

2018

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# Programme

**Canadian Society for the History  
and Philosophy of Science  
Annual Conference**

**Congrès annuel de la Société  
canadienne d'histoire et de  
philosophie des sciences**

**26-28 May/mai 2018**

**University of Regina  
Regina, Saskatchewan  
Canada**

**Part of the Congress of the Humanities  
and Social Sciences**

**Dans le cadre du Congrès  
des sciences humaines**

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## Programme at a Glance / Programme sommaire

### SATURDAY MAY 26 / SAMEDI 26 MAI

ROOM	FN-1020	FN-1008	FN-1010
8:45 – 10:15	Scientific Models	Science, Technology and the State I	Causation in Historical Perspective
10:30 – 12:00	Philosophy of Biology	Science, Technology and the State II	Social Epistemology I
13:30 – 15:00	Philosophy of Mathematics	Authority and Ideals in Environmental Science	Scientific Realism
15:15 – 16:45	Evidence	Panel on Tara Abraham's book <i>Rebel Genius</i>	Structuralism, Underdetermination and Skepticism
17:00 – 18:30	<b>International Keynote Speaker: <i>About Methods</i></b> by Jutta Schickore (Room: Luther College Auditorium)		

### SUNDAY MAY 27 / DIMANCHE 27 MAI

ROOM	FN-3305	FN-2007	FN-3304
8:45 – 10:15	Philosophy of Biology II	Panel on Terence Keel's Book <i>How Christian Thought Became Racial Science</i>	Social Epistemology II
10:30 – 12:00	Philosophy of Physics I	Archeology and Contemporary Technology	Individuals and Elements in Ecology and Evolution
13:30 – 15:00	Special Panel: Science and Indigenous Ways of Knowing: Synergies or Solitudes?		Aristotle
15:15 – 16:45	<b>Drake Lecture: <i>How Genetics Succeeds: An Account of Scientific Investigation</i></b> by C. Kenneth Waters (Room: Campion College Auditorium)		
17:00 – 19:00	President's Reception (Room: CK-122)		

### MONDAY MAY 28 / LUNDI 28 MAI

ROOM	FN-1016	FN-1011	FN-1012
8:45 – 10:15	Philosophy of Physics II	Pillars of the Earth: History and Philosophy of Science and Religion	Science and Characters
10:30 – 12:00	Scientific Metaphysics	19 <sup>th</sup> Century Science and Medicine	Tradition and Transformation in Science
12:05 – 13:25	<b>Annual General Meeting &amp; Hadden Prize Ceremony (Lunch Served; Room LC-100)</b>		
13:30 – 15:00	Model Theory and Logical Structure	Teaching HPS	Pluralism

# Programme

## FRIDAY MAY 25

18:00 - 20:00 Executive Meeting / Réunion du Comité exécutif  
LC 213

## SATURDAY MAY 26

Saturday  
8:45 - 10:15  
FN-1020

### SCIENTIFIC MODELS

Chair: **Matthew Howery** University of Western Ontario

**Blind Spots and Models: The Case of Information Elaboration in Philosophical Models of Diversity**  
**Sina Fazelpour** University of British Columbia

**Armchair Chemistry and Theoretical Justification in Science**

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

**False Models for Fecund Research Programs**

**William Bausman** University of Geneva

Saturday  
8:45 - 10:15  
FN-1008

### SCIENCE, TECHNOLOGY AND THE STATE I

Chair: **Geoff Bil** University of British Columbia

**Sampling, Statistics and the State: New ways of probing probability in Independent India**  
**Gordon McOuat** University of King's College

**Imperial Mobilities: Technologies of Time, Space, and Motion in the Panama Canal**

**Caroline Lieffers** Yale University

Saturday  
8:45 - 10:15  
FN-1010

### CAUSATION IN HISTORICAL PERSPECTIVE

Chair: **John Lehmann** University of Western Ontario

**Human Manipulation in Scientific Experiments: Aristotle on Seawater**  
**Christopher Byrne** St. Francis Xavier University

