Martina Schlünder University of Toronto

[Should we even try to identify diseases in the past?](#)

Andrew Cunningham University of Cambridge

[History as tracking the evolution of our knowledge of disease](#)

Nicholas Binney University of Exeter

Joint session with the Canadian Society for the History of Medicine / Session conjointe avec la Société canadienne d'histoire de la médecine. This session is made possible in part thanks to the Aid for Interdisciplinary Sessions Programme of the Canadian Federation for the Humanities and Social Sciences (CFHSS) / Cette session est rendue possible grâce au support financier du fonds de soutien pour les séances interdisciplinaires de la FCSH

12:15 - 13:15

LUNCH BREAK / BIG THINKING LECTURE

[The power of change: Leadership, community and resiliency](#)

His Worship Naheed Nenshi, Mayor, City of Calgary, Alberta

13:30 - 15:00
ICT 114

INVESTIGATING TECHNOLOGIES OF NATIONHOOD: RACE, BELONGING, BIOLOGISM

Chair and organiser: OmiSoore Dryden, Thorneloe University

[Genetic Technologies and the Biological Race-ing of Blood: Blood Donation and the Imagined Community](#)

OmiSoore Dryden Thorneloe University

[Technologies of Return: DNA Databasing, Biologism, and Transnational Asian Adoption](#)

Jenny Heijun Wills University of Winnipeg

[Genetic Genealogy and the Politics of Race: The Case of Québec](#)

Darryl Leroux Saint Mary's University

13:30 - 15:00
ICT 116

CONCEPTUALIZING FUNCTIONS IN ECOLOGICAL, SOCIAL-ECOLOGICAL AND EARTH SYSTEMS

Chair: Pierre-Olivier Méthot, Université Laval. Organiser: Antoine Dussault, University of Toronto

[The geofunctions perspective: Between geoengineering and Gaia theory](#)

Gillian Barker University of Western Ontario

[Ecological functions as ahistorical and contextual properties](#)

Antoine C. Dussault University of Toronto and Université Paris I/IHPST

[What is the ecological function of keystone species?](#)

Sophia Rousseau-Mermans Université de Montréal and Université Paris I/IHPST

[On the meaning of social-ecological "coevolution"](#)

Eric Desjardins University of Western Ontario

13:30 - 15:00
ICT 121

20TH CENTURY SCIENCE

Chair: Conor Burns, Ryerson University

[Cool Relations: Science and Mountaineering on the Juneau Icecap, 1948-51](#)

Dani Inkpen Harvard University

[Contested Truths in Agriculture: Could the Dirty Thirties Have Been Prevented?](#)

Anthony Penders Tacoma Community College

[Science, Culture and Metaphysics in Edwardian England](#)

Richard Feist Saint Paul University

15:00 - 15:15

COFFEE BREAK

15:15 - 16:45
ICT 114

PARADIGMS, INSTRUMENTS AND NARRATIVES

Chair: Jack MacIntosh, University of Calgary

[Knowledge from Instruments](#)

Isaac Record Michigan State University

[The Search for Kuhn-loss: A New Strategy for HPS](#)

Jamie Shaw University of Western Ontario

[In defense of story-telling](#)

Adrian Currie University of Calgary

15:15 - 16:45
ICT 116

PHILOSOPHY OF ECOLOGY

Chair: Eric Desjardins, University of Western Ontario

[Ecological Bottlenecks](#)

Makmiller Pedroso Towson University

[Extension et défense de l'approche organisationnelle des fonctions écologiques](#)

Victor Lefèvre Université Paris 1 - Panthéon Sorbonne

[Putting Popper Into Practice](#)

Andrew Inkpen University of Pittsburgh

15:15 - 16:45
ICT 121

EXPERIMENT IN THE HISTORY OF SCIENCE

Chair: Teri Gee, Brigham Young University - Idaho

[Meno's Paradox for Experimentalists: Replicating Heinrich Hertz's Electromagnetic Standing-Wave Experiment](#)

Quinn Harrington University of Toronto, **Jenifer Barton**, University of Toronto,

[The Art of Experiment in Newton's Opticks](#)

Kirsten Walsh University of Bucharest

[Light at First Sight: The Ibn al-Haytham Paradigm](#)

Zaheeda P. Alibhai University of Ottawa

16:45 - 17:00

COFFEE BREAK

17:00 - 18:30
ICT 121

INTERNATIONAL KEYNOTE SPEAKER

[How Einstein Discovered](#)

John Norton University of Pittsburgh

SUNDAY MAY 29

8:45 - 10:15
ICT 114

THE NATURE AND LEGACY OF PTOLEMAIC SCIENCE

Organizer and chair: Anne-Laurence Caudano, University of Winnipeg

[Ptolemy's Astrological Rays](#)

Jacqueline Feke University of Waterloo

[Abu Ma'shar vs. Ptolemy: Astrology vs. Astronomy](#)

Teri Gee Brigham Young University - Idaho

[Rescuing Ptolemy: Byzantine Astronomy in the early 15th Century](#)

Anne-Laurence Caudano University of Winnipeg

8:45 - 10:15
ICT 116

SCIENCE AND EXPERTISE

Chair: Mike Thicke, Bard College

[A Different Kind of Rigour: What Climate Scientists Can Learn from Emergency Room Doctors](#)

Kent Peacock University of Lethbridge

[Reflective Equilibrium and Reasonable Expert Disagreement](#)

Dustin Olson University of Rochester

[On the illegitimate roles of values in expert reasoning and interventions](#)

François Claveau Université de Sherbrooke

9:00 - 12:00
SH 268

SCIENCE AND METAPHYSICS: 50 YEARS OF PHILOSOPHY OF SCIENCE AT THE UNIVERSITY OF CALGARY

Organizer and Chair: Allen Habib, University of Calgary

[Substance Ontology and the Metaphysics of Laws: Neglected Connections](#)

Travis Dumsday Concordia University of Edmonton

[Science and Metaphysics: Lessons from Microbiology](#)

Marc Ereshefsky University of Calgary

[Kant's Defence of Quantum Mechanics \(Yet another look at Kant on Causality\)](#)

Jack MacIntosh University of Calgary

[On the Prospects of an Effective Metaphysics](#)

Kerry McKenzie University of California, San Diego

[Historically-informed Scientific Metaphysics: An argument for the No General Structure Thesis](#)

Ken Waters University of Calgary

Joint session with the Canadian Philosophical Association / Session conjointe avec l'Association canadienne de philosophie

10:15 - 10:30

COFFEE BREAK

10:30 - 12:00
ICT 114

SCIENCE IN CANADIAN ENVIRONMENTAL HISTORY

Organizer and chair: James Hull, University of British Columbia, Okanagan

[Navigating Literature Concerning the History of Canadian Fisheries Science](#)

Jennifer Hubbard Ryerson University

[Northern Science, Scientists, and Environments](#)

Liza Piper University of Alberta

[Science in – and out – of the Woods](#)

James Hull University of British Columbia, Okanagan

10:30 - 12:00
ICT 116

SCIENCE, SOCIETY AND POLICY

Chair: Francois Claveau, Université de Sherbrooke

[The Science-Policy Relationship Hierarchy \(SPRHi\) Model: Explaining Co-Production in Dialogues between \(Climate\) Science Organizations and Government Agencies](#)

Garrett Richards University of Saskatchewan

[Research questions and methods at the science–policy interface](#)

Brooke Struck Science-Metrix

[La dimension spatiale des activités scientifiques et technologiques \(Grenoble, France – 1950-2015\)](#)

Thomas Lerosier Université Grenoble Alpes

[Reconsidering the Scientific Commodity](#)

Mike Thicke Bard College

10:30 - 12:00
SH 268

SCIENCE AND METAPHYSICS: 50 YEARS OF PHILOSOPHY OF SCIENCE AT THE UNIVERSITY OF CALGARY (CTD.)

12:15 - 13:15

LUNCH BREAK / BIG THINKING LECTURE

Naomi Klein Award-winning journalist, syndicated columnist and New York Times bestselling author

13:30 - 15:00
ICT 114

EARLY MODERN SCIENCES

Chair: Stephen Snobelen, King's College

[Explanatory Virtues in the 17th Century: Kepler and Mersenne's Competing Theories of Musical Consonance](#)

Domenica Romagni Princeton University

[Observing Goethe's Organisms](#)

Gregory Rupik University of Toronto

[The Science of Vital Force: Diego de Torres Villarroel and la nueva ciencia in the Spanish Enlightenment](#)

Nicolás Fernández-Medina The Pennsylvania State University

13:30 - 15:00
ICT 116

PHILOSOPHY OF BIOLOGY

Chair: Denis Walsh, University of Toronto

[Le concept de fonction dans la théorie bio-statistique de Christopher Boorse : une perspective pluraliste](#)

David Prévost-Gagnon Université Laval

[Evolvability and Genealogy in Evolutionary Developmental Biology](#)

Celso Antonio Alves Neto Leibniz Universität Hannover

[Individuality Pluralism and the Evolutionary Contingency Thesis](#)

Alison McConwell University of Calgary

[Biological Individuality from Holobiont Perspective](#)

Sinan Sencan University of Calgary

13:30 - 15:00
ICT 121

EMERGENCE, CAUSATION AND LAWS

Chair: Vincent Guillin, Université du Québec à Montréal

[A New Approach to Causal Selection](#)

Brian Hanley University of Calgary

[In Defence of Randomised Clinical Trials](#)

Marius Backmann Universität Konstanz

[Jan Smuts' version of holism](#)

John Collier University of KwaZulu-Natal

[Complétion locale et transitoire des lois ceteris paribus](#)

Guillaume Schlaepfer Université de Genève

15:00 - 15:15

COFFEE BREAK

15:15 - 16:45
ICT 114

NINETEENTH CENTURY SCIENCE AND IMPERIALISM

Organizer and chair: Debra Lindsay, University of New Brunswick

[Birds, Beasts, and Backers in British North America: The 'American Woodsman' goes North](#)

Debra Lindsay University of New Brunswick

[Smithsonian in the Subarctic: Spencer Baird, Scientific Reconnaissance, and Alaska as the Focus of Transnational Natural History in the mid to late nineteenth century](#)

Matthew Laubacher Ashford University

[Empire of Fear: Ethnobotany, Onomastics and Trust from India to Aotearoa New Zealand, 1848- 1867](#)

Geoff Bill University of British Columbia

15:15 - 16:45
ICT 116

COMING TO LIFE

Organizer and chair: Christophe Malaterre, Université du Québec à Montréal

[C'est la vie](#)

Kelly Smith Clemson University

[Five Lives](#)

Lucas Mix Harvard University

[Making Sense of Evolution in a Universal Context](#)

Carlos Mariscal Dalhousie University

[Chemical Evolution: from Natural History to Theory](#)

Christophe Malaterre Université du Québec à Montréal

15:15 - 16:45
ICT 121

LOGIC AND MATHEMATICS

Chair: Kenneth Waters, University of Calgary

[On Tarski's Reconstruction of Semantical Concepts](#)

Gabriel Larivière Simon Fraser University

[Mathematical Physics is Intuitionistic](#)

Jared Richards University of Western Ontario

[Neurophilosophy of number](#)

Hourya Benis Sinaceur CNRS

16:45 - 17:00

COFFEE BREAK

17:00 - 18:30
ICT 121

DRAKE LECTURE

[Values and Voluntarism Revisited](#)

Kathleen Okruhlik The University of Western Ontario

MONDAY MAY 30

8:45 - 10:15
ICT 114

HISTORY OF THE MIND AND BRAIN SCIENCES

Chair: Delia Gavrus, University of Winnipeg

[The Sciences of Brain and Mind in American Medical Education: Psychiatry, Neurology, and Harvard's Medical School, 1900-1945](#)

Tara H. Abraham University of Guelph

[The absent body in psychiatric classification, diagnosis, and treatment](#)

Catherine Stinson University of Western Ontario

[Du soi-disant retard scientifique de la psychiatrie francophone dans le Québec des années 1950. Essai de déconstruction d'un mythe historiographique tenace](#)

Alexandre Klein Université d'Ottawa

8:45 - 10:15
ICT 116

MODERN PHYSICS

Chair: Daniela Monaldi, York University

[Molecular Symmetry, Beauty and Truth](#)

Myron A. Penner Trinity Western University, **Amanda J. Nichols** Oklahoma Christian University

[The Reality of Jean Perrin's Atoms and Molecules](#)

Robert Hudson University of Saskatchewan

[\(Neo-\)Kantian Frameworks for the Interpretation of Quantum Mechanics](#)

Michael Cuffaro University of Western Ontario

8:45 - 12:00
ICT 121

BOOK PANEL WITH PETER HARRISON THE TERRITORIES OF SCIENCE AND RELIGION

Organizer and chair: **Yiftach Fehige** University of Toronto

Author: **Peter Harrison** University of Queensland

Discussants:

Bernard Lightman York University

Jack MacIntosh University of Calgary

Adam Richter University of Toronto

Stephen Snobelen King's College

10:15 - 10:30

COFFEE BREAK

10:30 - 12:00
ICT 114

COGNITIVE SCIENCES

Chair: Catherine Stinson, University of Western Ontario

[Replying to the grain argument against multiple realization based on the human language abilities](#)

Daniel Booth University of Western Ontario

[What it's Like to Be a Bat](#)

Joseph F Keeping York University

[Carving the Mind at its Homologous Joints](#)

Vincent Bergeron University of Ottawa

10:30 - 12:00
ICT 116

SCIENTIFIC REALISM

Chair: Gillian Barker, University of Western Ontario

[Topological Idealization, Asymptotic-Minimal Model Explanation, and the Aharonov-Bohm Effect](#)

Elay Shech Auburn University

[How Nomological is the Quantum State in Quantum Field Theory?](#)

Thomas De Saegher University of Western Ontario

[No Escape for No Miracles: The No Miracles Argument and the Base Rate Fallacy](#)

Amanda Bryant CUNY

10:30 - 12:00
ICT 121

BOOK PANEL WITH PETER HARRISON THE TERRITORIES OF SCIENCE AND RELIGION (CTD.)

12:05 - 13:25
ICT 121

**LUNCH — ANNUAL GENERAL MEETING
& HADDEN PRIZE CEREMONY
DÎNER — ASSEMBLÉE GÉNÉRALE ANNUELLE
& REMISE DU PRIX HADDEN**

13:30 - 15:00
ICT 114

ETHOLOGY AND HUMAN NATURE

Chair: Tara Abraham, University of Guelph

[Edward O. Wilson and human social behavior: a comparative review between On Human Nature and The Social Conquest of Earth](#)

Livia Assunção Federal University of Bahia

[L'éthologie « à la française » : la problématique réception de la science millienne du caractère chez les psychologues français fin de siècle](#)

Vincent Guillin Université du Québec à Montréal

[Dogs to the Rescue: A Historical and Contemporary Analysis of Animal Assisted Therapy](#)

Azra Alibhai Carleton University

13:30 - 15:00
ICT 116

HISTORY OF QUANTUM PHYSICS

Chair: Alexei Kojevnikov, University of British Columbia

[Fritz London and the Scale of Quantum Mechanisms](#)

Daniela Monaldi York University

[Einstein, Millikan and Quantum Theory: The Evidential Import of the Photoelectric Effect](#)

Molly Kao University of Western Ontario

[Quantum Physics in India through the lens of Satyendranath Bose](#)

Somaditya Banerjee University of Idaho

13:30 - 15:00
ICT 121

SCIENCE AND RELIGION

Chair: Adam Richter, University of Toronto

[Biblical History in the Natural Philosophy of John Wallis \(1616-1703\)](#)

Adam Richter University of Toronto, IHPST

[Newton and the God of the gaps](#)

Stephen D Snobelen University of King's College

[Evolution as a Fact?: A Discourse Analysis](#)

Jason Jean University of Saskatchewan

15:00 - 15:15

COFFEE BREAK

15:15 - 16:45
ICT 114

HISTORY OF SCIENCE

Chair: Anne Laurence Caudano, University of Winnipeg

[The “Nightmare” of Chemistry? Transforming Late-Nineteenth Century Perceptions of Alchemy](#)

Susan Hroncek Wilfrid Laurier University

[Edwin Bidwell Wilson et modernisation des sciences aux États-Unis, 1900-1945](#)

Juan Carvajalino Université du Québec à Montréal

[The Principles of Aristotle's Physics](#)

Christopher Byrne St. Francis Xavier University

15:15 - 16:45
ICT 116

SCIENCE AND VISUAL CULTURE

Chair: Bernard Lightman, York University

[Taking Spectacle Seriously: Wildlife Films and the Legacy of Natural History Display](#)

Eleanor Louson York University

[“Packin’ a ’45, a dipper, and an Argus”: Photographing Medical Entomology in the Second World War](#)

Caroline Lieffers Yale University

15:15 - 16:45
ICT 121

**BOOK PANEL WITH DENIS WALSH
ORGANISMS, AGENCY, AND EVOLUTION**

Organizer and chair: **Yiftach Fehige** University of Toronto

Author: **Denis Walsh** University of Toronto

Discussants:

Frédéric Bouchard Université de Montréal

Ingo Brigandt University of Alberta

Carla Fehr University of Waterloo

Joint session with the Canadian Philosophical Association / Session conjointe avec l'Association canadienne de philosophie

ABSTRACTS / RÉSUMÉS

Tara H. **Abraham** University of Guelph

The Sciences of Brain and Mind in American Medical Education: Psychiatry, Neurology, and Harvard's Medical School, 1900-1945

As American psychiatrists moved from the asylum to the state hospital during the early twentieth century, and assert a new form of professional status, psychiatry began to be regarded more formally as a medical specialty. This resulted in two related developments: psychiatrists had more complex and contentious interactions with neurologists and neuropathologists, and psychiatry acquired a growing presence within medical school curricula. This shift in disciplinary status took place at a time when medical education itself was experiencing a period of reform, with new labs, clinical facilities, and higher educational standards. How did such developments shape medical education at Harvard vis-à-vis the disciplinary relations between psychiatry, neurology, and neuropathology? By examining medical school registers, records from the Dean's office of Harvard's medical school, standards of scientific practice, and the activities of professional associations, this paper will examine the intertwined effects of both medical school reform and the rise in prominence of psychiatry in medical education. I will suggest that in the case of Harvard, disciplinary relations were coloured by the more biological perspective of the builders of Harvard psychiatry: C. Macfie Campbell, Harry C. Solomon, and Stanley Cobb. Examining the alliances forged at Harvard between the brain and mind sciences will add an important dimension to our standard picture of disciplinary legitimation in American psychiatry during the first half of the twentieth century as well as the evolving relations between the laboratory and the clinic.

Azra **Alibhai** Carleton University

Dogs to the Rescue: A Historical and Contemporary Analysis of Animal Assisted Therapy

Mental health issues are on the rise across university campuses. Today, anxiety is the most prevalent health issue affecting males and females between the ages of 15 to 24 in North America. In particular, in excess of 20% of all university students experience test anxiety at levels significant enough to impede both their academic performance and their quality of life. Over the last few decades there has been an increase in scholarly interest in animal assisted therapy (ACT) on anxiety disorders. However, animal assisted therapy occupies a paradoxical position in the history of science. While some historians point to Sigmund Freud's observational analysis of the anxiolytic effects that his "therapeutic collaborators" had on patients and his dogs' ability to assess their current mental status. Some historians date the history of animal assisted therapy back more than 5000 years ago with the use of "cynotherapists" in ancient Greece. Building on the important work that has already been done on the anxiolytic effects of animal assisted therapy that has shown that an interaction with a dog can have positive physiological and psychological effects and alleviate many cognitive and emotional stress related symptoms. This paper analyzes the role that animal assisted therapy has played throughout history and argues that from a contemporary and epistemological standpoint ACT must be re-examined and re-conceptualized to provide a viable and alternative modality in treating individuals with anxiety disorders. More specifically, this paper examines the benefits of dog therapy as an anxiolytic intervention that buffers the negative physiological and psychological effects of test anxiety on post-secondary students.

Zaheeda P. **Alibhai** University of Ottawa

Light at First Sight: The Ibn al-Haytham Paradigm

According to Thomas Khun (1970), "a paradigm shift is a change from one way of thinking to another. It's a revolution, a transformation." Abu Ali-al-Hasan, also known by the Latin Alhazen (b. Basra 354/965, d. Cairo 430/1039) was at once a philosopher, mathematician, physicist (the Physicist), astronomer and optician (Father of Optics). Over the course of his life he would write around 200 books on astronomy, mathematics, physics, philosophy and theology. Most notably, his book of optics, *Kitab al-Manazir* (The Book of Optics) articulated for the first time the modern idea that we see because light is introduced into the eye, rays of light enter the eye from sources of light and objects to reflect and refract light. He confidently rejected the extramissionist theories (light exits the eye and shines upon objects) of Plato, Euclid and Ptolemy. Ibn al-Haytham proved his hypothesis with the use of mathematics, performed experiments with tools he created and formulated methods to replicate his results. His research, observations and exhaustive experiments would transform the study of optics into a new science and develop the basis of what is known as the *scientific method*. This paper examines Ibn al-Haytham's historical and epistemological approach that not only transformed the study of optics into a new science but also radically challenged the accepted authority of the ancients and existing schematisms. By taking a closer look at Kuhn's concept "paradigm" I argue that, Ibn al-Haytham's work ushered in a new, confident and paradigmatic method of "doing science" that not only severed 1000 years of "accepted dogma" but had formative and enduring

implications for the European Renaissance and provides the basis from which all contemporary ideas about light, vision and optics have been built upon.

Mathieu **Arminjon** Université de Genève

Emergence d'une « physiologie critique » dans le milieu universitaire états-uniens de l'après 1968 : repères historiques et implications épistémologiques

On peut difficilement comprendre les problématiques et les enjeux des sciences humaines et sociales contemporaines sans se rapporter au tournant critique des années 1970 qui a vu émerger les *gender*, *cultural* ou *subaltern studies*, etc (Cusset, 2003). Ces disciplines sont généralement perçues comme procédant d'une critique radicale des sciences naturelles opérée par les sciences humaines et sociales. On peut se demander si une telle vision ne témoigne pas d'une mécompréhension continentale du contexte politique et institutionnel états-uniens du tournant des années 1970, foyer de ces reconfigurations des savoirs (Moore, 2013). Mon intervention aura pour tâche de montrer comment la théorie critique n'a pas seulement profondément imprégné les sciences humaines et sociales mais aussi les sciences naturelles américaines de l'après 1968, en particulier la biologie (Rose, Lewontin, and Kamin 1984; Levins and Lewontin 1985). Il s'agira de montrer sous quelles conditions est née une « physiologie critique » s'opposant aussi bien aux réductionnismes biologiques que sociaux et visant, au travers du concept d'allostase (Sterling and Eyer 1988), par exemple, à historiciser les faits biologiques. Je montrerai comment cette reconfiguration épistémologique et politique, spécifiquement américaine, dont les sciences féministes (Fausto-Sterling 2005) et l'épidémiologie sociale (Krieger, 2001) sont les héritières directes, est à l'origine d'une conceptualisation des différences de genre et de race qui se démarque radicalement des approches critiques européennes.

Lívia **Assunção** Federal University of Bahia

Edward O. Wilson and human social behavior: a comparative review between *On Human Nature* and *The Social Conquest of Earth*

The nature of human condition has been one of the most common inquiries for the humanities and social sciences. In the early 1970s, Edward O. Wilson argued that, in order to give an appropriate description of the human nature, the social sciences were neglecting evolutionary biology. In 1978 Wilson's decision to include evolutionary biology into the analysis of social behavior resulted in the publication of the book *On Human Nature*. In this work, Wilson expanded his ideas on the sociobiological foundations of human nature and focused on the role of genes in the determination of human behaviors. Wilson's second book on human social behavior, *The Social Conquest of Earth* (2012), reached the scientific community thirty years later in the peak of the controversy about multilevel selection. Historically, both *On Human Nature* and *The Social Conquest of Earth* were important works, which offered significant contributions for an evolutionary approach to the study of human behavior. Whereas their sociobiological determinism caught the attention of scientists and academics, their focus on human nature and human behavior attracted the general public. Within this historical framework, this research seeks at comparing both works. The comparison will be centered on three main topics, which summarize the essential differences in Wilson's evolutionary thought between 1978 and 2012. Firstly, we will consider Wilson's changing views concerning the evolution of human sociality. Secondly, we will focus on the variation in Wilson's ideas on the evolution of altruism. Finally, we will compare both books considering how Wilson modified his view on group selection and multilevel selection.

Marius **Backmann** Universität Konstanz

In Defence of Randomised Clinical Trials

The standardised Randomised Clinical Trial (RCT) has been exceedingly popular in medical research, Economics, and practical policy making. Recently, RCTs have faced criticism. Two major types of criticism can be differentiated. First, it is argued that we cannot be certain that our sample is not atypical with regard to possible confounding factors. Due to the complexity of human organisms, societies, and economies, randomising does not guarantee that the sample is not skewed (Cf. e.g. Worrall 2002). The second criticism concerns what sort of claim RCTs warrant. According to Nancy Cartwright, RCTs establish deductively that within a subset of the population, a treatment probabilistically causes a certain outcome. From this we infer that the same treatment will also cause this outcome in the population. Due to imperfect sampling methods and our insecure knowledge of the similarity between sample and population, this last inference fails (Cf. e.g. Cartwright 2007). I will argue that at least in the case of medical research, we know enough about the relevant causal mechanisms that we are justified to ignore a number of factors we have good reason not to expect to be disruptive. I will also argue that RCTs should not be taken to deductively infer probabilistic causal claims in the way Cartwright proposes, but ampliatively. In practice, a lot of RCTs are far from the idealised model Cartwright proposed, but it's still the best method on the market to test the efficacy of a treatment in a large number of test subjects.

Somaditya **Banerjee** University of Idaho

Quantum Physics in India through the lens of Satyendranath Bose

Historians have analyzed the social and cultural contexts of the late Imperial and Weimar Germany and the ways in which they contributed to the development of quantum physics. However, they have not sufficiently analyzed the ways that transnational flows which act horizontally and are better indices of knowledge interchange, rather than a vertical model of center-periphery. Through the lens of Indian physicist Satyendranath Bose, this paper will explore in part how fundamentally new concepts of the German quantum physics transformed and established roots in a different cultural and political situation, namely the condition of colonial India. But it is also about how a physicist from colonial India—Satyendranath Bose—shaped German physics through Bose-Einstein statistics. Furthermore, this interconnectedness between Bose and German physicist Albert Einstein, understands Indian science as a complex form of cultural hybridization between the local and the global, including the broad notion of a 'local cosmopolitanism'. I argue that scientists like Bose were espousing a unique brand of local cosmopolitanism that combined Indian traditional culture with some British influences, and often times also with features that were neither Indian nor British, to show the transnational spectrum of the notion. The production of new knowledge through quantum statistics by Bose uncovered the co-constructed nature of scientific knowledge and the transnational nature of the quantum.

Gillian **Barker** University of Western Ontario

The geofunctions perspective: Between geoengineering and Gaia theory

A false dichotomy impedes our ability to understand and manage climate change and other changes in earth systems. It seems that we must choose between a mechanistic perspective that sees the Earth as an elaborate machine suitable for management by geoengineers, on the one hand, and the full-blown organicism of Gaia theory, on the other. Both of these perspectives are seriously flawed. A promising intermediate approach is beginning to emerge, however—what we term the “geofunctions perspective.” This perspective sees earth systems as functionally integrated, and focuses on the role that social-ecological functioning plays in these systems. It highlights the importance of nonlinear interactions between processes, the distinctive kinds of dangers and opportunities that these may create, and the need for integration of understanding across disciplinary boundaries. The concept of earth-system functions—geofunctions—is already in wide use, but is in need of analysis. The organizational or persistence accounts of function provide possible frameworks for developing an account of geofunctions, but some distinctive problems require consideration.

Hourya **Benis Sinaceur** CNRS

Neurophilosophy of number

How do we extract numbers from our perceiving the surrounding world? Neurosciences and cognitive sciences provide us with a myriad of empirical findings that shed light on hypothesized primitive numerical processes in the brain and in the mind. Yet, the hypotheses based on which the experiments are conducted, hence the results, depend strongly on sophisticated mathematical models. These sophisticated models are used to describe and explain neural data or cognitive representations that supposedly are the roots of primary arithmetical activity. Moreover philosophical previews are involved in the generalizations presented as extrapolations from experimental data. My aim is at bringing to light the technical and conceptual infrastructures of the presumed neural or cognitive, material or symbolic, actual foundations for our elementary arithmetical abilities.

Vincent **Bergeron** University of Ottawa

Carving the Mind at its Homologous Joints

We know that the human brain shares many of its principles and functions with that of other species, and that for any human cognitive function, we can expect that (at least) some component(s) of it could be found in the cognitive repertoire of another species. What is less clear, however, is how best to exploit this evolutionary continuity in order to identify precisely the components of the human cognitive architecture that we share with other species and that have remained stable across extended evolutionary periods. In this paper, I argue that a useful way to think about these shared components is to think of them as cognitive homologies. In contrast with the well known concept of structural homology in biology—defined as the same structure in different animals regardless of form and function, where sameness is defined by common phylogenetic origin—the proposed notion of cognitive homology focuses on the functional properties of homologous brain structures that tend to remain stable across extended evolutionary periods. I then argue, using recent findings from the cognitive neuroscience of social cognition, that the identification of cognitive homologies can greatly contribute to the identification of stable structure-function relationships (one-to-one mappings between brain structures and cognitive operations) which, in turn, can be used for the construction of new cognitive ontologies.

Geoff **Bill** University of British Columbia

[Empire of Fear: Ethnobotany, Onomastics and Trust from India to Aotearoa New Zealand, 1848- 1867](#)

The marginalization of vernacular plant names and knowledge after Linnaeus is a common theme in the historiography of imperial botany. While this critical emphasis has yielded useful insights, it has also overshadowed a more contingent and protracted history of the means by which indigenous phytonyms were sidelined in scientific botany over the course of the nineteenth century. My paper provides a snapshot of this history. The first part of my analysis centers on Joseph Dalton Hooker's experience in India and the Himalayas (1848-1851). As head of a large exploratory mission, with little or no facility in any Indian language, and perennially suspicious of his native guides and porters, Hooker was an influential contributor to a method of botanical reconnaissance at odds with the formation of affective - and often effective- knowledge-making relationships across indigenous-European cultural boundaries. The second part of my discussion chronicles the ways in which this experience came to bear on Hooker's Handbook of the New Zealand Flora (1864-1867), with particular reference to the index of Māori and Latin plant names that concludes the volume, and the means whereby conditions in 1860s Aotearoa New Zealand shaped how the Handbook was received. More specifically, I argue for the role of fear, uncertainty and violence in the conception, contestation, and diffusion of Hooker's imperial perspective on indigenous ways of knowing in nineteenth-century New Zealand.

Nicholas **Binney** University of Exeter

[History as tracking the evolution of our knowledge of disease](#)

Several historians have identified a tension in the historiography of disease (Wilson 2000; Wootton 2004; Cooter 2010; Stein 2014). On the one hand, there are historians who treat at least some aspects of our knowledge of particular diseases as timeless, and discovered independently of any social, cultural and historical factors (Wootton 2004; Grmek 1989; Jackson 2009). On the other hand, there are historians who treat all aspects of our knowledge of disease as historically contingent, and invented in particular social and historical contexts (Cunningham 2002; Wilson 2000; Stein 2014). Both of these approaches to the writing of disease history fail to show how it is possible to write *longue durée* histories of disease without treating some aspect of disease as timeless and ahistorical. Using the case study of the development of knowledge of the disease heart failure, I will argue for an intermediate historiographical view in which it is possible to do just this. This can be done by treating our knowledge of disease as an evolving lineage of ideas and practices, analogous to an evolving lineage of animals. Evolutionary biologists have long been able to study how present day species evolved without having to locate some aspect of the species in question that remains constant across the generations, and without arguing that the lineage is evolving towards some teleological goal. Using the example of the development of knowledge of heart failure, I will argue the same is possible when studying the history of disease.

Daniel **Booth** University of Western Ontario

[Replying to the grain argument against multiple realization based on the human language abilities](#)

The grain argument (Bechtel and Mundale 1999) is the most pressing contemporary objection to multiple realization. In reply to this objection I present a several case studies in the cognitive- and neuro- science of language. I contribute examples of multiple realization that involve a correct matching of grains of description, showing that there are cases of multiple realization. First, I discuss the well-known issue of language lateralization and how that lateralization can be affected by handedness. I contrast normal cases of language lateralization with cases where brain damage alters individuals' language capacities. Second, I raise some considerations regarding cases of second- or multi- language learning and use. Drawing upon examples from this research I consider the challenge of matching grains of description. On the basis of these considerations I develop a second response to the grain argument. I argue that some interpretations the grain argument. those that treat every difference at some level of description as fixing the correct grain at which to describe a phenomenon, beg the question against multiple realization. On the basis of these examples I conclude that given the type of variation that research into language abilities deals with, it is justifiable to regard many language capacities as multiply realized, and that this kind of multiple realization is not the result of mismatched grains of description.

Ingo **Brigandt** University of Alberta

[Explanatory Understanding in Systems Biology without Mechanistic Explanation](#)

A mechanistic explanation details how the operation of a mechanism generates the phenomenon of interest. This explanatory understanding may come from mentally simulating the behaviour of the mechanism's components, facilitated by a mechanism diagram. Given that a complex mechanism cannot be mentally simulated, the notion of a dynamic mechanistic explanation has been introduced for situations where a mathematical model is needed to show that the mechanism's operation indeed generates the behaviour to be explained. Although several philosophers have pointed to mathematical models in systems biology to illustrate the idea of dynamic mechanistic explanation, modelling in systems biology is not exhausted by (dynamic) mechanistic explanation. Instead, I show how mathematical models can provide

explanatory understanding without tracking the operation of a mechanism. I focus on two ways of mathematically analyzing dynamical systems. First, I discuss how bifurcation analysis offers insights into global dynamic features of a system. It can show how a system behavior is independent from possible changes in quantities or from changes in organizational features. Rather than simulating one operation of the mechanism, bifurcation analysis offers an analysis across different molecular parameters and even across different organizations, which are sometimes not from the actual system in nature. Second, I more briefly discuss the investigation of control hierarchies by means of sensitivity analysis. This differs from a (dynamic) mechanistic explanation, which shows how the overall mechanism produces some behavior, as the mathematical analysis of control hierarchies provides an understanding of the different contributions made by different system components.

Bryson **Brown** University of Lethbridge

[Chunk and Permeate Inferences in Regional Climate Models](#)

Regional climate models (RCMs) are finer-grained climate models 'nested' in global climate models (GCMs). Nesting can be one-way, with results of the GCM for cells surrounding the area covered by the RCM 'driving' the RCM, or two-way, with a feedback relation between results calculated in the GCM and those calculated in the RCM. *Chunk and permeate* (C&P) is an inference strategy for coping with inconsistent premise sets proposed in Brown and Priest (2004, 2015) as a model of reasoning in the old calculus, which avoids logical catastrophe by allowing specified conclusions from calculations that assume $\delta \neq 0$ to 'permeate' into a separate cell in which we set $\delta = 0$. One-way nesting imposes boundary conditions on the regional model based on those produced by the GCM in the cells surrounding the region. This over-rides the internal equations of the regional model and allows the regional model to evolve a finer grained model of how weather patterns in the region may respond as the surrounding global climate changes. In two-way nesting, the interaction affects the results of both the GCM and the RCM as results from each feed back into the other. Here we model the exchange of parameter values between GCMs and RCMs in both one and two-way nesting using the C&P approach, and argue that inconsistency tolerance in scientific practice is both more widespread and less troubling than has been generally appreciated.

Amanda **Bryant** CUNY

[No Escape for No Miracles: The No Miracles Argument and the Base Rate Fallacy](#)

The no-miracles argument (NMA) for scientific realism, which says that the success of science would be a miracle if scientific realism were false, has recently been accused of base rate fallaciousness. The base-rate fallacy is a common error made in probabilistic reasoning, in which the reasoner neglects an occurrent frequency of crucial relevance. I consider three responses to the accusation of base-rate fallaciousness: 1) NMA is not a probabilistic argument and therefore the fallacy is not applicable; 2) the language of the argument is not conducive to a base rate; and 3) it is sometimes permissible to ignore base-rates, because correct reasoning can lead us away from the truth. I reject all three responses. Regarding 1), I argue that NMA is probabilistic because the most salient difference between its explanation of success and alternative ones is a difference in likelihood to obtain. Regarding 2), I argue that even if the language of the argument is ineliminably vague, it is nonetheless possible to specify an approximate base-range of approximate truth. Regarding 3), I say that the fallibility of non- deductive forms of inference does not license the abandonment of the rules of inference. So the charge of base rate fallaciousness is apt. However, I also argue that producing a base rate would not save the argument, because once the base rate of approximate truth is in hand, NMA is superfluous as an argument for realism. The upshot is that the realist should abandon NMA altogether.