**Capricious or Scientific? Mill's Problem of Causal Selection**

**Brian Hanley** University of Calgary

10:15 - 10:30  
FN-1008

COFFEE BREAK

Saturday  
10:30 - 12:00  
FN-1020

### PHILOSOPHY OF BIOLOGY I

Chair: **Eric Muszynski** Université du Québec à Montréal

**Against Mechanism: Developing a Process Framework for Biology**  
**Katherine Valde** Boston University

**Structuralism and the Metaphysics of Biological Practice**

**Tiernan Armstrong-Ingram** University of California

**Are Pathways Really Just Mechanisms?**

**Timothy James Perkins** University of Calgary

Saturday  
10:30 - 12:00  
FN-1008

## SCIENCE, TECHNOLOGY AND STATE II

Chair: **Caroline Lieffers** Yale University

Cold War Objects of Persuasion: American Science at Expo 58

**Andrew Ede** University of Alberta

Exploring History of Computing with Prototypes

**Zbigniew Stachniak** York University

What Water Meant to Stalinist Science: The Case of the Communal Hygienists

**Chris Burton** University of Lethbridge

Saturday  
10:30 - 12:00  
FN-1010

## SOCIAL EPISTEMOLOGY I

Chair: **Devon Moriarty** University of Waterloo

The Collective Intentionality of Epistemic Communities

**Nicholas Overgaard** University of Toronto

Replication/Crisis: Implementing Criticism in a Time of Methodological Crisis

**Alan Richardson** University of British Columbia

The Methodological Basis of Peer Review

**Jamie Shaw** University of Western Ontario

12:15 - 13:15

LUNCH BREAK

Saturday  
13:30 - 15:00  
FN-1020

## PHILOSOPHY OF MATHEMATICS

Chair: **Ananya Chattoraj** University of Calgary

Justifying restrictions on mathematical means as in Bishop's constructivism

**Robert Thomas** University of Manitoba

Accounting for the Directionality of Mathematical Explanations

**Erlantz Etxeberria Altuna** University of Western Ontario

Le débat sur l'axiome du choix: Zermelo et Sierpiński contre les semi-intuitionnistes français

**Valérie Lynn Therrien** University of Western Ontario

Saturday  
13:30 - 15:00  
FN-1008

## AUTHORITY AND IDEALS IN ENVIRONMENTAL SCIENCE

Chair: **Jaipreet Virdi** University of Delaware

Marine science, red tide, and the challenges of, boundaries, locations and scale in marine ecosystems

**Jennifer Hubbard** Ryerson University

As Clover Killed the Fern: The History and Memory of 'Ecological Imperialism' in Aotearoa New Zealand

**Geoff Bil** University of British Columbia

Chasing Wildlife Films' Uncertain Impacts

**Eleanor Louson** York University

Saturday  
13:30 - 15:00  
FN-1010

## SCIENTIFIC REALISM

Chair: **Greg Lusk** University of Chicago

Scientific Realism and Internal vs External Degrees of Truth

**Matthew Howery** University of Western Ontario

Against Van Fraassen's Historical Defense of Constructive Empiricism

**Curtis Forbes and Noah Stemeroff** University of Toronto

What survives theory change

**Aaron Sidney Wright** Stanford University

15:00 - 15:15  
FN-1008

COFFEE BREAK

Saturday  
15:15 - 16:45  
FN-1020

## EVIDENCE

Chair: **Kristine Palmieri** University of Chicago

What Was Perrin Really Doing?

**Robert Hudson** University of Saskatchewan

Data and phenomena: Two challenges from the Epistemology of Measurement

**Greg Lusk** University of Chicago

The Method of Hypothesis in the 19th Century: Whewell, Mill, Herschel, Jevons, and Peirce on the Criterion of Consilience

**Klodian Coko** University of Western Ontario

Saturday  
15:15 - 16:45  
FN-1008

## BOOK PANEL WITH TARA ABRAHAM REBEL GENIUS: WARREN S. McCULLOCH'S TRANSDISCIPLINARY LIFE IN SCIENCE

Organizer and chair: **Vivien Hamilton** Harvey Mudd College

Author: **Tara Abraham** University of Guelph

Discussants:

**Delia Gavrus** University of Winnipeg

**Ernst Hamm** York University

**Vivien Hamilton** Harvey Mudd College

Saturday  
15:15 - 16:45  
FN-1010

## STRUCTURALISM, UNDERDETERMINATION AND SCEPTICISM

Chair: **Sinan Sencan** University of Calgary

Empirical Underdetermination, Scepticism and Van Fraassen

**Dan Goldstick** University of Toronto

Neo-Kantianism and Structural Realism: From a Skeptical Point of View

**Lydia Patton** Virginia Tech

Epsilon, Indeterminacy, and Structuralism

**David DeVidi** University of Waterloo

16:45 - 17:00  
LC Auditorium

COFFEE BREAK

Saturday  
17:00 - 18:30  
LC Auditorium  
(Luther College)

## INTERNATIONAL KEYNOTE SPEAKER

### ABOUT METHOD

**Jutta Schickore** Indiana University Bloomington.

## SUNDAY MAY 27

Sunday  
8:45 - 10:15  
FN-3305

### PHILOSOPHY OF BIOLOGY II

Chair: **Valérie Lynn Therrien** University of Western Ontario

Is this pluralism? Diversity in biological explanations of behavior

**Eric Muszynski** Université du Québec à Montréal

Analyse de la construction de l'ethos et de l'identité des collectifs de biohacking

**Guillaume Bagnolini** Centre d'éthique contemporaine

Épigénétique : Au-delà de l'opposition nature-culture

**Guillaume Pelletier** University of Laval

Sunday  
8:45 - 10:15  
FN-2007

### BOOK PANEL WITH TERENCE KEEL

### HOW CHRISTIAN THOUGHT BECAME RACIAL SCIENCE

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

Author: **Terence Keel** University of California

Discussants:

**Jaipreet Viridi** University of Delaware

**Ernst Hamm** York University

**Elizabeth Neswald** Brock University

**Yiftach Fehige** University of Toronto

Sunday  
8:45 - 10:15  
FN-3304

### SOCIAL EPISTEMOLOGY II

Chair: **Brian Hanley** University of Calgary

Influence from Within or Influence from Without: Mutually Exclusive Strategies for Scientists to Impact Policy?