Christopher **Byrne** St. Francis Xavier University

[The Principles of Aristotle's Physics](#)

In the twentieth century, historians of science held an extended debate about the principles of Aristotelian natural science. That debate typically took place within the context of a larger debate about the differences between Aristotelian natural science and the natural science of the Scientific Revolution. Two questions figured prominently, one from kinematics and one from dynamics: the first was whether inertial motion was even conceptually possible within Aristotle's physics, and the second was whether Aristotle had a mechanics, that is, an account of the basic causal interactions between physical bodies simply insofar as they are material objects. This paper sets out the main positions in this debate and offers what I take to be a more accurate account of the principles of Aristotle's physics, including his view of inertial motion and the principles of his mechanics.

Justin **Bzovy** University of Western Ontario

[Aristotle and the Essentialism Story](#)

Many have claimed that essentialism is incompatible with evolutionary theory. I examine three main tracts through which such a claim has been made: (1) as a foil through the essentialism story; as a candidate ontology for biological entities

through either (2) modern natural kind thinking, or (3) the work of Aristotelian scholars. I argue that essentialism fails as an ontological framework for biological entities, but can help determine the sort of framework we need as a more sophisticated foil. To achieve this, I develop a taxonomy of essentialism. First, the essentialism story has rendered 'essentialism' a dirty word in biology. Since the mid-twentieth century, biologists have referred pejoratively to essentialist or typological views (views antithetical to evolutionary or population thinking). Second, philosophers have argued that we must reconceive essences in light of evolution, or hold that there are none in biology. Because of the essentialism story, the latter has had more traction amongst biologists. But the former strategy carries Boyd's HPC-kind theory in the vanguard. Third, scholars have reinterpreted Aristotle's conception of essence. Some have claimed that although typological essentialism is incompatible with evolutionary theory, Aristotle's teleological essentialism is not. I show a common problem with HPC-kind theory, typological, intrinsic, and teleological essentialism as ontological frameworks for biological entities: history. I also show how teleological essentialism can be used as a sophisticated foil for choosing between different ontological frameworks that are able to account for history.

Juan **Carvajalino** Université du Québec à Montréal

Edwin Bidwell Wilson et modernisation des sciences aux États-Unis, 1900-1945

E. B. Wilson était un mathématicien Américain formé autour de 1900. Il joua un rôle fondamental, mais négligé par l'histoire des sciences, dans la modernisation des sciences et le développement de l'interdisciplinarité aux États-Unis entre 1900 et 1945. Dans cette présentation, la carrière et le travail de Wilson sont rapidement abordés: sa formation en tant que mathématicien (1900), ses travaux en mathématiques et les fondements des mathématiques et des sciences (1901-1910), ses recherches en physique mathématique (1910-1922), son tournant statistique (1922-1930) ainsi que ses travaux en sciences sociales et économiques (1930-1945). Wilson regardait l'ère scientifique dans laquelle il vivait comme une ère d'anxiété. L'objectif de la présentation est de montrer comment l'histoire de la gestion de cette anxiété par Wilson peut nous éclairer en tant que récit en histoire des sciences. La thèse principale est que les discussions sur les fondements mathématiques qu'il mena en début de carrière jouèrent un rôle thérapeutique dans la gestion de sa propre anxiété tout en l'amenant à définir ce qu'était la rationalité mathématique. Pour Wilson, cette rationalité représentait les fondements mêmes de toute science. Elle est le fil conducteur qui permet de comprendre son influence sur la modernisation des sciences américaines, son apport au développement de l'interdisciplinarité. Elle est aussi l'élément clé qui permet de comprendre ses positions quant au lien entre science et société.

Anne-Laurence **Caudano** University of Winnipeg

Rescuing Ptolemy: Byzantine Astronomy in the early 15th Century

Byzantine astronomy was strongly rooted in Ptolemy's *Almagest* and *Handy Tables*, as well as its Late Antique commentators. In the fourteenth century, however, even the most fervent supporters of Ptolemaic astronomy had to concede that Ptolemy's data had become inaccurate. The importation of new astronomical tables and methods from Persia since the late thirteenth century further emphasized the inexactitude of the Ptolemaic tables. This observation prompted the elaboration of new tables based on the *Almagest* and the *Handy Tables*, and notably adapted to the meridian of Constantinople. Other astronomers strove to find ways to compare, correct, and reconcile the Ptolemaic and Persian approaches, however. Among them, John Chortasmenos, a teacher at the Patriarchal School, spent considerable energy gathering and comparing the results obtained by different texts and methods for calculating syzygies, eclipses, solstices, and equinoxes. While Chortasmenos did not pen an astronomical treatise per se, his work embodies the Byzantine attempts at correcting, while altogether preserving, Ptolemy's legacy.

François **Claveau** Université de Sherbrooke

On the illegitimate roles of values in expert reasoning and interventions

The idea that there is no legitimate roles to values in expert reasoning and interventions is widely rejected, and rightly so. There is also a tacit agreement that some roles of values are nevertheless illegitimate. The difficulty lies in characterizing with some precision what these illegitimate roles are. This article starts by arguing that the division of epistemic labor underlying the phenomenon of expertise necessarily involves lossy information compression. It then builds a small model to evaluate some propositions in the literature on how to delineate the set of illegitimate roles of values in expert reasoning and interventions. These propositions include the restriction to epistemic values, the distinction between direct and indirect roles (Douglas 2009) and a priority given to epistemic values (Steel 2010). I argue that these propositions are faulty. I finally propose and assess an alternative proposition that relies on the distinction between lossy and lossless information processing.

John **Collier** University of KwaZulu-Natal

Jan Smuts' version of holism

Smuts coined 'holism' to apply to systems where the whole is greater than the sum of the parts. It implies emergence, associated with J.S. Mill, though Mill did not use the word. Both ideas are basic to Systems Theory and Ecology. Smuts was an accomplished botanist, but also a politician and statesman. He was quite religious, but saw civil rights as part of the evolution of humans from our biological natures. However, he thought that White men were most evolved, White women less so, with Asians and Blacks at the bottom. He was criticized even in his own time for using his ideas about holism to justify imperialism. Obviously, from reading his work, there is some truth to this, but that does not mean that his basic idea of holism was any more wrong than those of the much more liberal J.S. Mill. I will try to explain how Smuts' ideas about holism held together, and how they did not. The case is instructive about how good ideas can be abused.

James **Crombie** Université Sainte-Anne

Clodomiro Picado Twight - découvreur de la pénicilline (?) et « Benemérito de la Patria »

La présente étude porte sur la vie et l'oeuvre du scientifique costaricain Clodomiro Picado Twight (1887-1944) - et sur le rôle de la science et de l'éducation dans le développement démocratique. Nous examinons d'abord les éléments qui permettraient éventuellement d'accorder à Picado la priorité sur Fleming pour la découverte des propriétés antibactériennes de la pénicilline. Picado est connu pour ses recherches en hématologie, en immunologie et en phytopathologie - mais surtout pour ses études des serpents venimeux et le développement d'antidotes à leurs venins. L'Instituto Clodomiro Picado est encore reconnu pour son travail dans ce domaine. D'origine sociale modeste, Picado s'est vu accorder une bourse par le Congrès costaricain pour poursuivre ses études à l'Institut Pasteur de Paris. Gutiérrez & Monje-Nájera (1989) se sont penchés sur les conditions socio-économiques du Costa Rica du début du 20^e siècle qui ont permis à ce talentueux individu de réaliser son potentiel. Nous nous demandons même si la reconnaissance et le soutien accordés à l'éducation ainsi qu'à la science pure et appliquée n'ont pas valu au Costa Rica un avantage sur les pays avoisinants au chapitre du développement démocratique. Parmi de nombreuses autres marques de reconnaissance à l'endroit de son plus illustre scientifique, le Costa Rica a décerné à Picado à la fin de sa trop courte vie le titre de « Benemérito de la Patria », équivalent approximatif de « héros de la nation ».

Michael **Cuffaro** University of Western Ontario

(Neo-)Kantian Frameworks for the Interpretation of Quantum Mechanics

It is commonly held that Kant's metaphysics was definitively refuted by modern developments in mathematics and natural science. However recent scholarship has shown that the truth is more subtle. Many—but not all—now recognise, for instance, that many of quantum theory's founders, particularly Bohr, were substantively influenced by Kantian ideas. I will begin by arguing in favour of this connection, by showing that Kant and Bohr share criteria for the determination of objective experience. While the connections between Kantian ideas and Bohr's are implicit, some contemporaries of Bohr were explicit about the links between Kant's metaphysics and their own. For Heisenberg, quantum theory shows that Kantian metaphysics is indefensible. Yet he argues it should be transformed rather than rejected outright. For Hermann, Kantian metaphysics, properly interpreted, is actually not in tension with quantum mechanics. For Cassirer, Physics' methodology requires radical alteration in light of quantum mechanics. However Cassirer's particular conception of the relativised a priori is nevertheless firmly rooted in Kantian metaphysics. All of the foregoing ideas represent alternatives, to one sympathetic to Kant, for comprehending the implications of quantum mechanics. But it is Bohr's view which is most consistent with the spirit of Kantianism. Bohr's view further sheds light on the issue of the unity of science. Science is disunified in the sense that different aspects of the same phenomenon can be described in contradictory ways if one takes such descriptions literally. Yet such descriptions can nevertheless be made compatible if we are willing to accept their inherent limitations.

Andrew **Cunningham** University of Cambridge

Should we even try to identify diseases in the past?

In 1999 Bruno Latour, that *enfant terrible* of science studies, questioned (to put it mildly) whether it is in any way meaningful to claim that the Egyptian pharaoh, Ramses II, who died three thousand years ago, died of tuberculosis? I am probably one of the few scholars in the area who agrees with Latour completely, though on slightly different grounds. My view, built on my experience as a historian of medicine, is twofold. One is that with the invention of the microbiological laboratory in the late nineteenth century, by Pasteur, Koch, and their colleagues, the mode of making of identifications of infectious disease changed so radically that it is logically impossible to compare diagnoses of infectious diseases before and after this event. The two positions (before and after) are simply incommensurable. My second major point, is that we should abandon the attempt at retrospective diagnosis altogether as historians of medicine, because (as I put it) '*You die of what your doctor says you die of*', both now and in the past. If we don't respect actors' categories (I argue), we might as well renounce the attempt to understand people in the past, including their diseases and their deaths. Although this

view looked dangerously relativistic to some scholars, others have also adopted it. In my talk, I shall elaborate on these positions and propose new arguments to support my view.

Adrian **Currie** University of Calgary

[In defense of story-telling](#)

Storytelling and scientific investigation are often thought to be at logger-heads. Storytelling—positing narratives—has a whiff of illegitimacy: after all, if scientific knowledge is generated through methodical empirical enquiry, what role could there be for merely possible narratives? I argue that such views are mistaken and founded on two related misunderstandings of the nature of scientific storytelling. On the one hand, a narrative's justification is taken to lie in coherence—mere logic—and thus is presumably on an equal footing with a wide range of other possible narratives. Stories are, at best, only 'how possible' explanations. On the other hand, narratives are speculative. They outrun our available evidence and thus potentially break norms of scientific assertability and are vulnerable to subjective bias. These objections are too quick. I argue that narrative evidence is not based on coherence, but rather can be understood in the same fashion as evidence standardly is in historical reconstruction. Further, narratives can extend our foothold in the past by providing more points of empirical contact. By filling out the content of our hypotheses, narratives are more open to tests. Speculation plays an important role in historical reconstruction because it is required for discovering evidential relevance. Due to the opportunistic, 'omnivorous' nature of historical reconstruction, it is difficult to know what evidence will be relevant prior to investigation. Positing a narrative reveals new avenues of empirical inquiry by demanding that scientists examine the world from that narrative's perspective. Rather than being scientific illegitimate, then, storytelling is central to successful reconstructions of past token events.

J. Cecilia **Cárdenas-Navia** Yale University

[Color Struck: Dermatology and Melanin Sciences as Liberationist Tools](#)

As growing sociopolitical unrest converged with mounting incidences of skin cancer, dermatologists sought to bolster their status as physician-scientists capable of treating skin maladies while investigating the mysteries of pigment. Thomas B. Fitzpatrick (Harvard), Aaron Lerner (Yale), and John A. Kenney, Jr. (Howard) utilized laboratory-based technologies, including electron microscopy and spectrophotometry, to advance their clinical practices. Inquires into albinism, vitiligo, and other pigmentation disorders were integral to biomedical understandings of melanin, its source, and its function; moreover labels of "Negro" and "Caucasian" skin, labels that had long diffused the medical literature, proved inadequate to describe and treat the wide spectrum of skin tones in American patients. True-life testimonials from Richard Wright, Emily Juana Burke, and Michael Jackson further complicated these blurry demarcations, highlighting the instability of racial categorization and the political stakes of skin color alteration. The Fitzpatrick scale, posited in 1975, presented a phototyping classification schema that ordered light and dark-skinned patients into six groupings; assignments to Type I through Type VI privileged photosensitivity, erythema, and tanning reactions over ethnoracial attachment. This scale of difference neatly sidestepped biomedical constructions of "race," building upon previous efforts that did not rely on the subjectivity of the human eye. By privileging treatment over taxonomy, this metric offered a "race"- independent assessment of skin color that prioritized sun reactivity over visiocultural affiliation. Although concurrent studies in dermatology, genetics, and other scientific disciplines still adhere to and replicate various forms of "race"-based thinking, this case study offers an alternative and progressive medico-scientific framework for discerning human difference.

Thomas **De Saegher** University of Western Ontario

[How Nomological is the Quantum State in Quantum Field Theory?](#)

I argue that, in quantum field theory, the quantum state required, along with other laws, to derive the existence of objects localized in spacetime is itself partially law-like, or quasi-nomological, by analyzing Albert's Narratability Failure. The wave function representing the state in non-relativistic quantum mechanics has been construed as quasi-nomological by primitive ontologists, however, I am able to extend this claim to quantum states in quantum field theory and without a commitment to the primitive ontology view (instead only realism about the quantum state). Moreover, arguing from narratability failure makes more precise the sense in which the quantum state is quasi-nomological, and, given this result, it is clear that it is impossible to separate the quantum state's ontological and nomological aspects. Such a fact remains unclear for the wavefunction in the non-relativistic setting. But given the quantum state necessary to derive the existence of local macroscopic objects is not divisible into law and ontology, it must not be possible to construct an explanatory narrative from the ontology of quantum mechanics guided by separate laws to everyday objects. Realists about the quantum state commonly aspire to provide such a narrative and thus an upshot of my finding is to reject the possibility of attaining a certain widely desired ideal in the interpretations of quantum mechanics literature.

Eric **Desjardins** University of Western Ontario

On the meaning of social-ecological “coevolution”

The concept of Social-Ecological System (SES) is one of the fundamental notions in the encompassing framework of resilience thinking. Adopting the SES as the unit of analysis entails a “human-in-ecosystem” perspective. Researchers interested in SESs often use the notion of “coevolution” in order to qualify the human-nature interaction, but their usage tends to be metaphorical and imprecise. The primary objective of this paper is to develop and further specify the meaning of the concept of social-ecological coevolution. After a critical analysis of two of the most elaborated accounts in ecological economics, the paper uses the framework of niche construction theory to define social-ecological coevolution. In brief, it proposes that social-ecological coevolution is the reciprocal adaptation of human-social and ecological ensembles through human and ecological niche construction activities. This conception can guide interpretation and research in fruitful directions. It also clarifies an important assumption of some of the most interesting normative propositions in ecosystem managements. Thus, S-E coevolution should be treated as a guiding principle in research and management projects whose objective is to build functional Earth Systems.

OmiSoore **Dryden** Thorneloe University

Genetic Technologies and the Biological Race-ing of Blood: Blood Donation and the Imagined Community

In her book, *Fatal Invention: How Science, Politics, and Big Business Re-create Race in the Twenty-First Century*, Dorothy Roberts (2011) states, “race is central to every aspect of the new science and technology that is emerging from genomic research.... This science and technology is redefining race as a natural division written in our genes” (286). Thus, knowledge derived from genetic science has increasingly been used to explain aspects of the socio-political world, including the transmission and treatment of HIV/AIDS and blood donation. In this paper, using a black queer transnational/diasporic analytic, I ruminate on the deployments of racialized narratives that link blood and bodies with disease, specifically HIV/AIDS. The Canadian Blood Services (CBS) was created to manage the blood system in Canada in response to the tainted-blood crisis of the late 1980s and early 1990s. Part of their work to protect the national blood supply was the implementation of a donor questionnaire. CBS is now in the process of implementing genetic testing of blood donors. How, I ask, does the screening process of potential blood donors, which already participates in the cataloguing of racialized/sexualized bodies and their blood, impact the perceived “colour-blind” approach in this new commitment to genetic testing? How do these connections between blood and bodies with disease relate to blood, genes and more effective blood transfusions? Blood, and the donation of blood, is a disciplinary regime and apparatus that is put into operation not only in the creation of the body and its continued maintenance and surveillance, but also in how a national community of donors is imagined. As such, blood brings bodies, kinship, race, and health into confluence; therefore it is necessary to read the questionnaire alongside a desire for genetic testing.

Travis **Dumsday**, Concordia University of Edmonton

Substance Ontology and the Metaphysics of Laws: Neglected Connections

In the literature on substance ontology, one of the foundational debates is that between advocates of substratum theory, bundle theory, primitive substance theory, and hylomorphism. These theories address in part the underlying nature of substances (e.g., is a substance qua substance necessarily a compound of substratum and attributes, or is a substance just a set of compresent attributes?). In the literature on laws, the main parties to a similarly foundational debate are regularity theory, nomological necessitarianism, and dispositionalism. Work on these two sets of debates is typically done independently, with little attempt to draw implications between them. For instance, dispositionalists have been known to pair that theory of laws with each of the four main substance ontologies: Brian Ellis (2001; 2002) was a dispositionalist primitive substance theorist but in his (2009) converted to being a dispositionalist bundle theorist; C.B. Martin (1980; 2008) was a dispositionalist substratum theorist; and David Oderberg (2007) is a dispositionalist hylomorphist. None employs dispositionalism to argue for their favoured substance ontology or vice versa. Similar diversity exists with respect to the other main ontologies of law and of substance. It is time to curtail this sunny ecumenism, for in fact certain ontologies of law entail certain substance ontologies and vice versa. In a larger project I seek to survey the range of these neglected interconnections. However, in this short paper I develop only one example of this relationship: I argue that bundle theory not only entails dispositionalism but a certain specific version of that theory, pan-dispositionalism.

Antoine C. **Dussault** University of Toronto and Université Paris I/IHPST

Ecological functions as ahistorical and contextual properties

I will argue that, breaking with a theoretical trend influential in the life sciences since Williams (1966), function concepts as used in ecology should be understood as conceptually independent of the evolutionary history of their bearers. Instead, they should be conceived as depicting ahistorical properties which are highly dependent upon the ecological context of their bearers (organisms and other components of ecosystems). In this purpose, I will discuss the selected effect (SE)

account of community-level functional organization proposed by Sober and Wilson (1989; see also Wilson 1997; Basl 2011). I will first argue that this account conflicts with two key aspects of the actual use of function concepts in ecology: 1) The fact that, in the spirit of Elton's (1927) "functional niche" concept, ecologists use function concepts to group species which have divergent phylogenies; and 2) The observation that ecosystem ecology and its functional approach can be properly conceived as a kind ecosystem-level physiology, linked to what Mayr's (1961) called functional as opposed to evolutionary biology (Hagen 1992). Since a defender of the SE account could agree with those observations and yet adopt a revisionist stance regarding the current use of function concepts in ecology, I will then review possible reasons in favor of making such more compliant with the SE account. Doing so will lead me to discuss some alternatives to the SE account such as the causal role account (Odenbaugh 2011), the organizational account (Nunes-Neto, et al. 2014) and the persistence-based account (Dussault and Bouchard forthcoming).

Marc **Ereshefsky** University of Calgary

Science and Metaphysics: Lessons from Microbiology

The typical view of biological individuality holds that biological individuals are just like us: organisms have two parents from the same species and start life as single zygotes. However, recent work in microbiology challenges this view. Microbial consortia act just like individuals in natural selection, yet they have hundreds of parents from dozens of different species, and they don't start life as a single zygote but as a complex aggregate. The lesson here is not merely that we have been wrong about individuality, or that there are counterexamples to our favoured account. The lesson is deeper than that. What is being challenged is the assumption that there is one correct theory of individuality; that the biological world is ultimately carved in one particular way. Given the contingent nature of evolution we should expect a plurality of kinds of biological individuals. Moreover, given the contingent nature of evolution we should allow that new and different kinds of individuals might evolve; that the category 'biological individual' is in fact open-ended. What does this imply for metaphysics? First, we should not assume that there is a fundamental structure to the world such that there is one ultimately correct way to divide the world into biological individuals. Second, we need to be more pluralistic and more pragmatic about biological individuality. Third, when we answer the question 'What is a biological individual?' with a plurality of accounts, we may be more successful than we think.

Erlantz **Etzeberria** University of Western Ontario

Can Scientific Models Explain?

How can false models explain real phenomena? Alisa Bokulich (2011) has recently argued for a new kind of model explanation that solves this puzzle. Relying on Woodward's theory of explanation (2003), Bokulich argues that a model explanation consists in providing counterfactual information about how the explanandum phenomenon would be different had the factors cited in the model (explanans) been different. In this paper I argue that there is a fundamental mistake in her account. First, according to her view, a real phenomenon counterfactually depends on idealized variables, or more generally, on a false model, which seems absurd. This appears to reverse the relationship between models and phenomena— phenomena are ontologically prior to models, so her theory is metaphysically misguided. Second, Bokulich's proposal wrongly assumes that counterfactuals such as "if the elements of the model had been different, then the real world phenomenon would have been different" are true. But it is possible that if things had been different in a model, then the real world phenomenon would still be the same, thus failing to achieve any explanation. This is because models are idealizations of facts, and the same set of facts can admit different ways of idealization and, hence, different models. As a result, Bokulich's proposal is neither metaphysically nor epistemically adequate. I conclude that her requirement of isomorphism should be revised to avoid the problems presented in this paper and preserve the asymmetry there seems to be between scientific models and real phenomena.

Richard **Feist** Saint Paul University

Science, Culture and Metaphysics in Edwardian England

Alfred North Whitehead and John McTaggart Ellis McTaggart are two of the most prominent metaphysicians in the Edwardian period of British Idealism. They are often seen as quite diametrically opposed: Whitehead's atomistic metaphysics is arguably one of the most developed systems of process philosophy whereas McTaggart's personal idealism fundamentally rejects all notions of process, to the point of the rejection of time itself. Whitehead was mathematically trained and developed a relativistic physics which he posed as an alternative to Einstein's. McTaggart studiously avoided building metaphysics on any kind of scientific knowledge and even claimed to have no serious knowledge of science. But interestingly enough, upon serious examination, the two systems are remarkably similar. This paper details the systems, illustrates their similarities, and discusses the role of culture and science in the construction of these systems.

Jacqueline **Feke** University of Waterloo

[Ptolemy's Astrological Rays](#)

In his astrological text, the *Tetrabiblos*, Ptolemy describes celestial bodies as transmitting their powers through the heavens and into the sublunary realm. The way they do this is by means of rays. Ptolemy nowhere states what these rays consist of, if anything, or how the stars transmit them, and yet they bring the powers of the stars into contact with one another as well as with sublunary bodies and souls. It is because the stars' rays come into contact with the elements comprising the sublunary region that the stars and their movements effect changes there, including meteorological phenomena and even the characteristics of human souls. In this paper, I will explore the nature and movements of these celestial rays by drawing on Ptolemy's physical theory as portrayed in the *Tetrabiblos* as well as his *On the Kritêrion and Hêgemonikon*, *Planetary Hypotheses*, *Optics*, and fragments from his lost *On the Elements*.

Nicolás **Fernández-Medina** The Pennsylvania State University

[The Science of Vital Force: Diego de Torres Villarroel and *la nueva ciencia* in the Spanish Enlightenment](#)

My proposed paper deals with Diego de Torres Villarroel's fascinating *Anatomía de todo lo visible, e invisible de ambas esferas* of 1738, a travel journal of sorts in which the author is transported to an ulterior world of fantasy and voyages with a group of companions through the depths of the earth, the azures of heaven, and more importantly, the medicalized body. Although remembered mostly as a mathematician, author, and astrologist, Torres was a lifelong student of science and medicine who kept abreast of the latest advancements in anatomy and physiology. As will become clear in my presentation, even scholars like Torres who safeguarded theological paradigms of body-soul dualism were incapable of "sanitizing" their own discursive practices of the so-called subversive revelations of modern science and its vitalist preoccupation. What was known as *la nueva ciencia* (medical and anatomical theory and science) not only infiltrated Spanish intellectual circles, but it would profoundly alter the epistemic appraisal of the body's vital force and its implications on medical and sociopolitical practices, an area of study that still today has received little critical attention. In my presentation I will demonstrate to what degree Torres's *Anatomía* articulates one of the more intriguing defenses of the soul's authority in matters of vital force, a defense that points ironically to the great gains made by *la nueva ciencia* during the early eighteenth century in Spain.

Sergio A. **Gallegos** Metropolitan State University of Denver

[What do scientific models represent? A Peircean response](#)

In recent decades, philosophers of science have devoted considerable efforts to understand what models represent. One popular position, which has been endorsed by Barberousse and Ludwig (2009, 57), is captured by the fundamental claim that 'models are (...) representations of fictional situations.' Another position, which has been endorsed by Teller (2009, 244), involves the thesis that, though models often involve fictional elements, these are 'used as component fictions to represent the real trajectories of real objects, the real fluid behavior of real bodies of water.' Though these two positions may seem to be incompatible, I believe it is possible to reconcile them. The basic insight that underpins my proposal is that, insofar as a scientific model is a representation, it can be used to represent a fictional situation in some contexts or circumstances while it can be used in others to represent a real state of affairs (or a portion thereof). Using a threefold distinction between different representations proposed by Peirce in 1867 in 'On a New List of Categories', I develop an argument based on a proposal recently made by Kraleman and Lattman (2013) that shows that the two aforementioned positions can be reconciled by distinguishing different ways in which a representation can be used. In particular, on the basis of Peirce's distinction (W2, 56) between icons, indices and symbols, I argue that models can sometimes function as icons, sometimes as indexes and sometimes as a symbols, depending on the context in which they are considered and the use that they are developed for because they all have iconic, indexical and symbolic features. In virtue of this, the upshot of my paper is to show that scientific models can represent, depending on the specific context or circumstances, either fictional situations or real states of affairs.

Teri **Gee** Brigham Young University - Idaho

[Abu Ma'shar vs. Ptolemy: Astrology vs. Astronomy](#)

In the modern world, the line between astronomy and astrology is firmly delineated. Astronomy is science. Astrology is not. In Antiquity and the Middle Ages, the separation between the two is less clear. In this paper, I take two astrological texts, Abu Ma'shar's *Kitab al-Madkhal al-kabir* and Ptolemy's *Tetrabiblos*, and look at how the two of them defend astrology based on its relationship to astronomy. While Ptolemy presents astronomy and astrology as two aspects of the same science, Abu Ma'shar explicitly separates astrology ('ilm al-nujum) from 'ilm al-kull, which includes both astronomy and cosmology in its purview. While this separation would become more formalized in later centuries, Abu Ma'shar is using this separation to raise astrology to the pinnacle of the sciences, the highest and noblest of them all. The use of separation becomes a method of glorifying astrology rather than presenting it as a less accurate science, as Ptolemy did.

Vincent **Guillin** Université du Québec à Montréal

L'éthologie « à la française » : la problématique réception de la science millienne du caractère chez les psychologues français *fin de siècle*.

Dans un des rares articles consacrés à l'éthologie de John Stuart Mill et à son devenir (Leary 1982), D. Leary a bien montré la manière dont ce programme de recherches avait échoué à se développer, en Angleterre, en une spécialisation psychologique théoriquement unifiée et institutionnellement reconnue. Mais Leary souligne aussi que « tel n'a pas été le cas en France (...), [où] on a entrepris de développer une *éthologie* qui imitait plus ou moins consciemment le programme original de Mill » (Leary 1982, 157). Dans notre présentation, nous aimerions montrer que la reprise du projet millien d'une science des lois de formation du caractère, en particulier chez Théodule Ribot, Frédéric Paulhan et Alfred Fouillée, s'est opérée dans le cadre d'un débat plus général sur les parts respectives de la « nature » et de la « culture » dans la détermination et la manifestation des aptitudes mentales humaines et que ce sont ces circonstances qui ont en grande partie déterminé une des modalités caractéristique de la réception française de l'éthologie, à savoir une focalisation résolue sur les déterminants biologiques du caractère, qui tranche radicalement avec l'« artificialisme » psychologique de Mill et son insistance sur la « pliability ».

Brian **Hanley** University of Calgary

A New Approach to Causal Selection

I offer and explain a new approach to the problem of causal selection: how we select one or a few causes as 'the cause' among many causes in complex causal situations. Mainstream approaches typically takes causal selection as just another problem among the many traditional problems of causation (e.g. preemption, omission, etc.) for which the right causal theory can account for. I propose an alternative approach to causal selection that uses a modest theory of causation for distinguishing causes from non-causes, such as Woodward's (2003) interventionist account, and looks to context-sensitive pragmatics to explain why certain causes are selected when they are. This approach offers an account of causal selection that does not gloss over the actual principles scientists and engineers use to effectively select among causes when modeling or manipulating complex causal situations. My approach also provides a way to use causal selection to reconceive and analyze other traditional problems of causation that diverges from their mainstream conceptions along lines of causes and non-causes. By reconceiving traditional problems of causation in terms of a modest causal theory and pragmatic causal selection, this approach offers a way forward for these traditional problems that can be informed by scientific and engineering practice. I explain how my approach differs from mainstream approaches to causal selection, and the philosophical upshot of the approach as both providing an account of causal selection and a means to analyze causal reasoning.

Quinn **Harrington** University of Toronto, Jenifer **Barton**, University of Toronto

Meno's Paradox for Experimentalists: Replicating Heinrich Hertz's Electromagnetic Standing-Wave Experiment

This paper presents our attempt to replicate Heinrich Hertz's famous electromagnetic wave experiments of 1887, and it recounts our efforts to observe and quantify the standing-wave effect reported by Hertz. Our work suggests that the production of the effect presents a number of challenges. In particular, our Hertz-style electric spark generator produces a weak effect in the detector. Identifying the problem will require determining the sensitivity of the experimental apparatus to its environment, developing more sophisticated experimental techniques, and even using "supportive apparatus" that may aid in diagnosing our divergent results. With this work, we are presented with many material difficulties that challenge the notion that created scientific phenomena are either present or absent. Our findings suggest that it is a more complicated process, and that a weak effect may need to be "coaxed" or "coddled" into a stronger observable existence, which can require much patient tweaking and nurturing of the experimental apparatus. The striking weakness of the observed effect in our work raises important historical questions regarding the replication of historical scientific experiments and Hertz's own experimental process. One prominent question is this: would Hertz have been able to overcome the production and observational challenges we've faced without the theoretical presumption, drawn from either Maxwell or Helmholtz's electromagnetic theories -- that there was an effect in waiting of observation? Does the tenacity to coax at least some observable effects from apparatus require a confidence in the correctness of the relevant theory?

Peter **Harrison** The University of Queensland

Book Panel - *The Territories of Science and Religion* by Peter Harrison

Organiser: Yiftach **Fehige** University of Toronto. Panelists: Peter **Harrison** The University of Queensland (Australia), Bernard **Lightman**, York University, Jack **MacIntosh**, University of Calgary, Adam **Richter**, University of Toronto, and Stephen **Snobelen**, King's College.

This book panel features Peter Harrison's most recent contribution the interdisciplinary field of science and religion. In *The Territories of Science and Religion* Harrison presents a genealogical analysis of the relationship between science and

religion. Historically, Harrison tells for the first time a story of the emergence of the categories of science and religion in Western consciousness. Philosophically, he argues that the manner of their emergence can provide crucial insights into their present relations. Harrison will present a summary of his views, and respond to points of critique presented by Yiftach Fehige (Chapter One: “The Territories of Science and Religion”; Chapter Five: “Science and the Origins of ‘Religion’”), Bernard Lightman (Chapter Six: “Professing Science”), Jack MacIntosh (Chapter Three: “Signs and Causes”), Adam Richter (Chapter Five: “Utility and Progress”), and Stephen Snobelen (Chapter Two: “The Cosmos and the Religious Quest”).

Susan **Hroncek** Wilfrid Laurier University

[The “Nightmare” of Chemistry? Transforming Late-Nineteenth Century Perceptions of Alchemy](#)

In an 1852 lecture to the Royal Institution, Michael Faraday announced that “the time had passed” for scientists “to spurn the doctrines of the alchemists,” including the alchemists’ belief in transmutation and the Elixir of Life (7). Although early-nineteenth century historians of chemistry like Thomas Thomson and William Whewell had condemned alchemy as a shadow in chemistry’s past, by the 1850s, recent discoveries in atomic structure, particularly “the condition of allotropism,” according to Faraday, “goes far to vindicate many opinions of the alchemists” and “shatters ... our absolute repudiation of the doctrine of transmutation” (7). This admission from the most eminent scientist in Britain marked a new direction for chemistry in the late-nineteenth century—one that encouraged chemists and historians of the period to reexamine their perceptions of the history of chemistry and the relationship between alchemy and chemistry. Such a re-examination forced writers of the period, including Marcellin Berthelot, George Henry Lewes, and Henry Carrington Bolton, to rationalise their conception of chemistry as a “modern science” with the long history of alchemical practices and mystical beliefs that haunts its progress. This consequently transformed their perceptions of chemistry’s future development, and, in this paper, I trace this transformation in late-nineteenth century chemical discourse as the claims of the alchemists grew increasingly less fantastical and would at last, in 1901 with the discovery of atomic transmutation, become reality.

Jennifer **Hubbard** Ryerson University

[Navigating Literature Concerning the History of Canadian Fisheries Science](#)

The history of fisheries biology is daunting: it embraces aspects of political history, policy studies, the history of science and technology, social history, economic history, and environmental history, not to mention the history and sociology of the fisheries themselves. Prior to the 1990s, there were almost no histories of Canadian fisheries biology, aside from in-house efforts by scientists. Today, Canadian studies of the history of the nation’s fisheries, the scientists who have researched them, and the technocrats and others who have ‘scientifically’ administered them, run the gamut of the fields listed above. However, almost all the available literature suffers from regionalism, since scholars tend to focus on developments in specific coastal regions, oceanic areas, or lake and river systems. Can or should this regionalism be overcome, considering that the fisheries tend to be internationally-contested resources? What are the identifiable lacunae in the history of Canadian fisheries biology? This paper will attempt to answer these questions while surveying the literature on contentious fisheries conservation and other issues, and the contributions of Canadian scientists and other individuals, in the history of Canadian fisheries biology and management.

Robert **Hudson** University of Saskatchewan

[The Reality of Jean Perrin's Atoms and Molecules](#)

Jean Perrin’s early 20th-century work in support of the reality of atoms and molecules, for which he received a Nobel Prize in 1926, is often taken as paradigmatic of the sort of reasoning (‘robustness reasoning’) in which multiple, different experimental sources are able to put on firm footing a theoretical result. By means of a variety of experimental sources dealing with the viscosity of gases, Brownian movement, critical opalescence, the black body spectrum – even the blueness of the sky – Perrin thought himself to have established a relatively precise value for Avogadro’s number and to have thereby exhibited the reality of atoms and molecules. In this paper I demonstrate that Perrin does not in fact use robustness reasoning in support of the reality of atoms and molecules. Rather, his approach is to use a similar form of reasoning, ‘calibration reasoning’, whereby one experimental route is claimed to be the standard by which to judge other experimental strategies. Does the resultant calibration approach lead to a defensible realism? I argue that it does, contra the anti-realist interpretations of Perrin’s work by Bas van Fraassen and Peter Achinstein. But it is a different form of realism from the one claimed by Stathis Psillos to be present in Perrin’s work (i.e., in Psillos’ 2011 paper, “Moving Molecules Above the Scientific Horizon”), since Psillos wrongly bases his realist interpretation of Perrin’s work on the faulty assumption that Perrin’s realism is motivated by a form of robustness reasoning.