**Garrett Richards** University of Saskatchewan

Assessing the Epistemic Reliability of Science Experts on the Internet: A Case Study in Reddit's r/Science

**Devon Moriarty** University of Waterloo

Externality, Pollution, and Economic Policy

**Rebecca Livernois** University of British Columbia

10:15 - 10:30  
FN-2007  
FN-3305

COFFEE BREAK

Sunday  
10:30 - 12:00  
FN-3305

## PHILOSOPHY OF PHYSICS I

Chair: **Thomas De Saegher** University of Western Ontario

### Comparative Structure

**Isaac Wilhelm** Rutgers University

### The Status of Classical Physics in Contemporary Science

**Markus Aliiksaar** University of Toronto

### Philosophy's Epistemic Progress and the Scientific Ideal

**Dustin Olson** University of Regina

Sunday  
10:30 - 12:00  
FN-2007

## ARCHEOLOGY AND CONTEMPORARY TECHNOLOGY

Chair: **Erich Weidenhammer** University of Toronto

### The archaeology of geophysics: Collecting the history of radiometric dating

**Erich Weidenhammer** University of Toronto

### Reaching the Shore: Three Waves of Computer Simulations in Archaeology since the 1960s

**Fan Zhang** University of Toronto

### Inside the Instrument: Cave Markings of the Late 20th Century

**Victoria Fisher** University of Toronto

Sunday  
10:30 - 12:00  
FN-3304

## INDIVIDUALS AND ELEMENTS IN ECOLOGY AND EVOLUTION

Chair: **Katherine Valde** Boston University

### Bateson on characters, genes, and species as theoretical Elements

**Aleta Quinn** University of Idaho

### An account of pregnancy in the light of process ontology

**Hannah O'Riain** University of Calgary

12:15 - 13:15

LUNCH BREAK

Sunday  
13:30 - 15:00  
FN-2007

## SPECIAL PANEL: SCIENCE AND INDIGENOUS WAYS OF KNOWING: SYNERGIES OR SOLITUDES?

Organizer and chair: **Lesley Cormack** University of Alberta

Panelists:

**Kim TallBear** University of Alberta

**Andrew Reynolds** Cape Breton University

**Gordon McQuat** University of King's College

**Theodore Binnema** University of Northern British Columbia

Sunday  
13:30 - 15:00  
FN-3304

## ARISTOTLE

Chair: **Christopher Byrne** St. Francis Xavier University

### The Continuity of Life and Mind in Plato's and Aristotle's Concepts of *Psuchē*

**Zacharia A. Neemeh** University of Memphis

### A Cheap Nature? Aristotle on the Many Functions of the Heart

**Adam Woodcox** University of Western Ontario



15:00 - 15:15  
Campion  
Auditorium

COFFEE BREAK

Sunday  
15:15 - 16:45  
CM Aud.

## DRAKE LECTURE

**How Genetics Succeeds: An Account of Scientific Investigation**  
**C. Kenneth Waters** University of Calgary

Sunday  
17:00 – 19:00  
CK 122

## PRESIDENT'S RECEPTION

## MONDAY MAY 28

Monday  
8:45 - 10:15  
FN-1016

### PHILOSOPHY OF PHYSICS II

Chair: **Markus Aliiksaar** University of Toronto

**The Dynamics of Entangled States**

**Kent Peacock** University of Lethbridge

**Dynamical Variables and the Structure of Realist Interpretations of Quantum Mechanics**

**Thomas De Saegher** University of Western Ontario

Monday  
8:45 - 10:15  
FN-1011

### PILLARS OF THE EARTH: HISTORY AND PHILOSOPHY OF SCIENCE AND RELIGION

Chair: **Anthony Nairn** University of Toronto

**Science in Islam: Sir Syed the nechari (naturalist)**

**Sarah Qidwai** University of Toronto

**“Those are some of the things that molecules do, given four billion years of evolution.”: Does Cosmos Enchant Science?**