James **Hull** University of British Columbia, Okanagan

Science in – and out – of the Woods

This paper discusses the place – and sometimes the absence – of science in Canadian historical writing about the forest and forest industries. Reviewed are the classics of staples-thesis influenced economic history, critical studies of forest policy and more recent writings of a more clearly environmental history nature. The appointment of the federal Commission of Conservation which at least nominally attempted to bring academic ideas about forestry to forest exploitation is identified as a key development in the understanding of science in the forest in Canada. However this development has been at best imperfectly linked to the emergence of university-level programmes of forestry education and, crucially, to changing science-based technologies of forest product manufacture.

Dani **Inkpen** Harvard University

Cool Relations: Science and Mountaineering on the Juneau Icecap, 1948-51

Forms of identity and social belonging have been important tools for historians studying the moral lives of scientists. The gentleman of the seventeenth and nineteenth centuries, the courtier of the sixteenth, and the entrepreneur of the twentieth century are well known to historians of science; and gender, politics, and character are easily recognized as categories relevant for interrogating the personal and public lives of scientists. In this paper, I argue that sport and identities formed through recreation may be valuable categories in our studies of twentieth century field sciences. I do so by analyzing a territorial dispute that took place on the Juneau Icecap, Alaska in the late 1940s between glaciologist Maynard Miller and climber Fred Beckey. Rather than pit the cultural authority of science against that of mountaineering, disputants used the shared form of social belonging and ethical vocabulary of mountaineering to address their conflict. The culture of mountaineering trumped that of science. I suggest that this is because mountaineering, long understood by its practitioners as a calling, had the capacity to engender a strong sense of identity and ethical commitment. As alpine field sciences generally require some mountaineering skills, and often attract climbers and mountain lovers, identification as a mountaineer may impact the moral lives of scientists working at altitude. This paper falls in line with Vanessa Heggie's recent arguments to attend to the relationships between sport and science in the twentieth century.

Andrew **Inkpen** University of Pittsburgh

Putting Popper Into Practice

This paper examines the influence of Karl Popper's philosophy of science on biologists, particularly community ecologists from the mid-1970s through the 1980s. At this time the epistemic norms in community ecology were in considerable flux, and two distinct groups of ecologists emerged and vied over the future direction that ecology should take. One group drew explicitly on Popper's philosophy, and argued that only if ecology became "Popperian" would it escape being a "soft" or "sick" science (and become a "hard" science like physics and molecular biology). I am particularly interested in the experimental norms of these two groups and how Popper's philosophy was used to adjudicate "proper" experimental methodology from "improper." In this paper, I will deal specifically with three issues. First, why Popper's philosophy, and not anyone else in philosophy at the time? Was it the simplicity of Popper's ideas? Their rhetorical power? Or was it the content of his philosophy that mattered to these ecologists? Second, this case presents a unique opportunity: how and through what means does philosophy get translated and appropriated by scientists themselves? Why did Popper, as opposed to other philosophers, particularly those offering alternative positions, show up on these scientists' radar? Finally, and more normatively, was their use of Popper's philosophy (a) consistent with Popper's actual position and (b) good for the future of community ecology.

Jason **Jean** University of Saskatchewan

Evolution as a Fact?: A Discourse Analysis

The "Evolution as a Fact" discourse has existed within public scientific literature since the 1920s. However, despite its 85+ year history, and how pervasive this discourse has become, there remains very little uniformity within the discourse regarding when evolution became a fact, how it became a fact, whether evolution is both a theory and a fact, or whether evolution is still a theory. There is no consistency regarding the definition of the term 'fact', nor whether it is appropriate to utilize or modify the term from either scientific or lay terminology. The scientists and public scientists who contribute to this discourse never critique other contributions despite incompatibilities and inconsistencies with their interpretations, and, to the extent that authors discuss other contributions, misinterpretations are common and unaddressed. This discursive trend is interpreted utilizing Thomas Gieryn's concept of cultural cartographies for the purposes of convincing the public and policymakers to invest and support scientific careers and scientific knowledge hegemony. It represents a clear case of scientific fundamentalism wherein the creationist threat is engaged, not through organized rational discussion and debate, but through superficial rhetoric made by public scientists.

Molly **Kao** University of Western Ontario

[Einstein, Millikan and Quantum Theory: The Evidential Import of the Photoelectric Effect](#)

When Einstein first put forth the hypothesis of light quanta in 1905, the scientific community's reaction was not enthusiastic. One of the factors contributing to this was the lack of precise experimental data available for the phenomena Einstein was addressing. When Millikan performed his experiments on the photoelectric effect almost a decade later, the results were in striking agreement with Einstein's predictions, and scientists began to take the light quanta hypothesis much more seriously. A philosophical analysis of Millikan's work can thus provide insight into how experiments can guide developing theories. In this talk, I argue that Millikan's work did not provide evidence for the existence of photons as is sometimes argued. One of the major accomplishments of Millikan's work was his confirmation of Einstein's predicted linear relationship between stopping potential and frequency of light. I argue that this result does not differentiate between alternative physical explanations of why the linear relationship holds. This is because it would be possible to derive the linear relationship with alternative accounts of the physical underpinnings of this behaviour, all of which could be considered to be confirmed by the experiments. Nevertheless, this work contributed significantly to the development of a quantum theory by providing a measurement of the fundamental theoretical parameter known as Planck's constant.

Joseph F **Keeping** York University

[What it's Like to Be a Bat](#)

In his essay "What is it Like to Be a Bat?" Thomas Nagel argues that any scientific account of consciousness must fail to explain the subjective character of experience, the "what it is like to be" in a particular conscious state. This is because the subjective character of experience is accessible only from the first person, whereas science always operates in the third person. He illustrates this through the case of bat echolocation, which he asserts is unlike any sense that we possess and therefore beyond our ability to imagine. The prospects for a satisfactory physicalist account of consciousness are therefore quite dim. Drawing upon the enactive approach to perception, I attempt to show that the subjective character of a particular sensory modality is determined by its pattern of sensorimotor interaction and the information it gathers. Both of these factors are amenable to third-person methods of investigation and description. Consequently, contra Nagel, the subjective character of experience is something that can be investigated and described scientifically. Nagel's error is based upon an epistemologically untenable juxtaposition of the subjective to the objective, overlooking their crucial interdependence.

Alexandre **Klein** Université d'Ottawa

[Du soi-disant retard scientifique de la psychiatrie francophone dans le Québec des années 1950.](#)

Essai de déconstruction d'un mythe historiographique tenace. L'histoire de la psychiatrie québécoise a été écrite autour de la distinction entre une psychiatrie anglophone privilégiée et donc avant-gardiste et une psychiatrie francophone désuète parce qu'embourbée dans la religion et délaissée par les gouvernements. Face au Verdun Protestant Hospital, premier hôpital d'Amérique du Nord à utiliser, dès 1953, la chlorpromazine, l'Hôpital Saint-Jean-de-Dieu, dont un ancien patient dénoncera en 1961 l'insalubrité et l'absence de traitements médicaux. Pourtant, même s'ils ne bénéficiaient pas, avant les années 1960, des mêmes conditions d'enseignement, de formation ou de travail que leurs collègues anglophones, les psychiatres québécois francophones n'en étaient pas moins eux aussi à la pointe de la recherche scientifique mondiale. Loin du retard que de nombreux ouvrages historiques lui attribuent encore aujourd'hui, la psychiatrie québécoise francophone abordait en effet les mêmes sujets, traitait les mêmes problèmes et utilisait les mêmes méthodes que sa consœur anglophone. C'est ce que nous entendons prouver dans cette communication en étudiant les travaux des psychiatres francophones publiés entre 1948 et 1961 dans différentes revues scientifiques (Canadian Medical Association Journal, Canadian Psychiatric Association Journal, Union médicale du Canada) et universitaires (Montréal Médical, McGill Medical Journal, Laval Médical). En comparant leurs recherches à celles de leurs collègues anglophones, nous démontrerons que les psychiatries québécoises des deux communautés linguistiques travaillaient alors au sein d'un même paradigme et à un seuil épistémologique commun. Nous serons ainsi en mesure de contribuer à la déconstruction d'un mythe historiographique tenace, participant ainsi à l'écriture d'une nouvelle histoire de la psychiatrie canadienne.

Gabriel **Larivière** Simon Fraser University

[On Tarski's Reconstruction of Semantical Concepts](#)

Between 1928 and 1936, Tarski attempted to clarify several metamathematical concepts by reconstructing them in and for formal languages. It is in that context that semantical concepts like *definability* and *truth* were explicitly defined for the first time. I argue that these semantical reconstructions are mathematically and philosophically very different than his and other people's reconstructions of syntactical concepts for three reasons. First, they are defined for compositional object languages. Second, they are defined in compositional languages. Third, they lead Tarski to change his views about what

his formal languages aim at and really do: they no longer aim at capturing intentions and they no longer give meaning-as-use to their primitives, but instead, aim at extensions in a compositional way. I exhibit this new turn by comparing his “On Definable Sets of Real Numbers” (1930) to his “Z badań metodologicznych nad definijowalnością terminów” (1934). I then extend this reading to his famous “Pojęciu prawdy w językach nauk dedukcyjnych” (1933). I finally oppose this narrative to that of commentators like Patterson (2008) and (2012) who argues that Tarski’s reconstructions of semantical and syntactical concepts are carried with the same views of meaning as they follow from his general Intuitionistic Formalist philosophical project.

Matthew **Laubacher** Ashford University

[Smithsonian in the Subarctic: Spencer Baird, Scientific Reconnaissance, and Alaska as the Focus of Transnational Natural History in the mid to late nineteenth century](#)

Spencer Fullerton Baird’s dedication to develop the Smithsonian into a center of Pan-American natural history led to a significant investment in collecting in the subarctic in the mid to late nineteenth century. Following up on the efforts of Robert Kennicott in the Hudson Bay Territory, Baird’s sponsorship led to the Smithsonian being the main scientific beneficiary of the ill-fated Western Union Telegraph Expedition to Alaska in 1867. The Expedition cost Kennicott his life, but led to the emergence of William Healey Dall as a reliable collector and correspondent for Baird’s Smithsonian. The W.U.T.E. also influenced the government’s decision to purchase Alaska from Russia, leading indirectly to the development of a number of meteorological stations throughout the territory. In his typical enterprising fashion, Baird used this opportunity to post collectors at these stations, including a young E.W. Nelson, leading to a steady stream of Alaskan natural historical and anthropological specimen to the Washington museum. Nelson, like Kennicott prior, maintained his own collection network in the subarctic, working closely with native peoples to procure specimens for the Smithsonian; indeed, Nelson’s relationship with native peoples allowed him to serve as an effective transmission point for native knowledge to a scientific audience. The combination of Baird’s transnational focus and the subsequent sponsored scientific reconnaissances of Kennicott, Dall, and Nelson contributed greatly to the Smithsonian becoming the center of subarctic natural history and anthropology in the United States at a time of expanding cultural and scientific interest in the region.

Victor **Lefèvre** Université Paris 1 - Panthéon Sorbonne

[Extension et défense de l'approche organisationnelle des fonctions écologiques](#)

Les écologues emploient un vocabulaire fonctionnel. Cette pratique soulève au moins deux problèmes : le problème de la normativité – attribuer une fonction à une entité, c’est dire ce qu’elle est censée faire – et le problème de la téléonomie – attribuer une fonction à une entité, c’est expliquer son existence à partir de son activité, soit une inversion du schéma explicatif causal classique. Pour résoudre ces problèmes les philosophes de la biologie ont développé plusieurs théories. Les principales rencontrent des difficultés spécifiques lors de leur application au cas des fonctions écologiques : l’approche systémique de Cummins (1975) sous-détermine la classe des fonctions écologiques – Odenbaugh (2010) qui l’adopte se voit par exemple contraint à attribuer des fonctions écologiques aux volcans et aux éclairs à l’encontre des pratiques des écologues. L’approche étiologique-sélective de Neander (1991) doit quant à elle souscrire à l’hypothèse controversée d’une sélection naturelle opérant sur les écosystèmes. Nous endossons comme alternative l’approche organisationnelle de Nunes-Neto, et al (2014) considérant une fonction écologique comme une contrainte soumise à clôture organisationnelle dans un écosystème donné. Nous en proposons une reformulation en s’appuyant sur la caractérisation récente de Montévil et Mossio (2015) de la clôture organisationnelle. Nous soutenons que cette nouvelle formulation génère une classe de fonctions écologiques plus proche de celle des écologues sans pour autant tomber dans le travers de la sous-détermination comme le fait l’approche systémique ni s’éloigner des théories communément admises en écologie comme le fait l’approche étiologique. En particulier, cette approche organisationnelle rend compte des attributions de fonctions aux parties dites « abiotiques » des écosystèmes. Nous répondons ainsi à une objection de Bouchard et Dussault (2015) contre l’approche organisationnelle.

Thomas **Lerosier** Université Grenoble Alpes

[La dimension spatiale des activités scientifiques et technologiques \(Grenoble, France – 1950-2015\)](#)

En France, comme dans d’autres pays, les activités scientifiques subissent d’importantes transformations depuis la fin de la Seconde Guerre mondiale (professionnalisation, transformation des universités, augmentation du nombre d’étudiants, etc.). Ces mutations introduisent de nouveaux rapports à l’espace physique (Grossetti 1995 ; Kargon et Leslie 1994). Partant d’une étude de cas, l’enjeu de cette communication sera de saisir comment, en se transformant, les activités scientifiques recomposent le tissu urbain, génèrent des connexions ou délaissent des espaces. Elle montrera que différents rapports à l’espace se succèdent dans le temps. Après avoir occupé des bâtiments dispersés dans la ville, les activités scientifiques se concentrent dans des espaces réservés (campus universitaires, parcs technologiques). Puis, à partir des années 1990, elles sont envisagées comme un réseau d’acteurs et de lieux à travers le tissu urbain. On

s'intéressera successivement à la construction discursive du territoire, aux dimensions matérielles des espaces scientifiques et technologiques ainsi qu'aux effets de proximité dans les coopérations scientifiques. Il s'agira de saisir à la fois les effets propres engendrés par ces espaces et leur dimension de réification – toujours inachevée – de l'espace social (Bourdieu 1993).

Darryl **Leroux** Saint Mary's University

Genetic Genealogy and the Politics of Race: The Case of Québec

This paper presents preliminary findings from a research project that focuses on the relationship between genealogy and genomics in Québec. Genealogy has a storied history in Québec and French Canada that builds on nearly a century-and-a-half of family history research. In fact, the genealogy industry continues to grow, with tens of thousands of people actively belonging to dozens of genealogical associations. Recently, Québec has also embraced population-level genetic research with the founding of Cartagène, one of the largest national genomics projects in the world. Several scholars have demonstrated how Cartagène's existence as a scientific and commercial enterprise is at least partly due to the rich genealogical data available in Québec (Bibeau 2004; Hinterberger 2010). One of the primary ways in which genealogy and genomics, or more specifically, DNA-based ancestry testing combine is through what Alondra Nelson (2008) has called "genetic genealogy," or the "use of DNA analysis for the purpose of inferring ethnic or racial background and aiding with family history research" (761). In this sense, family history researchers fill in the blanks in genealogical records with results obtained through DNA ancestry testing. This paper documents the recent work of the two largest genealogical associations in Québec in order to illustrate how changing ideas of "blood" and "genes" – linked as they are to associated scientific and technological innovations – are redefining notions of race and difference in Québec in ways that dovetail with notions of national belonging.

Caroline **Lieffers** Yale University

"Packin' a '45, a dipper, and an Argus": Photographing Medical Entomology in the Second World War

On 25 January 1945, the U.S.S. Magoffin slid into New Caledonia's Nouméa Harbour. On board was Sergeant Charles Remington, a young medical entomology technician with the U.S. Army's 218th Malaria Survey Unit. Armed with his Argus camera, Remington recorded a year's work in New Caledonia, the Philippines, and finally Occupied Japan. While official images of military medical entomology depict the discipline's advances with measured triumphalism, an analysis of this rare amateur archive presents a more nuanced portrait of wartime science. The Second World War rendered the Pacific a cultural crossroad, and the first section of this paper focuses on Remington's relationships with native peoples. At once hegemonic and affectionate, respectful yet evocative of salvage ethnography, his photos reflect the fundamental ambiguity of a wartime role that combined military domination, colonialist politics, and close interaction with locals. The second section examines relationships between the scientists and their environment; the photos document the military researchers' slippages between masculine play and physical and intellectual conquest. As the unit moved into Japan in late 1945, however, this research impulse shifted to a deeply professional spirit of scientific internationalism. The third section examines how Remington put aside his fascination with the visual exotic and took formal pictures of Japanese fellow-scientists not as enemies or "natives" but as colleagues. Medical entomology's unofficial visual record hosted a complex military logic of tourism and camaraderie, ethnography and exploration, as well as a legacy of international scientific cooperation and collegiality.

Debra **Lindsay** University of New Brunswick

Birds, Beasts, and Backers in British North America: The 'American Woodsman' goes North

John James Audubon devoted the last half of his life to depicting the birds and mammals of North America. His monumental *Birds of North America* (four volumes; 1827–1838) contained 435 plates depicting (almost) 500 species that were described in five companion volumes entitled *Ornithological Biography* (1831–1839), and the *Quadrupeds of North America* (1845; 1846–1854) which he produced with collaborators was described by scientist Spencer F. Baird as the "crowning work" of their labors in his own ground-breaking work, *The Mammals of North America* (1859, xiii). From 1820 until the mid-1840s, Audubon wandered in search of specimens and subscribers for his beautiful books, and his peregrinations took him to BNA three times: to New Brunswick in 1832; to Labrador in 1833; and to Upper and Lower Canada in 1842. This paper examines how a transplanted European who identified as a proud citizen of America used imperial connections to advance his work in natural history.