**Anthony Nairn** University of Toronto

**Atheism vs. Atheism in the Encounter Between Science and Religion**

**Yiftach Fehige** University of Toronto

Monday  
8:45 - 10:15  
FN-1012

### SCIENCE AND CHARACTERS

Chair: **Rebecca Livernois** University of British Columbia

**« Notre avenir à tous »? Généalogie et critique de la précaution dans l'éthique Jonassienne du futur**

**Bertrand Guillaume** Dartmouth College

**The Relevance of Intellectual Character for Scientific Inquiry**

**Mark Young** Keyano College

**“Grandfathers of the Ether”: Robert Roberts, Edward Mills, and Astronomical Lecturing in Nineteenth-Century Wales**

**Jake Bridges** University of Alberta

10:15 - 10:30  
FN-1011

COFFEE BREAK

Monday  
10:30 - 12:00  
FN-1016

SCIENTIFIC METAPHYSICS

Chair: **Kent Peacock** University of Lethbridge

Ismael's Objective Modality in light of Chemical Kinds Classificatory Practice

**Ananya Chatteraj** University of Calgary

Understanding McTaggart's Paradox of Time and its Relation to Science

**Richard Feist** Saint-Paul University

Scientific Metaphysics, Justification, and Fuzzy Disciplinary Boundaries

**Amanda Bryant** Trent University

Monday  
10:30 - 12:00  
FN-1011

19<sup>TH</sup> CENTURY SCIENCE AND MEDICINE

Chair: **Jennifer Hubbard** Ryerson University

Richard Whately's Elements of Logic and Its Popular Discontents

**Jared Neumann** Indiana University

The Artist-Patient: The Visual Archive of the Crichton Royal Institution, 1839-1857.

**Katie Powell** University of British Columbia

Temporary Measures: Women Astronomers at Greenwich in the Late 19th Century

**Kane Mullen** University of Alberta

Monday  
10:30 - 12:00  
FN-1012

TRADITION AND TRANSFORMATION IN SCIENCE

Chair: **Justin Bzovy** University of Alberta

The transformation of 18th century philology: Göttingen and the «archelogy» of texts

**Kristine Palmieri** University of Chicago

Abraham Sharp on the Margins of the Republic of Letters

**Jason Grier** York University

A Bibliometric History of the Social and Human Sciences

**François Claveau** Université de Sherbrooke

Monday  
12:05 - 13:25  
LC-100  
(Luther College)

LUNCH SERVED AT:  
ANNUAL GENERAL MEETING & HADDEN PRIZE CEREMONY  
DÎNER SERVI À:  
ASSEMBLÉE GÉNÉRALE ANNUELLE & REMISE DU PRIX HADDEN

Monday  
13:30 - 15:00  
FN-1016

MODEL THEORY AND LOGICAL STRUCTURE

Chair: **Hannah O'Riain** University of Calgary

F.P. Ramsey as Proto-Model Theorist

**John Lehmann** University of Western Ontario

On the Application of Carnap's Internal/External Distinction to the Realism/Anti-Realism Controversy

**Yousuf Hasan** University of Western Ontario

Realist Intuitions: The Logical Structure of the Theoretical Virtues of Scientific Theories

**Corey Mulvihill** University of Ottawa

Monday  
13:30 - 15:00  
FN-1011

## TEACHING HPS

Chair: **Isaac Record** Michigan State University

Opening the Black Box of Teaching

**Isaac Record** Michigan State University

Teaching Disability Through Materiality

**Jaipreet Virdi** University of Delaware

Monday  
13:30 - 15:00  
FN-1012

## PLURALISM

Chair: **Tiernan Armstrong-Ingram** University of California

Integrative Pluralism and Holobiont Individuality

**Sinan Sencan** University of Calgary

What could Scientific Pluralism be?

**Cristian Larroulet Philippi** CU Boulder

Lyme Disease in Canada

**Justin Bzovy** University of Alberta

# Abstracts / Résumés

SATURDAY MAY 26

Saturday  
8:45 - 10:15  
FN-1020

## SCIENTIFIC MODELS

Chair: Matthew **Howery** University of Western Ontario

### Blind Spots and Models: The Case of Information Elaboration in Philosophical Models of Diversity

**Sina Fazelpour** University of British Columbia

In recent years, philosophers of science have paid much deserved attention to the role of idealizations in scientific models, the difference between idealizations and abstractions, and whether, and in what sense, idealized assumptions can be considered as unproblematic in a given context (Woodward, 2006; Cartwright, 2007; Weisberg, 2007; Morrison, 2015). Less discussed is the distinct issue of agnotology – or study of ignorance – in modeling contexts (Proctor & Schiebinger, 2008). Idealizations and abstractions are explicitly inaccurate modeling assumptions that, one hopes, do not threaten the intended purpose of the model. In contrast, blind spots occur when an aspect of the phenomenon that is crucial to the intended purpose of the model is, possibly inadvertently, not represented at all. Here we consider this issue in connection with models of the epistemic value of diversity for group performance and what is known in diversity research as “information elaboration” (Kitcher, 1990; Hong & Page, 2004; Muldoon & Weisberg, 2011). Information elaboration is the process whereby the distributed cognitive resources of group members are effectively integrated towards solving a common task, and is the focus of a good deal of research on the impacts of diversity on group performance (Bear & Wooley 2011; Smith-Doerr et al. 2017). Our examples illustrate that blind spots can vary in scope, for instance, omitting information elaboration altogether or only some highly significant sub-feature of it, such as the effect of social identity on communication. We conclude by discussing the ethical-epistemic implications of these blind spots for diversity research.

### Armchair Chemistry and Theoretical Justification in Science

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

In the late 19th century, Sophus Jørgensen proposed structures for cobalt complexes that utilized the more developed bonding principles of organic chemistry and the reigning understanding of valence. Similar to how organic compounds typically form hydrocarbon chains, Jørgensen created models for cobalt complexes that also had a chainlike structure. His models featured (1) a cobalt metal center with three attachments because cobalt was understood as trivalent and (2) one of those attachments was a chain of atoms, like the carbon chain featured in organic chemistry. Alfred Werner proposed a different model for cobalt compounds that featured octahedral arrangements around the cobalt metal center, calling the metal complex a coordination compound. Werner’s coordination theory introduced a new type of valence allowing cobalt to have six attachments and abandoned Jørgensen’s chain theory. Experimental work confirmed Werner’s theory making it central to inorganic chemistry. One issue in the Jørgensen-Werner debate over the structure of cobalt complexes concerns differences between the two scientists over the nature of theoretical justification-- the epistemic reasons each had for resisting change (as with Jørgensen) or looking for a different model (as with Werner). We compare and contrast the concepts of theoretical justification employed by Jørgensen and Werner. Jørgensen felt that Werner lacked justification for his experimental model. Werner, presumably, had some justification for his model, albeit a different sort of justification than Jørgensen. We conclude by noting how the different concepts of theoretical justification embodied by Jørgensen and Werner connect with current philosophy and practice of science.

### False Models for Fecund Research Programs

**William Bausman** University of Geneva

The uses of false models within biology remains underexplored. In this paper I characterize and integrate several uses of false models within research programmes. I focus on the role of neutrality assumptions in the family of neutral theories across biology. Neutrality assumptions—that all individuals in a group, regardless of kind, are functionally equivalent—are false in the sense that they exclude the relevant form of selection from operating in the domain. Assuming neutrality functions as a methodological *starting point* by neutrality research programmes in the sense that neutrality is relaxed—individual differences are included—when the predictions of the neutral models are not good enough. In particular, neutralists have two basic strategies for responding productively to poor predictions: either they take this as a sign that selection processes are causally important to the pattern (*Baseline Modeling*), or else they take it as a sign that there is a problem with the neutral theory or its formalization (*Adding Complexity*). Making assumptions that are false in the same way as neutrality enables these strategies because when you leave out an important factor and you are wrong, you know what you need to include, and you learn the circumstances in which what you excluded is really important.

Saturday  
8:45 - 10:15  
FN-1008

## SCIENCE, TECHNOLOGY AND THE STATE I

Chair: **Geoff Bil** University of British Columbia

### Sampling, Statistics and the State: New ways of probing probability in Independent India

**Gordon McQuat** University of King's College

This paper will examine the development of statistics and probability in India in the years surrounding Independence. Far from “emulating” the West – i.e., tracing a one-way trajectory from European center to periphery – Indian statistics and probability incubated in conditions local to the Indian context: the waning years of colonialism and the rising of nationalism, the engagement with an irreducible diversity in landscape and peoples, and the uneasy negotiations between “home-spun” authenticity of the Gandhian movement and the Nehruvian commitment to ascendancy and independence through central scientific planning. This biopolitical milieu produced a statistic of unprecedented richness, introducing new techniques and approaches into the center of probability. This paper will trace its origins and its way into the routes of Western statistics.

### Imperial Mobilities: Technologies of Time, Space, and Motion in the Panama Canal

**Caroline Lieffers** Yale University

This presentation examines the role of mobility and its technologies in the construction of the Panama Canal. Drawing on disability studies, the history of technology, and the history of American transnationalism, this presentation centers that reconceptualising and mastering mobility were central concerns in the assertion of American global and imperial power in the first decades of the twentieth century. In the design and construction of the Canal, I argue that mobility was reconceptualised at three unique but interrelated scales: the personal movement of individuals who were injured and disabled during the blasting and digging, the movement of dirt in reshaping the landscape, and the movement of military and trade ships through the completed Canal. In each of these examples, the United States relied heavily on technology to change and control movement, and each involved reimagining the limits of time, space, and productivity. Artificial limbs and a “cripple farm” governed the movement of disabled workers, new technologies for earth-moving allowed the Canal to be built on an impossibly ambitious timeline, and the completed Canal seemed literally to shrink time and space by allowing ships to move quickly between oceans. Understanding United States imperialism requires examination of technologies of time, space, and motion from the smallest to the largest scales.