Eleanor **Louson** York University

Taking Spectacle Seriously: Wildlife Films and the Legacy of Natural History

Display In the 21st century, a distinct subgenre of natural history program emerged, consisting of wildlife documentary series and feature-length films of unprecedented visual spectacle. I identify this as a "blue-chip renaissance" attributable to a combination of technical innovations, high production values, extensive coproduction agreements, and traditional

elements of the wildlife genre, resulting in a characteristic visual style emphasizing spectacular imagery of wildlife and their environments. While the representational and knowledge-disseminating modes of documentary have received much critical attention, its aesthetic and spectacular dimensions are understudied, with the exception of a few theorists interested in these films' ability to inspire wonder in their audiences and who take spectacle seriously as a means of embodied, affective knowing for viewers (Beattie 2008; Cowie 2011; Scott 2003). I characterize the blue-chip renaissance as a significant recent iteration of natural history display; its films employ innovative techniques to visually showcase nature caught on film and inspire wonder in audiences, following the tradition of cabinets of curiosity and museum collections. Scholarship on wildlife films focuses overwhelmingly on its educational role, particularly for issues of misrepresentation and fakery. By taking spectacle seriously, I argue that the entertainment and educational mandates of wildlife filmmaking are co-constitutive, like those of natural history display in general.

Jack **MacIntosh** University of Calgary

[Kant's Defence of Quantum Mechanics \(Yet another look at Kant on Causality\)](#)

Kant's remarks on causality have given rise to a great deal of comment, mostly unsympathetic. In this paper I argue that the Second Analogy contains one strong central response to Hume's worry. (Lewis White Beck pointed out that there are two principles involved in the Second Analogy: "every event has a cause," and "same cause, same effect." In this paper I focus on the first.) Given Kant's assumptions his argument is valid, but it does not have quite the conclusion that Kant believed it to have. Not to be mysterious, Kant's defence really amounts to a defence of quantum mechanics, not, as he understandably assumed it did, of classical mechanics. My defence of Kant aims to show that his unacceptable (phenomenalistic) premises are replaceable by more plausible ones which he could have accepted. En route I suggest that this re-interpretation avoids a number of current criticisms. I also note that although Kant writes, as do many of his commentators, as if causality were the central issue, the real issue turns around the notion of reliable law-like regularities. Kant's argument aims to show that there are such regularities, without any need to say precisely what they are. However, the laws he in fact believed could be shown to be necessary strengthen the point that the real interest is nomological rather than simply causal.

Christophe **Malaterre** Université du Québec à Montréal

[Chemical Evolution: from Natural History to Theory](#)

The concept of "chemical evolution" is notably used in the context of origins of life studies to account for the emergence of living matter from non-living matter. So construed, chemical evolution is often interchangeable with such terms as "abiogenesis" or "biopoesis". The concept can be traced back to the Darwinian turn of the mid 19th century. Huxley, Tyndall, Spencer or Haeckel, for instance, envisioned a progressive evolution of non-living matter into life forms. Subsequently, the concept can be found in the writings of many prominent 20th century scientists working on the origins of life, from Oparin and Haldane at the start of the century to Joyce, de Duve or Szostak more recently, and many others. In this contribution, I argue that the meaning of the concept has shifted over time: whereas it started as a label for an episode of natural history -the likely succession of events that culminated in the appearance of life- it has turned into an evolutionary theory based on specific processes and whose aim is to account, in a naturalistic way, for the transition from non-living matter to living matter. As an episode of natural history, its main role was that of a descriptive narrative. As a theory, its role became explanatory. This shift, I argue, was made possible by the transposition of biological evolutionary processes -such as evolution by natural selection- into the chemical realm.

Carlos **Mariscal** Dalhousie University

[Making Sense of Evolution in a Universal Context](#)

Recent discoveries, such as the existence of hundreds of exoplanets in our universe and the presence of water on Mars, provide us with new contexts in which life-like phenomena can arise. Developments in astrobiology and synthetic biology raise the possibility that we will be faced with unfamiliar phenomena in unfamiliar environments, in which it may not be obvious if the phenomena is the result of evolution by natural selection. For example, the only life-detection experiments ever done on Mars yielded ambiguous results, with one researcher, Gil Levin, still arguing his particular experiment discovered life on Mars (Levin 2013). In this talk, I argue how rethinking key biological notions as independent of the contingencies of life on Earth, may make sense of such ambiguity. By considering strangely or minimally evolving systems, we can see how much personal and scientific judgment must come into play. It is likely too optimistic to assume we will know 'life' when we see it. One consequence of this view is that the distinction between evolutionary and non-evolutionary processes becomes blurred, which is consistent with current discussions in biology over the fuzziness of concepts such as reproduction, heritability, variation, population, fitness, etc. We claim the study of universal biology is a useful exercise in thinking about the field of evolutionary biology as a whole, and the contexts to which it best applies.

Alison **McConwell** University of Calgary

[Individuality Pluralism and the Evolutionary Contingency Thesis](#)

How to individuate biological entities is a contested notion in philosophy of biology. The question of biological individuality concerns how to carve up the organic world into basic units. Evolutionary individuals are biological individuals that natural selection takes as its object. Criteria for evolutionary individuality are disputed (Godfrey-Smith 2009, 2011, 2013, Dupré and O'Malley 2009, Ereshefsky and Pedroso 2013, 2015, Pradeu 2010, 2012, and Clarke 2013). I propose that there are many ways to individuate biological entities because there are many types of evolutionary individuals. I address the problem of evolutionary individuality informed by the version of evolutionary contingency that highlight features of change, impermanence and lack of necessity (Gould 1989, Beatty 1995, 2006, Desjardin 2011, and Turner 2010). Different types of individuals can emerge, evolve, and eventually disappear because the mechanisms which create and maintain them undergo evolutionary change. And so, rather than just one type of evolutionary individual identified by a single set of universal and necessary conditions, there are multiple types of evolutionary individuals that exist throughout the course of evolution. A contingency framework makes sense of individuality pluralism.

Kerry **McKenzie** University of California, San Diego

[On the Prospects of an Effective Metaphysics](#)

Metaphysicians have fallen into disrepute yet again, at least among philosophers of science. Topping the list of grievances is metaphysicians' failure to incorporate real physics into their theories of basic ontology, presenting it instead as a toy version of classical physics when in fact we believe it to be quantum mechanical. But what is curious about all this is that such grievances appeared just as philosophers of physics moved to embrace non-fundamental ontology – including classical ontology – as bona fide physical entities. Thus the formal continuities we now know to exist between the quantum and the classical are claimed to sanction our belief in everyday objects, and moreover sanction them as conceptualized independently of anything more fundamental. But this scenario suggests an escape route for the despondent metaphysician. Given that we now recognize effective physics – the study of non-fundamental physical ontology as conceptualized in non-fundamental terms – cannot the metaphysician likewise aim to produce an effective metaphysics: an accurate though approximate metaphysics of the non-fundamental, developed independently of what lies beneath? In this talk I will argue that the effective paradigm in physics in fact supplies no warrant for the viability of an effective metaphysics. As such, while it seems that we can profitably pursue the scientific study of the non-fundamental in blissful ignorance of the more fundamental, this profitability does not transfer to the metaphysics of science. Although that is a conclusion that has depressing implications for metaphysicians, the process of seeing why it is true helps shed light on the perennially perplexing question of what it is that makes metaphysics metaphysics.

James **McNutt** Queen's University

[“By Means of X-Ray Shadows:” X-Ray Technology in the Curriculum at Queen’s-Affiliated Medical Colleges](#)

The x-ray machine was a ubiquitous innovation in the twentieth century. This technology allowed surgeons to accurately diagnose injured areas of the body, such as fractures. Despite this fact, Joel D. Howell contended that x-ray technology did not immediately translate into influencing patient care in American hospitals (Howell 1995). Within a broader study of medical curriculum change at Queen’s-affiliated medical colleges in Kingston, Ontario during the period 1896 to 1910, this paper proposes to examine the references made to x-ray technology in the textbooks employed at Queen’s College. This paper will consider Queen’s professors’ attitudes toward the use of x-ray, using published journal articles in the Queen’s Medical Quarterly as primary sources. As attested by a comparison between medical and surgical textbooks, this paper argues that, while in the surgery discipline the value of x-ray was evident from the beginning, a relevant application of the technology was not immediately identified by practitioners in the realm of curative diseases. This paper will attempt to explore medical discourses regarding when, and under what circumstances, the use of x-ray was appropriate. This research will contribute to the literature on the interconnectedness of medicine and technology and will track the changing attitudes of doctors toward this scientific medical device as its application expanded.

Letitia **Meynell** Dalhousie University

[Getting the picture: Towards a new account of scientific understanding](#)

In recent years there has been an explosion of interest in scientific understanding as an epistemic success term that is distinct from scientific knowledge. Although this literature is diverse, to say the least, four dominant strands can be seen: understanding through exemplification (endorsed by Nelson Goodman and Catherine Elgin); understanding as unification (endorsed by Phillip Kitcher); understanding through mechanistic thinking as certain types of causal modelling (endorsed by James Woodward); and understanding as contextualization (endorsed by Henk De Regt and Dennis Dieks). In my presentation I will argue that, far from being competitors, if one takes the right approach to the characteristic content of understanding then one can appreciate the extent to which these theories are complementary. In particular, I will argue that we should treat the characteristic content of understanding as pictorial, in contrast to the characteristic content of

knowledge, which is propositional. Through this lens one can appreciate the extent to which successful pictures exemplify, unify, show mechanical (and other) causal relations, and contextualize their content. Thus my account of understanding rests on providing an original account of the content of what is understood.

Lucas **Mix** Harvard University

Five Lives

Life is notoriously difficult to define. I set forth five types of “life,” which not only address different phenomena, but may require different standards of discourse to meaningfully address. Conflation of the types leads to confusion when we fail to distinguish between the question at hand and underlying epistemological questions. Life (1) or physical existence deals with physical bounds of aspects of any physical entity. Life (1) is rarely called life in modern discussions. Life (2) or biological life deals with the commonalities of all life as we know it, generally dealing with metabolism or reproduction. Life (3) or conscious life deals with how the environment moves internal states and vice versa. Life (4) or mental life deals with cognition and reason. Life (5) or transcendent life deals with a variety of claims for how lives (1-4) are integrated into larger wholes. Questions of how the five lives relate to one another and what constitutes an acceptable account of each will depend on how we understand purpose, agency, intellect, and individuality. The distinctions will impact our foundational categories for ethics.

Daniela **Monaldi** York University

Fritz London and the Scale of Quantum Mechanisms

Fritz London presented his seminal idea of “quantum mechanisms on a macroscopic scale” at the first international meeting of physicists after WWII, the International Conference on Fundamental Particles and Low Temperatures, which was held in July 1946 at the Cavendish Laboratory in Cambridge, UK. London’s aim was to explain the low-temperature phenomena of superfluidity and superconductivity on the basis of the new conception of matter that emerged from quantum mechanics. His unifying interpretation of the “superfluids” was vindicated in the 1960s, and it earned London a place of honour among the spiritual fathers of condensed matter physics. This paper explores the genesis of London’s ideas in the context of the events that affected his life in the 1930s and 1940s, from his work in molecular physics and quantum chemistry in pre-war Germany, through his encounter with low-temperature physics and quantum statistics as a refugee in England and France, to the controversy with the Russian school of quasiparticles as an immigrant in the USA during and after the war. The aim is to link London’s innovative interpretation with broader developments in physics, in particular, with the evolution of physicists’ views about the nature of particles.

Pierre-Olivier **Méthot** Université Laval

Are diseases “entities” or “processes”? Narratives and disease concepts in twentieth-century medical history

Twentieth century medical historians have often pondered whether diseases are best characterized as “entities” or “processes” (Grmek 1995). Also referred to as the “ontological” and the “physiological” approaches (Cohen 1955), these alternative viewpoints have been connected to opposed philosophical perspectives (“realist” vs. “nominalist”) as well as to various scientific antinomies (“science” vs. “art”, “laboratory” vs. “bedside”, “reductionism” vs. “holism”; Rosenberg 2003; Temkin 1977). The distinction between an ontological and a physiological approach to health and disease has progressively acquired a life of its own in the twentieth century, and continues to inform current scholarship (see Anderson and Mackay 2014). Surprisingly, however, most scholars who have used the distinction have eschewed its historical origins; failing to acknowledge that the ontological and physiological views of disease were themselves historical products, they have also turned a blind eye to the ways in which this narrative contributed to shape medicine’s historiography in the past century. In this talk, I would like to make a step towards correcting this situation by historicizing this “supposed eternal dichotomy” (Cunningham 1992). Though in his polemic with the Paris school François Broussais did use the label “ontologist” to castigate his opponents, I will argue that it was the Swiss-born historian of medicine Henry E. Sigerist who first turned the dichotomy between “ontologists” and “physiologists” into a theoretical framework which was picked up by his students, notably by Ackerknecht and Temkin, before acquiring, during the second half of the twentieth century, the status of a transhistorical category in medical history. CHAIR: Jacalyn Duffin (Queen’s University).

Celso Antonio Alves **Neto** Leibniz Universität Hannover

Evolvability and Genealogy in Evolutionary Developmental Biology

In this paper I identify two limitations in the recent debates concerning evolvability. Firstly, it has been said that evolvability is influenced by factors other than developmental ones (Sterelny 2007). The discussion of these factors is usually limited to environmental and populational ones, whereas many others factors remain to be explored. Here I make the case for a type of factor that cross-cuts the very distinction between developmental and non-developmental factors and receives almost no attention in the debate, namely: factors affecting the formation of genealogical patterns in populations.

Secondly, it has been claimed that biological lineages are “units of manifestation” in evolvability (Brigandt 2007). This is to say that clades manifest evolutionary changes. I argue that this is a limited characterization of lineages by showing that they – not only as clades – play an important methodological role in evolvability. Both limitations are related to the fact that the relationship between genealogy and evolvability has not been properly considered in the literature. I make this point clear by discussing Lenski's experiments on bacterial evolution, showing how the genealogical feature of path-dependence is connected to evolvability (Woods et al 2011). Finally, I conclude that to bring attention to this relationship can help us to better understand the explanatory power of lineages in evolvability.

John D. **Norton** University of Pittsburgh

INTERNATIONAL KEYNOTE SPEAKER – How Einstein Discovered

What drove Einstein's discoveries? Was it asking naïve questions, stubbornly? Was it a mischievous urge to break rules? Was it the destructive power of operational thinking? It was none of these. They are myths that have arisen through our need to find a simple trick underlying his achievements. Rather, Einstein made his discoveries through lengthy, mundane investigations. They brought moments of disappointment, frustration and even despair. Einstein persisted with tenacity and discipline. Then there were also moments of transcendent insight. However these were rare moments and were only possible because of the painstaking preparatory work. I will illustrate these ideas with the examples of Einstein's 1905 discoveries of special relativity and the light quantum.

Kathleen **Okruhlik** The University of Western Ontario

DRAKE LECTURE – Values and Voluntarism Revisited

This paper builds on earlier efforts, some of which focused exclusively on Bas van Fraassen's voluntarism. Here the focus is wider, although van Fraassen's position continues to figure prominently, as do certain feminist approaches to science. In addition, there are cameo appearances by St. Augustine, Descartes, Otto Neurath, C.I. Lewis, and Jean-Paul Sartre. One question that poses a continuing challenge concerns what it takes for a position to count as instantiating a form of voluntarism. So, for example: does a self-conscious decision to incorporate a particular set of socio-political values into one's research count as an example of epistemic voluntarism? Or do such choices fail to qualify, since they occur in the context of model choice and theory development rather than in the context of belief or theory acceptance? Might one argue instead that the value choices that shape theory development do not necessarily disappear or “wash out” in the context theory testing and justification? If so, it would seem that the effects of epistemic voluntarism and the values that shaped theory development would remain in the theory that is accepted. The two philosophical approaches that figure most prominently in this discussion are American Pragmatism and Sartrean Existentialism.

Dustin **Olson** University of Rochester

Reflective Equilibrium and Reasonable Expert Disagreement

Highly proficient, educated, and experienced individuals disagree with one another within topics that each is an expert. Call this a case of *expert disagreement within a domain of inquiry*. In the epistemology of disagreement, cases typically reference epistemic peers—individuals equally well-informed and equally well-equipped to correctly assess a candidate proposition. Expert disagreement is a subset of peer disagreement restricted to a specialized domain of inquiry. I propose that a domain of inquiry has, at least in principle, the following features: meta-level propositions, general principles, and specific judgements. In physics, for example, “Physics is the study of fundamental laws,” describes the domain. “Hypotheses should in principle be falsifiable,” describes a principle that some physicists may accept. And, “String theory cannot be falsifiable,” is a specific judgment one could find in this domain. That disagreement occurs at any of these levels is clear. Debates over what a fundamental law is or over the falsifiability criterion or over the scientific status of string theory have each occurred amongst expert physicists. Assuming that these physicists are familiar with each other's expertise and the reasons each has for their alternative view, can they reasonably disagree? On the one hand, it would be strange to conclude that, as experts, they have unreasonable beliefs in their areas of expertise. And yet, if they indeed recognize each other as an epistemic peer, then it seems to fly in the face of rationality that either could believe she is more likely to be right than the other. I suggest that the method of inquiry known as *reflective equilibrium* (RE) provides a promising avenue to assess this challenge. Focusing on its underlying epistemic features, I defend an evidentialist interpretation of RE, arguing for the possibility of reasonable expert disagreement.

Kamuran **Osmanoglu** University of Kansas

The Biological Reality of Race does not underwrite the Social Reality of Race: A Response to Spencer

Quayshawn Spencer (2014) defends the biological reality of ‘race’. He argues that ‘race’ as used in the current US racial discourse picks out a biologically real entity. Spencer thinks that folk racial classification has a biological basis—in particular, he argues that the current US meaning of ‘race’ is a proper name for biologically real entity. First, Spencer says

that the current US census classification yields five different races. Second, he argues that recent human population genetic research also yields an interesting level of genetic clustering at the $K=5$ level. Thus, he contends that the current US racial discourse matches nicely with recent genetic population clustering results, i.e. $K=5$ level of human population structure. (Spencer calls the $K=5$ level of human population structure ‘the Blumenbach partition’ in honor of J.F. Blumenbach.) Therefore, he argues that ‘race’, in its US meaning, picks out a biologically real entity, i.e. US racial categories are biologically real. However, we argue that Spencer’s argument does not succeed to prove that ‘race’ is a biologically real entity in a broader sense, i.e. broader than the US meaning of race. Moreover, this broader sense of ‘race’ is much more interesting than the US sense, and does much better justice to the social reality of universal race discourse. Apart from this, there are internal worries with Spencer’s argument, in that the kind of genotypic clustering ($K = 5$ level of human population structure) he relies on is not the only biologically interesting way of clustering human populations.