Saturday  
8:45 - 10:15  
FN-1010

## CAUSATION IN HISTORICAL PERSPECTIVE

Chair: **John Lehmann** University of Western Ontario

### Human Manipulation in Scientific Experiments: Aristotle on Seawater

**Christopher Byrne** St. Francis Xavier University

Some accounts hold that the human manipulation of causal processes is crucial to scientific experiments; in Leibniz's summary of Francis Bacon's new method, to know nature, we must put it on the rack. As a result, natural and field experiments—where human control of the causal process is missing—are called ‘quasi-experiments’ and considered to be inferior. If, in turn, experiments are required for scientific knowledge, then there can be no scientific knowledge where artificial interventions are held to prevent us from seeing what is natural. Thus, it is argued, Aristotle had no physics or indeed any natural science because he thought scientific inquiry required us to stand back and watch the natures of things reveal themselves. This paper argues for two claims: 1) historically, Aristotle's experiments with seawater show that there is room for the human manipulation of causal processes in his natural science; 2) more generally, human manipulation of causal processes is not necessary for scientific knowledge; otherwise, large parts of astronomy, biology, and geology must be considered unscientific. Human manipulation bears on the isolation of causal processes, not their production. Indeed, the inductive inferences drawn from scientific experiments presuppose that the causal processes studied this way are indifferent to human intervention.

### Capricious or Scientific? Mill's Problem of Causal Selection

**Brian Hanley** University of Calgary

John Stuart Mill's *A System of Logic* stands at the center of philosophical discussions that cross a number of disciplines. The influence stems from a small set of remarks about causation in a passage clearing ground for his famous “methods.” A few key claims, and the use of a notable term, have come to shape an entire literature on an important philosophical problem. The subject of this literature is about how we single out important causes in cases where many causes bring about an effect. The notable term is “capricious,” and the key claims are that we select important causes capriciously and unscientifically. The problem at the center of this literature is *whether Mill was right*. Why do we deem some causes more important than others? Do we select subsets of important causes based on whims, or on principle? These kinds of questions define *the problem of causal selection*. Resurgent interest in causal selection among philosophers of science has led to new challenges to Mill's claims. Despite taking Mill as the problem's origin, few of them carefully examine the reasoning behind Mill's famous claims. In this paper I articulate Mill's arguments within the contexts of his overall project in *Logic* and his assumptions about

science and causation. While my analysis suggests that Mill's *conclusions* about causal selection are not a good fit for contemporary discussions, I argue that Mill discussion offers important insights about causal selection.

10:15 - 10:30  
FN-1008

COFFEE BREAK

Saturday  
10:30 - 12:00  
FN-1020

## PHILOSOPHY OF BIOLOGY I

Chair: **Eric Muszynski** Université du Québec à Montréal

### Against Mechanism: Developing a Process Framework for Biology

**Katherine Valde** Boston University

Ask most biologists, or philosophers of science, and they will readily tell you that the natural world does not work like a wristwatch. They might say something like 'nature doesn't have edges' and that if we look closely enough we won't discover clear boundaries between species or parts of the human body or trees in a forest. Nonetheless biologists quickly revert to the mechanistic framework in doing work. Such biologists are operating in a sort of conceptual limbo. On the one hand, they tacitly accept a mechanist view but on the other, they explicitly reject that the world is really made of mechanisms. The purpose of this paper is to make some suggestions about how to break out of this conceptual limbo. This paper will challenge the mechanistic framework by considering a series of microbiological examples, and systematically extending them to suggest a systematic failing of the framework. This paper will also suggest that a "process framework" provides a superior model for understanding the natural world. A process framework rejects the idea of an inventory of discrete entities, and instead calls for a broader perspective focusing on how phenomena are maintained and stabilized over time and space. This paper will develop a processual understanding of the work done on one specific example (bacteria and the human gut microbiome), and suggest the importance of an ecological approach to biology more generally. I argue that these projects are worth developing since they hold the promise of resolving a serious conceptual inconsistency among philosophers and biologists.

### Structuralism and the Metaphysics of Biological Practice

**Tiernan Armstrong-Ingram** University of California

Structuralism purportedly resolves problems of objecthood in mathematics, physics, and scientific theory change. Steven French has argued that the 'structuralist tendency' in philosophy of science ought to be extended in the form of Biological Structural Realism (BSR). He argues that the success of Ontic Structural Realism (OSR) for fundamental physics suggests that BSR will produce similar successes for biological problems. There are two reasons to be skeptical of French's move from OSR to BSR. First, strong disanalogies exist between the problem of individuality in fundamental physics and the various problems of biological individuals. The disanalogies suggests that structural solutions to biological problems, if they exist, may not bear any strong resemblance to OSR. Second, OSR is developed as a metaphysics *for* physics, a response to specific problems and practices within the science of physics. French develops his BSR primarily as an extension of OSR and not in response to problems faced within the actual practice of biology. BSR is not developed as a metaphysics *for* biology. Contra French's suggestion, structuralism is already present in the metaphysics of biological practice and intertwined with the problems of biological individuality. The range and diversity of problems and practices in biology suggest that a monist metaphysics will be inadequate for all biology. The more plausible alternative to BSR is to explore and develop a pluralist metaphysics for biology, inclusive of objects, processes, and structures.

### Are Pathways Really Just Mechanisms?

**Timothy James Perkins** University of Calgary

It is often thought that the New Mechanist philosophy got its start with Machamer, Darden and Craver (2000) as they proposed an entity and activity-centric view of mechanisms to account for explanation in the biological sciences. This view has gained traction since then, leading to a claim by Carl Craver that thinking in terms of mechanisms has been so successful that they can account for all other explanatory terms in the biosciences, including 'pathway', 'substrates', 'modulators', etc. (Craver 2007, 3). For this paper I challenge the notion that mechanisms got their start with MDC, and instead emerged from the reductionist thinking of logical positivist philosophers in the 1960s. Further, I challenge the notion that the mechanism term can account for other explanatory terms in the sciences, specifically ecology in my case. I argue that the reductionist origin of mechanisms has influenced the claim made by Craver, and provide a case in ecological studies where the term 'pathway' and 'mechanism' are offered together, but do very different work in the explanation offered. From this case I show that it matters how the scientists conceive of the world for the conclusions they draw, and that paying attention to the scientists reasoning and terms they choose to use is important for an accurate image of scientific practice.

Saturday  
10:30 - 12:00  
FN-1008

## SCIENCE, TECHNOLOGY AND STATE II

Chair: **Caroline Lieffers** Yale University

### Cold War Objects of Persuasion: American Science at Expo 58

**Andrew Ede** University of Alberta

The first World Fair following World War II was held in Brussels in 1958. It has been seen as an ideological battleground between the United States and the USSR, with each respective power advancing its view of the world and the future with their displays. The USSR had scored a major propaganda coup with the launch of Sputnik I and II in 1957, so there was added pressure on the American exhibitors to demonstrate that the US was a match for Soviet science and technology. Part of the response was a display of American science with contributions from important researchers such as Linus Pauling. In the spirit of the “Atoms for Peace” program, the American display included a working nuclear reactor. This presented the physical objects of science as objects of persuasion that embodied an effort to attract potential client states and at the same time demonstrate that the United States was not behind the Soviet Union in science

### Exploring History of Computing with Prototypes

**Zbigniew Stachniak** York University

Prototypes of computers play an integral role in the hardware development cycle. In a continuous process of iterating and improving that begins with the computer's proof of concept, a designer learns how the current design should be modified to achieve the desired parameters or revised if technological, financial, or other constraints make achieving the overall objectives no longer feasible. The prototypes are discarded as soon as their functionality is tested, performance measured, faults detected and analyzed. Occasionally, functional prototypes are publicly demonstrated in pre-announcement stage of the development cycle to attract the attention of the industry, target users, and venture capital. After years, some of these prototypes end up in technology museums. When analyzed, they reveal the invention process, design strategies, and phases. They show what information and options were available to the design team: what the designers knew and didn't know, how well they understood what they were doing, and how that understanding shaped their decisions. In this presentation, I will analyze the prototypes of the MCM/70 personal computer {one of world's earliest personal computers and one of the most important computers designed and manufactured in Canada. My analysis is focused on the impact of corporate culture and politics on the design process and marketing of the MCM/70. I will discuss how technological difficulties were handled and how solving them created novel solutions.

### What Water Meant to Stalinist Science: The Case of the Communal Hygienists

**Chris Burton** University of Lethbridge

The Soviet academic discipline of communal hygiene developed as a means to reconcile health protection with very rapid industrial development under Stalin. My paper draws primarily from the archival records of the most senior scientific body of the Soviet Ministry of Health in Moscow from 1941 to 1953. The quality of water was the most prominent subject discussed in this archive, with multiple discursive threads. These include one on the science behind the expansion of the irrigation system in Central Asia; another on the science to avoid “over-development” alongside specific reservoirs near cities; and a third that explicitly proposed a science of meanings for water. I will examine how these discursive threads overlapped and differed. It is already clear that they were overshadowed by a further one: the research effort into one of the signatures of Soviet water science, *predel'no dopustimye konsentratsii*. Usually translated as maximum permissible concentrations, they were often referred to by non-Soviet specialists as thresholds. Their determination was an international phenomenon: in the toxicology of water, a threshold is the point at which a toxin is sufficiently diluted for no effect on human health to be observed. The different threads of discussion imply that several scientific meanings were ascribed to water but, influenced heavily by Stalinism, the communal hygienists increasingly came to understand water as a medium to facilitate the industrialization of the country as it carried away within it the detritus of production.