Kent **Peacock** University of Lethbridge

A Different Kind of Rigour: What Climate Scientists Can Learn from Emergency Room Doctors

Climate scientists are often accused of alarmism. And yet there is evidence that some (though certainly not all) scientists exhibit undue reticence (“erring on the side of least drama”) in communicating the risks attendant upon global anthropogenic carbonization, such as tropospheric warming, ice sheet collapse, and oceanic acidification. The reasons for this tendency to under-report are complex, and may include psychological and socio-political factors such as “seepage” from the poisonous discourse of climate science denial (Lewandowsky et al.). In this presentation I will argue that an important part of the reason for this undue reticence, when it occurs, is lack of clear ethical and methodological guidelines for research scientists in cases when their work points to the possibility of extreme outcomes that could be matters of immediate public concern. Today’s research scientists are well schooled in attaining the kind of rigor that conduces to the advancement of knowledge. What is needed in the face of the ecological threats humanity faces today is not a lessening of intellectual rigour, but a different type of rigor. Scientists can follow the model of the learned professions such as engineering and medicine, whose members for centuries have had to find a balance between the need to maintain intellectual rigour and the imperative to make life-or-death decisions in finite time on the basis of imperfect information.

Joanna L. **Pearce** York University

“Of course, the microscopic work must be taken on trust”: Educating the Blind in Victorian-Era Science

What are blind children capable of learning? Educators in nineteenth-century North America struggled with this question. While the common school curriculum included natural history and nature walks, mathematics and geography, geology and astronomy, blind children spent their education on literacy, religious studies, and vocational training. However, as residential schools for the blind became more firmly established in Canada and the United States, administrators of these schools realised the need for a broader curriculum. By demonstrating their commitment to an education more in line with that of the sighted, they would also bolster their arguments that their schools should be fully-funded by tax dollars, as common schools were, rather than on a charity-based model. Expanding the curriculum to include the natural sciences, mathematics, geography, human anatomy, and astronomy proved difficult. A variety of raised-print texts were in use across the continent, which meant textbooks could not be mass-produced. Models and apparatuses that would allow students to physically interact with the material had to be specially-made for each school. Despite these difficulties, a number of schools for the blind effectively introduced science education to their students. This paper will examine how some residential schools for the blind achieved this feat through careful development of a science-based curriculum and the use of tactile learning aids, many developed by the blind themselves. This expansion into the sciences challenged stereotypes of children with disabilities being less capable than their non-disabled counterparts.

Makmiller **Pedroso** Towson University

Ecological Bottlenecks

This paper is concerned with the evolution of biological individuals—i.e., the question of why free-living individuals (e.g., single cells) relinquished their independent existence to merge into higher-level individuals (e.g., multicellular organisms). I advance the hypothesis that biological individuals can evolve as a response to “ecological bottlenecks,” mass- mortality events caused by environmental stress such as antimicrobial treatments. In order to warrant this hypothesis, I will rely on empirical studies about biofilms, a type of microbial community infamous for their resilience against environmental perturbations. Ecological bottlenecks contrast with reproductive bottlenecks, an evolutionary mechanism commonly used to explain the stability of certain collectives, such as humans and other mammals. Like reproductive bottlenecks, ecological bottlenecks can account for the stability of individuals because they increase the costs of cheating among the parts of a collective. However, unlike reproductive bottlenecks, ecological bottlenecks can

account for the stability of individuals without requiring high genetic relatedness. Hence, reproductive bottlenecks may not be as crucial for the evolution of individuals as some have suggested.

Anthony **Penders** Tacoma Community College

Contested Truths in Agriculture: Could the Dirty Thirties Have Been Prevented?

Information caused the Dirty Thirties; more specifically, an inability by those with the proper methods and information to transmit to the public the understanding that was needed. Researchers in Canada and in the United States had developed methods to diminish soil destruction and to decrease the amount of damage done to an already eroded soil. By 1899, the Department of Agriculture in Ottawa had inaugurated crop rotations onto their Experimental Farms in the prairies and had mailed out, without charge, millions of trees to plains farmers as the government recognized that soil destruction was as great an issue as the limited annual rainfall. If the basic principles of soil management were reasonably well understood prior to the turn of the century then what caused the public to adopt unsafe and unsound farming practices that relied on improper ideas, incorrect people, and counterproductive machinery, in the early 20th century? The government and its researchers had a reasonably good (but by no means perfect) understanding of soil science, there were others, the practitioners of the science of dry farming, aided and abetted by the banks and the railroads and the manufacturers of farm implements, who had vested interests in selling products and methods that were very damaging to the soil. The key to prevention of the Dirty Thirties in Canada and the United States would have been to more ably promote what was already known about soil protection.

Myron A. **Penner** Trinity Western University, Amanda J. **Nichols** Oklahoma Christian University

Molecular Symmetry, Beauty and Truth

There are two broad ways in which the language of aesthetics creeps into scientific discourse. One way is at the level of theory, where a theory is said to display aesthetic properties like elegance or simplicity. Hence, scientists may prefer one theory over another based upon its aesthetic quality. Another way aesthetic language sometimes appears in science is at the level of observation, where certain particular observations are identified as beautiful or aesthetically pleasing. With respect to this latter way, crystallography in general, and molecular symmetry in particular, provides several examples of observations that seem to have an aesthetic quality to them. In our paper, we argue that the case of molecular symmetry supports a strong connection between beauty and truth, beauty of the sort described by Heisenberg as “the proper conformity of the parts to one another, and to the whole.” More specifically, we argue that (1) observations of molecular symmetry have aesthetic qualities, (2) these aesthetic qualities have strong explanatory value, and therefore that (3) molecular symmetry provides examples of a strong link between beauty and truth.

Liza **Piper** University of Alberta

Northern Science, Scientists, and Environments

This paper examines how the historiography of northern science in Canada has shaped, and now more recently, is being shaped by, the evolving field of northern environmental history. How has attention to the environment as an active agent influenced historical interpretations of the place of science in the North? Has environmental history offered ways to bridge some of the tensions between science as an “outside” practice, and the historical experiences of northerners, and especially indigenous northerners? The paper will reflect on the historiography of 19th and 20th century meteorological science in Canada’s high latitudes, and its influence on federal state interventions in the North, to illuminate the relationship between the histories of science and environments and how they have shaping understanding of Canada’s North.

David **Prévost-Gagnon** Université Laval

Le concept de fonction dans la théorie bio-statistique de Christopher Boorse : une perspective pluraliste

Cette recherche s’intéresse à la nature du concept de fonction impliqué dans le contexte de la théorie bio-statistique de Christopher Boorse (1977). On distingue communément deux grandes conceptions de la fonction : la théorie systémique développée par Cummins (1975) et la théorie étiologique défendue par Wright (1973). Alors que la théorie systémique associe le concept de fonction à une contribution dans la performance d’une certaine capacité d’un système donné, la théorie étiologique, quant à elle, l’assimile à une explication causale de type historique. L’objectif principal de la présente étude consiste à évaluer comment, entre ces deux grandes théories fonctionnelles, se positionne la notion de fonction impliquée dans la théorie bio-statistique de Christopher Boorse. En regard des caractéristiques propres à chacune des théories fonctionnelles, est considérée d’abord une certaine affinité (notamment en ce a trait à sa dimension anhistorique) du concept de fonction proposé par Boorse pour la théorie systémique. Une conception pluraliste, intégrant à la fois fonction systémique et fonction étiologique est par la suite défendue. L’imputation d’une dimension étiologique au concept de fonction impliqué dans la théorie bio-statistique est principalement soutenue par la distinction entre énoncés fonctionnels typiques (appliqués à des classes d’individus), et énoncés fonctionnels individuels (appliqués

à tel ou tel être singulier). Sont associés, respectivement aux conceptions étiologique et systémique, énoncés fonctionnels typiques et énoncés fonctionnels individuels. En relevant cette distinction entre énoncés fonctionnels typiques et individuels au sein même de la théorie bio-statistique, cette étude permet de conclure que la théorie de Boorse intègre une double conception de la fonction biologique.

Isaac **Record** Michigan State University

[Knowledge from Instruments](#)

We acquire much of our knowledge from technological instruments. It has been wrongly and uncritically assumed in epistemology that knowledge from technology is reducible to knowledge from the senses, memory, inference, and testimony. While instruments share similarities with these other sources, they constitute a distinctive source of knowledge. I propose a novel account of the acquisition of knowledge from instruments. I argue that obtaining knowledge from instruments depends on subjects' ability-knowledge; i.e., users' successfully operating their instruments and reading off information from them, and instrument-makers' reliably manipulating available material capacities. Because instrument makers and users rarely interact directly, the relevant abilities are distributed in an epistemic community. This abilities/capacities ontology can explain how technology effectively affects standards of justified belief, and how epistemic responsibilities related to information technologies can be allocated on a principled basis.

Garrett **Richards** University of Saskatchewan

[The Science-Policy Relationship Hierarchy \(SPRHi\) Model: Explaining Co-Production in Dialogues between \(Climate\) Science Organizations and Government Agencies](#)

It appears that the scientific consensus on climate change has not been followed by proportionate policy action. Relevant literature suggests that such a gap might be bridged by incorporating co-productive (i.e. deliberative, mutually influential, participatory) design elements into science-policy relationships. I synthesized causal models from such literature into an analytical framework of potential pathways from co-productive design to policy action. Through expert interviews, I then investigated three climate science-policy relationships in Canada: a municipal-level case between the Pacific Climate Impacts Consortium (PCIC) and BC municipalities, a provincial-level case between the Pacific Institute for Climate Solutions (PICS) and the Climate Action Secretariat (CAS), and a national-level case between the Canadian Foundation for Climate and Atmospheric Sciences (CFCAS) and the federal government. Comparing these cases to the analytical framework, I found that the expectation of true science-policy co-production was overly idealistic. Rather, it seems that science-policy relationships can be modeled onto a hierarchy of function: incidental interaction (at the bottom), basic partnership, interactive dialogue, and true co-production (at the top). While none of the cases genuinely reached the top level, they collectively revealed causal mechanisms that may explain why any given science-policy relationship ends up functioning the way it does.

Jared **Richards** University of Western Ontario

[Mathematical Physics is Intuitionistic](#)

The thesis of this paper is that mathematical physics is intuitionistic. Three examples motivate this thesis: the Bohrification of a non-commutative c -star algebra; synthetic differential geometry; and the internal description of a causal set. These examples extend over diverse areas of physics: classical and quantum mechanics, smooth manifolds and so space-time theories, and causal sets (deemed useful for theories of quantum gravity). Furthermore, these examples are similar in the following way: (1) Each begins with some inexact idea (doctrine, principle) from physics. (2) Each uses category theory, in particular topos theory, to make the idea exact in an agreeable and novel way. And (3) the 'intrinsic' or 'local' mathematics that characterizes the exact idea(s) is intuitionistic on pain of contradiction. So the quest for exact ideas in diverse and major areas of physics, we see, results in intuitionistic mathematical physics for these areas; thus the thesis of this paper. A more general argument for the thesis of this paper is also provided. This argument is based on the fact, made especially perspicuous by (pre)sheaf theory, that the mathematics of variable or structured systems/sets is generally intuitionistic. So I argue that physical systems are variable or structured to conclude this thesis. It is hoped that this paper gets both practitioners and philosophers of physics to take intuitionistic mathematics for physics (more) seriously.

Adam **Richter** University of Toronto, IHPST

[Biblical History in the Natural Philosophy of John Wallis \(1616-1703\)](#)

For John Wallis, Savilian Professor of Mathematics at Oxford and Presbyterian minister, the Bible was a valuable source of knowledge that complemented empirical and experimental evidence. This paper considers two cases that demonstrate the interaction between biblical and natural evidence in Wallis's thought. The first is his critique of Robert Hooke's theory of fossils, which depended on dramatic changes in ocean levels throughout the history of the Earth. In addition to raising physical and astronomical objections, Wallis finds biblical evidence indicating that the geography of the

Earth has not changed since the time of Noah's flood. In the second case, Wallis discusses whether humans are naturally herbivorous or carnivorous with the anatomist Edward Tyson. Here Wallis considers both the anatomy of the human digestive system and biblical passages that suggest humans have always eaten animals. These cases inform a twofold argument. Firstly, I argue that, while Wallis has mainly attracted the attention of historians of mathematics, he has an important place in the history of science and religion. Secondly, the particular insight emerging from these two case studies is that, for Wallis, historical evidence from the Bible contributes to the development of novel ideas in natural philosophy. This is especially clear when Wallis addresses the natural human diet and, considering evidence from both Scripture and Nature, devises a solution that redefines what it means to be a herbivore or a carnivore.

Domenica **Romagni** Princeton University

[Explanatory Virtues in the 17th Century: Kepler and Mersenne's Competing Theories of Musical Consonance](#)

In this paper I investigate an oft-overlooked theoretical disagreement between Kepler and Mersenne regarding the nature of musical consonance. This particular debate presents us with a puzzle because the scientific community at the time almost universally preferred Mersenne's theory, despite its possessing a number of explanatory gaps that were fully acknowledged by Mersenne and his contemporaries. The fact that it ended up being the more correct theory, even though it was not obvious at the time, presents us with an opportunity to identify the reasons why theorists might have correctly preferred this theory. The paper proceeds as follows: I begin by providing some information and background on the debate surrounding the nature of musical consonance and then go on to give a detailed account of Kepler and Mersenne's views, respectively. Following this, I examine some potential advantages that Mersenne's theory might possess over Kepler's, such as simplicity, empirical falsifiability, and potential for unification, and show why none of them are entirely adequate on their own to resolve the puzzle of the general preference for Mersenne's theory. In order to fully resolve our puzzle, I introduce the conception of 'potential for explanatory depth', which enables us to understand how the surface shortcomings of Mersenne's theory actually end up being indicators of its preferability and, more generally, how explanatory gaps in a theory can sometimes point to its desirability, provided the gaps are in the right place.

Esther **Rosario** University of Alberta

[Sexed Kinds and Sex Concepts](#)

In 2000, Sally Haslanger asked: "(What) is gender, and (what) do we want it to be?" I ask a similar question about sex. In considering this question I investigate whether sex can be understood as an HPC or a social kind. I argue that in order to understand what sort of kind sex is depends on the concept in use and its context. Haslanger (2012) draws a distinction between manifest and operative concepts: where the manifest concept marks a more explicit or public use of a concept, while the operative use marks a more "implicit, hidden, and yet practiced" use (370). I maintain that in order to determine what sort of kind sex is, we have to first determine the context in which we use the concept. For instance, in a biological context where biologists invoke the notion of sex difference as a difference in gamete size (males and females), the operative concept will be gametic sex. Within the biological context, gametic sex does not appear to be an HPC kind because it is neither explanatory nor flexible. However, in a given social context, the use of "biological sex" more often than not picks out not an operative concept but a manifest concept such as morphological sex (sexed phenotypes). Although morphological sex may be a candidate for an HPC kind in some social contexts, morphological sex can also be understood as a social kind (one that is not obviously social) in contexts where our target, manifest, and operative concepts are confused.

Sophia **Rousseau-Mermans** Université de Montréal and Université Paris I/IHPST

[What is the ecological function of keystone species?](#)

Keystone species (KS) have been initially defined by Robert T. Paine (1969) as a predator species (e.g., *Pisaster ochraceus*) whose predating activity on competing species (e.g., *Mytilus californianus*) is crucial for its ecological community's biodiversity and stability. Since then, the concept of KS has been used and understood in various ways by ecologists, biologists, conservationists, etc., among which some diverge from Paine's original definition (Mills, Soulé & Doak 1993). Today, it is then difficult to know what kind of "key" role (or "ecological function") keystone species might have – if any – in their community. In this context, the aim of this presentation will be twofold. First, I will clarify the functional relations that KS maintain with the diversity and stability of their ecological communities in Paine's account (1966, 1969, 1974, 1976) and alternative accounts (e.g., Jones et al 1994). Second, I will discuss how the KS concept can strengthen or weaken the plausibility of the organizational (Nunes-Neto et al 2014) account of ecological functions compared to the causal role (Odenbaugh 2011) and persistence-based (Dussault & Bouchard forthcoming) alternatives.

Gregory **Rupik** University of Toronto

Observing Goethe's Organisms

As the German Romantic poets, playwrights, and artists ruminated broadly about “life” near the turn of the 19th Century, some turned to observation and experimentation to ground their thought in the “lives” of individual organisms. Johann Wolfgang von Goethe (1749-1832) was exemplary in this regard, dedicating years of his life to observing the growth and development of plants, resulting in his *Versuch die Metamorphose der Pflanzen zu erklären* (*Metamorphosis of Plants*, 1790) and other works. While recent studies have considered Goethe's specific conception of plants (Kelley 2009) or his aesthetic/idealist conception of organisms' *archetypes* (Reigner 2013), none have focused on Goethe's broader understanding of the organism itself. In this paper, I will explicate Goethe's understanding of the organism from his *Metamorphosis of Plants* and his other scientific writings. I will demonstrate that his understanding of the organism—specifically its purposiveness and integrated form—is influenced by his observational and experimental methods, which are themselves coloured by his artistic training (Steigerwald 2002). By exploring the experimental/observational contexts in which Goethe's organisms' lived, moved, and had their being, I will elucidate his understanding of the organism and differentiate it from that of his contemporaries, namely Kant and Schelling.

Corey **Sawkins** University of Guelph

Unification by Counterfactual Dependency Relations

Unificationist accounts of explanation are no longer as well accepted as they once were. Many philosophers now favor causal accounts of explanation. One of the most successful causal accounts is Woodward's manipulationist model (2003). For Woodward, an explanation provides information about counterfactual dependency relations that shows us how the manipulation of factors in the explanans would thereby alter the explanandum (2003, 98-107). In this paper, I compare Woodward's account with Kitcher's unificationist account (1989). By applying them to special relativity (SR), I show that both accounts capture important aspects of the explanations provided by SR. Kitcher's account captures the fact that SR explains by unifying a large set of phenomena using a small set of argument patterns. Woodward's account captures the fact that SR explains by identifying counterfactual dependency relations that hold between the explanans and the explanandum. I then argue that the best way to understand the explanations provided by SR is to use an account of explanation that embraces both of these features. One that shows that special relativity explains by unification through the identification and use of counterfactual dependency relations. More specifically, I argue that the argument patterns of special relativity explain by specifying counterfactual dependency relations that obtain between the explanans and the explanandum. These counterfactual dependency relations are consequences of the theory's underlying assumptions about the kinematic nature of reality.

Guillaume **Schlaepfer** Université de Genève

Complétion locale et transitoire des lois ceteris paribus

Cette présentation aborde le problème sémantique de la condition ceteris paribus qualifiant les lois de type ceteris paribus. Nous partons de l'hypothèse que la condition ceteris paribus a pour fonction de référer de manière indexicale à l'état actuel de la connaissance relative au phénomène en question. Bien qu'il soit pratiquement impossible de compléter les lois ceteris paribus de manière générale et définitive, nous argumenterons qu'il est néanmoins possible de rendre explicites les facteurs pouvant interférer avec la loi relativement à un contexte théorique spécifique. Les discussions relatives à la méthode dite « de complétion » sont rappelées et une théorie alternative, bien qu'apparentée, est proposée afin de surmonter les contre-exemples opposés à cette méthode. La solution proposée est ensuite comparée aux principales théories supposées résoudre le problème que sont la théorie dispositionaliste et la théorie normale des lois ceteris paribus.

Martina **Schlünder** University of Toronto

In reality diseases do not exist, sick people do! – Ludwik Fleck on the concept of “disease entities

In his first epistemological paper on “Some Specific Features of the Medical Way of Thinking” (1927), Ludwik Fleck conceptualized diseases as “ideal, fictitious” entities and “scientific illusions”. Fleck's idea should not be misunderstood as an early medicalization critique aimed at debunking the “invention” of diseases for economic reasons. Rather, Fleck saw “disease entities” as crucial tools in medical reasoning: How could one find a law for irregular phenomena? Disease entities, thus, are conceptualized by Fleck (1935) as “thinking tools” and “convenient shortcuts” in view of ordering the range and diversity of pathological phenomena. These entities, however, do not map neatly onto the observed phenomena since they are made of abstractions, statistics, and hypotheses. The fictitious character of disease concepts leads to a split between theory and practice in medicine and physicians therefore need a specific way of thinking – a “thought style” – made of intuition, experience, and the ability to be inconsistent, to constantly change their perspective to navigate the gap between sickness and sick people. According to Fleck a uniform understanding of morbidity is impossible. Only by introducing time, by understanding the historic, temporal nature of disease entities is it possible to

turn the fictitious concepts of diseases into substantial clinical units. In my talk, I will follow Fleck's development of the concept of disease entities from his first paper to his 1935 monograph (*Genesis and Development of a Scientific Fact*) and discuss the extent to which his early conceptualization of disease impacted on the development of his general epistemology.

Sinan **Sencan** University of Calgary

Biological Individuality from Holobiont Perspective

Holobionts, which are a form of symbiosis, force both philosophers and scientists to reconsider the traditional treatments of biological individuality (e.g. Dupre' and O'Malley, 2012; Hutter et al., 2015). The concept of Holobiont stands for a multi-species symbiotic relationship, which is observed between eukaryotes and unicellular creatures. Although the concepts of biological individual and organism have been used interchangeably for a long time, this use is challenged by the multi-species of symbiosis. Various notions of biological individuality fail to accommodate the holobiotic relationships. For example, the anatomical, developmental, physiological, genetic, immune and evolutionary concepts of individuality (partly or entirely) ignore holobionts (Gilbert et al., 2012). In this paper, I argue that the weight of reductionist approaches, which embrace the identity between a genome and an individual (or an individual and an organism), need to be reconsidered in the light of metagenomic studies. One reason for my view is that microbial organisms can provide a second type of hereditary system, since they might be inherited from maternal parent (Gilbert, 2011). Thus, the notion of hologenome (i.e. the collective genome of the host and the symbiotic associations) gains importance against the reductionist conceptions about individuality. Consequently, the assumption that animals and plants are autonomous entities and paradigmatic examples for individuality has been challenged by hologenomic researches. Therefore, this paper critically evaluates the relationship between the concept of holobiont and the concept of biological individuality.

Jamie **Shaw** University of Western Ontario

The Search for Kuhn-loss: A New Strategy for HPS

The notion of 'Kuhn-loss', or the loss of puzzle-solving ability in a successive paradigm, has received remarkably little attention in the secondary literature (cf. Chang 2012). My paper makes three contributions in this area: (i) I articulate a clearer conception of Kuhn-loss, (ii) demonstrate its theoretical and practical importance using two historical examples, and (iii) show the advantages the search for Kuhn-loss possesses over other strategies in HPS. Since Kuhn does not develop this notion at length, my paper explicates a conception that we should be interested in. Here, I argue that instances of Kuhn-loss are worth discovering when successive paradigms are never able to regain what was lost and that Kuhn-loss should not be understood as the loss of puzzle-solving (contra Kuhn 1962 and Laudan 1978) but the loss of other epistemic virtues (specifically explanatory scope and prediction). Next I illuminate the importance of the task of discovering these instances of Kuhn-loss using two historical examples: the revival of the cosmological constant and of Priestley's electrochemistry. These examples illustrate how science progressed by retrieving instances of Kuhn-loss. Finally, I argue that the task of discovering Kuhn-loss provides a novel alternative strategy for HPS. Specifically, instead of merely using historical examples to confirm or disconfirm philosophical theories (Laudan 1981; Psillos 1999) or using historical examples to illustrate philosophical theories (Heidelberg and Stadler 2001 and DeWitt 2011), the search for Kuhn-loss allows us to directly engaging with scientific practices.

Elay **Shech** Auburn University

Topological Idealization, Asymptotic-Minimal Model Explanation, and the Aharonov-Bohm Effect

This paper looks at the idealizations and representational structures appealed to in the context of the Aharonov-Bohm (AB) effect. On the standard view, what we may call the topological account, it is often claimed that in order to explain the effect one must appeal to an idealized non-simply connected electron configuration space. However, by referring to an important distinction made by John Norton between limit properties and the properties of limit systems, I argue that such a position commits one to an untenable view of the necessity of idealizations in science. I thus reject the standard story by presenting an alternative non-topological interpretation of the effect. Implications for the debates surrounding asymptotic explanation, minimal models, and essential idealizations are discussed. Specifically, I defend a compatibilist approach, which holds that the conflict between those who embrace essential idealizations and those who abhor them is ultimately a non-issue.

Kelly **Smith** Clemson University

C'est la vie

There is an increasing need to come to a consensus about what living systems are and are not. We are launching an intensive search for life beyond Earth and disagreement over the proper concept of life has already created sharp debate concerning the interpretation key experiments. And developments in synthetic biology and computer science are forcing researchers to ask whether the systems they create embody the minimal characteristics of living systems. In recent

years, two ends of the continuum have dominated the debate. On one end are those who view definition as the specification of necessary and sufficient conditions, an approach ill suited to biological categories. On the other end are those who define life in terms of what can be easily tested or observed rather than what matters theoretically. As a result, thoughtful commentators tend to either call for a radical pluralism with respect to definitions of life or become pessimistic about the possibility of defining life at all. Yet both conclusions are premature and instead I propose an account of life similar to the phylogenetic concept of species developed by Mishler and Brandon. If we first identify an evolutionary “essence” of life, we can allow for a plurality of specifications of this more general category depending on factors like researcher interest. It is thus possible to hold on to the ideal of life as a natural kind while allowing that there is merit to more than one approach to the problem.

Stephen D **Snobelen** University of King's College

[Newton and the God of the gaps](#)

Isaac Newton's belief that God intervenes in the cosmos is commonly offered as a textbook example of “God-of-the-gaps” reasoning. In his famous letters to Bentley, Newton asserted that certain features of the solar system cannot be explained by “meer natural causes”. In his *Opticks*, he wrote that gravity causes the cosmos to become disordered over time “from the mutual Actions of Comets and Planets upon one another ... till this System wants a Reformation”, that is, a stabilising interposition by the hand of God. In 1715, Leibniz criticised the latter view as a theological infelicity, declaring that Newton's God is a poor watchmaker who lacked the foresight to create a perfect system. Two corollaries to the charge that Newton falls into “God-of-the-gaps” thinking made by commentators today are: 1) those who use God as an explanation in science are intellectually lazy and 2) theistic explanations for natural phenomena gradually retreat as naturalistic explanations crowd them out. Is Newton open to these criticisms? A review of Newton's published and unpublished writings suggests a complex answer. On the one hand, it may be that *rhetorically* Newton does use God as an explanation when he reaches the limit of his knowledge. On the other hand, Newton's view of God's continuous and omnipresent Providence shows that *theologically* there can be no gaps in the real world. The cosmos is created and sustained by God, but it is also always amenable to philosophical analysis and mathematical description.

Catherine **Stinson** University of Western Ontario

[The absent body in psychiatric classification, diagnosis, and treatment](#)

Disturbances of body perception are relatively common in psychiatric (and neurological) disorders, including impaired perception of body temperature, misidentification or disownership of limbs, and dissociation, yet these bodily symptoms play very little role in classification, diagnosis and treatment. Even a case like anorexia nervosa, where an impairment of body perception is the best predictor of both diagnosis and treatment outcomes, these body perception symptoms are all but ignored. Body-mass-index is the most common diagnostic tool, and re-feeding therapy is often the focus in treatment. Using this example of how disturbance of body perception is overlooked in anorexia nervosa, I illustrate several systematic problems in psychiatric nosology. The grouping of disorders into categories like personality disorders, anxiety disorders, feeding and eating disorders, etc., is one such problem. These categories are based partly on outdated theories of mental illness, partly on loose similarities in presentation. Grouping by similarity of presentation may help clinicians to more easily narrow down diagnoses, but can cause problems when these groups cross-cut the disorders' etiologies. Ignoring etiology in classification makes it difficult to draw connections between disorders that may be more closely related in terms of prevention, early detection, and treatment.

Brooke **Struck** Science-Metrix

[Research questions and methods at the science-policy interface](#)

In scientific research, questions and methods must be responsive to one another. Setting a research question without taking into account actual methods to collect and analyze information will lead to the formulation of an unanswerable question, one for which no available experiments will be adequate tests. Similarly, selecting data collection and analysis methods without taking into account the research question will lead to results without relevance—answering an unasked question. To overcome this issue, the setting of the research question and the selection of methods must constitute a dialogue, each adjusting to the other. This negotiation is usually conducted internally, either by a single individual or within a research group, and the process is overseen by a system of peer review. However, when it comes to scientific research to address policy questions, the question-formulation and research-designing functions are usually carried out by distinct groups. In this presentation, I will explore the impacts of this segregation (building on the work of Heather Douglas, especially her 2014 article, “Scientific Integrity in a Politicized world”), concluding that the need for iterative dialogue between research questions and methods should urge us to examine and review the adequacy of institutions that operate at the interface of science and policy.

Mike **Thicke** Bard College

Reconsidering the Scientific Commodity

Recently, philosophers of science have become increasingly interested in profit-driven science. By profit-driven science, I mean science not carried out in accordance with the Mertonian norm of disinterestedness, but instead carried out with the aim of making monetary gain. Some notable examples of this recent interest by philosophers include David Resnik's *The Price of Truth: How Money Affects the Norms of Science and The Commodification of Academic Research*, edited by Hans Radder. My talk will examine claims by Radder, Steve Fuller, and others, that science is becoming increasingly "commodified." I agree with this claim, but argue that it obscures two related but distinct trends in science: (1) an increasing emphasis on for-profit science and (2) a push to package and standardize scientific knowledge in a way that facilitates collaboration between research groups and across disciplinary boundaries. To explain this distinction, I will use Marx's account of commodification to analyze four classes of scientific commodities: scientific papers, patents, scientific databases, and scientific models.

Emine Hande **Tuna** University of Alberta

Art as a Social Kind

It is hard to categorize art under either natural or social kinds because there are no necessary conditions for calling something art but only sufficient conditions and it is not at all clear whether these conditions are natural facts. This has been the main rationale for defending anti-essentialism. However, some attempts have been made to meet the challenge of anti-essentialism by construing art as a natural kind (Davies 2003, Gaut 2000, and Dutton 2009). Unfortunately, all these accounts fail to provide reasons as to why one should accept either of their open-ended lists of sufficient non-necessary properties for identifying something as art. Another more promising suggestion comes from Adajian (2012) who thinks that the right motivation can be found in adopting Boyd's Homeostatic Property-Cluster theory. While I agree with Adajian's desiderata for constructing a successful theory of art, I argue that these desiderata cannot be met even if we use HPC-kind theory because art is a social rather than natural kind. My claim is that, even though we cannot appeal to standard theories of social kinds, because they take social kinds to be mind-dependent and less real, a more naturalized theory of social kinds will serve the purpose. By applying this theory which is developed by Mason (2015) to the domain of art, I propose that social facts such as "x is an artwork" or "y is not an artwork" are not grounded in mental facts involving rules we accept, but instead grounded in behavioural and relational facts.

Denis **Walsh** University of Toronto

Book Panel - Organisms, Agency, and Evolution by Denis Walsh

Organizer: Yitach Fehige University of Toronto. Panelists: Denis **Walsh** University of Toronto, Frédéric **Bouchard** Université de Montréal, Ingo **Brigandt** University of Alberta, and Carla **Fehr** University of Waterloo

This book panel features the work of Denis M. Walsh. The central insight of Darwin's *Origin of Species* is that evolution is an ecological phenomenon, arising from the activities of organisms in the 'struggle for life'. By contrast, the Modern Synthesis theory of evolution, which rose to prominence in the twentieth century, presents evolution as a fundamentally molecular phenomenon, occurring in populations of sub-organismal entities - genes. After nearly a century of success, the Modern Synthesis theory is now being challenged by empirical advances in the study of organismal development and inheritance. D. M. Walsh claims that the principal defect of the Modern Synthesis resides in its rejection of Darwin's organismal perspective, and argues for 'situated Darwinism': an alternative, organism-centred conception of evolution that prioritises organisms as adaptive agents.

Kirsten **Walsh** University of Bucharest

The Art of Experiment in Newton's Opticks

In his *Opticks*, Newton revealed himself to be a skilled experimenter. He employed optical instruments, such as prisms, lenses, and even thin films of air and water, to isolate, manipulate and explore optical phenomena. Focusing on the observations in book 2 of the *Opticks*, I interpret Newton's experimental process in terms of the Baconian method of natural history. Baconian natural histories have been (traditionally) viewed as large warehouses of facts. However, recent study of Bacon's Latin natural histories shows them to be complex reports containing, not only observations, but also descriptions of experiments, advice and observations on the method of experimentation, provisional explanations, questions, and epistemological discussions. There are many similarities between Newton's observations and Bacon's natural histories, in particular, Bacon's method of *experientia literata*. *Experientia literata* is a technique for guiding the intellect from one experiment to another. By following this technique, discoveries are made, not by chance, but by moving from one experiment to the next in a guided, systematic way. But there's more to this than the generation of experimental results: the experimental process itself reveals things about the phenomena beyond what is revealed by the collection of facts. Viewed in this way, Newton's observations are richer and more sophisticated than previously recognised. Drawing on his knowledge from both practical and theoretical domains, Newton built optical instruments,

invented experimental techniques and revealed new properties of light. He was, you might say, a master of the art of experimentation.

Ken **Waters** University of Calgary

Historically-informed Scientific Metaphysics: An argument for the No General Structure Thesis

Scientific metaphysics can be described as an attempt to theorize about the fundamental nature of the world by drawing upon the best scientific theories of our day. I challenge this approach to metaphysics by applying it to the science of genetics. But instead of applying it to today's genetics, I apply it to the genetics of the 1930s. I draw upon the best biological theories of this earlier period to theorize about the fundamentals of heredity, development, and evolution. I show that if philosophers of the 1930s adopted today's favored approach to scientific metaphysics, and if they wanted to identify the fundamentals of life, they could have drawn upon the best theories of their day to support the idea that genes are the fundamental units of heredity, development, and evolution. But subsequent developments in of biology have shown that genes are not fundamental units of heredity, development, and evolution. But I will not advance an antirealist view. I will maintain that classical geneticists were right about the causal relationship between genotype and phenotype, they were right about gene differences being located in linear fashion in chromosomes, and they were right about the roles that chromosomal mechanics in meiosis play in producing patterns of gene transmission. The problem with this approach to metaphysics does not stem from realism; it stems from the metaphysical assumption that life has an overall, fundamental structure and the epistemological view that scientific theories provide a basis for describing that fundamental structure.

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Technologies of Return: DNA Databasing, Biologism, and Transnational Asian Adoption

In 2003, Jane Jeong Trenka authored what is possibly one of the most cited memoirs about Asian adoption, *The Language of Blood*. A central theme in the book is the power of blood as a signifier for life, family, history, and identity—particularly for adoptees; blood transcends geographic and cultural distance and beckons to the narrator, prompting her return to her birth country—Korea. But inasmuch as blood has played a central part in the construction of this, and many other, Asian adoptee return narratives, this paper focuses on the shift from thinking about blood as the primary marker of race and kinship to a recent emphasis on genetics and DNA. I begin by addressing the odd paradox that sees Asian adoptees as simultaneously anti-essentialist (their identities, cultures, kinships, and nationalities are social constructions) and essentialist (connected to their lost biological origins and read through their willingness to “return” home) and the roles that blood plays in this contradiction. Next I analyze the applications of DNA database services, like 23andMe, that are marketed at Asian adoptees and claim to help them investigate and construct their biologic pasts through cyber, or at least technologically-driven, returns. I wonder: “how do the growing trends towards biologism and genomic identitarianism impact feelings of belonging, community, and nationhood for Asian adoptees who are already precariously located within the frameworks of race, ethnicity, ancestry, and space?” What do these DNA databases offer by way of community-building and how must we work within scientific parameters in our quests for more tangible subjectivity? For instance, what does it mean for us to turn to genetic screening services not just to understand ourselves but also to connect with others?