Saturday  
10:30 - 12:00  
FN-1010

## SOCIAL EPISTEMOLOGY I

Chair: **Devon Moriarty** University of Waterloo

### The Collective Intentionality of Epistemic Communities

**Nicholas Overgaard** University of Toronto

In the history of science, we know that a proper positioning of individual actors in their historical contexts involves a consideration of the epistemic communities of the time. For instance, we make sense of the initial resistance to Galileo's ideas by situating him in a community of Catholic theologians or Aristotelian natural philosophers. However, these epistemic communities are in a continuous state of expansion and specialization, which makes them notoriously difficult to identify and study. This difficulty forms the crux of an important methodological debate in the social studies of science today – namely, how to properly identify and study epistemic communities. One camp in this debate consists of historians, philosophers, and sociologists who approach communities as intellectually and culturally unified groups of scientists sharing a *conceptual framework* of qualities, like common beliefs and values, and a particular institutional structure. The competing camp

describes epistemic communities as *networks of practitioners* exchanging and transforming both information and materials to satisfy virtually any localized purpose. In this presentation, I will suggest that this debate could benefit from recent developments in the field of social ontology. In particular, I will argue that an analysis of the *collective intentionality* of an epistemic community allows us to conceptually constrain the continuous expansion of knowledge and to identify the proper social bearer of a set of beliefs.

### Replication/Crisis: Implementing Criticism in a Time of Methodological Crisis

**Alan Richardson** University of British Columbia

The replication crisis in fields that routinely employ statistical techniques (especially social and medical science) offers many opportunities for philosophical and methodological reflection. My topic in this paper is not directly on matters of statistical method but rather on dynamical issues of social epistemology. As the New York Times Magazine article “When the Revolution Came for Amy Cuddy” (October 18, 2017) makes clear, one aspect of the replication crisis in fields such as behavioural psychology has been a crisis of the scientific community as methodological critiques wreak havoc on individual careers. My question is: what do we learn from this case about the dynamics of setting up new standards of criticism within established scientific communities? My principal methodological intervention (building on some recent work by Jill Fellows) is that in addition to clarity about criticism and its point (following Popper) and concerns with proper distribution of cognitive authority and response to community criticism (following Longino), scientists need to attend to their own character and the character of those they criticize. In particular, since we know that criticism of views is not sharply separated from ostracism of individuals who promote those views, scientific communities need to be attentive to ways in which the former does not unfairly lead to the latter.

### The Methodological Basis of Peer Review

**Jamie Shaw** University of Western Ontario

Recently, a small, burgeoning literature seeks to uncover the methodological assumptions in current practices of peer review in scientific journals. For instance, Carole Lee argues that since qualitative studies suggest that most reviewers comment on distinct aspects of papers, the editorial decision to accept or reject papers require weighing ‘incommensurable’ reviews (Lee 2012, 2015). This, she claims, warrants a Kuhnian analysis. On the other hand, Shahar Avin argues that peer review is Polanyiian since it presupposes the reliability of the reviewer’s tacit knowledge rather than explicit methodological rules (Avin 2015; 2017). In my talk, I respond to this literature by demonstrating how particular peer review practices line up with traditional conceptions of scientific methodology. First, I argue, with Lee, that editorial practices presuppose Kuhnian assumptions. However, rather than balancing incommensurable reviewer comments, they are Kuhnian in that the *selection* of reviewers is consistent with the Kuhnian principle of ensuring that publications are consistent with the accepted paradigm. I also go on to show how the well-documented, and heavily criticized, conservatism of peer review is due to this practice (Stanford 2015). Second, I argue, against Avin, that the peer review process presupposes Polanyiian tacit knowledge because reviewer *comments*, which are explicit and analyzable, determine publication acceptance or rejection. Finally, I examine the extent to which peer review is consistent with the principle of maximal testability (Popper 1935; Feyerabend 1963). I argue that contemporary peer review minimizes the extent to which scientific publications are criticized and, thereby, is in conflict with this principle.

12:15 - 13:15

LUNCH BREAK

Saturday  
13:30 - 15:00  
FN-1020

## PHILOSOPHY OF MATHEMATICS

Chair: **Ananya Chattoraj** University of Calgary

### Justifying restrictions on mathematical means as in Bishop's constructivism

**Robert Thomas** University of Manitoba

It has been correctly claimed that Errett Bishop's constructive mathematics has not been philosophically justified. This paper considers justification of such limitations on the forces deployed in various styles of mathematics and, for Bishop as an example, mathematical and scientific but not philosophical justification. Restrictions are considered in terms of Brian Rotman's 1993 re\_nement of Philip Kitcher's 1984 ideal agent, who performs mathematical operations. They are found throughout mathematical history from ancient Greece (possibly Egypt). And it turns out that they are a common feature of contemporary mathematics in the guise of what mathematicians do a lot, instead of exploring a given landscape (an image common to G. Frege and G.H. Hardy), exploring what can be done with a specific tool like K-theory. In an inevitably pluralistic spirit, there is no philosophically based rejection of doing other things. There is nothing wrong with what K theory can't do; the restriction is one of interest, not on principle. Bishop's constructive mathematics might have received a less chilly reception from the mathematical mainstream if the same excellent mathematics had been surrounded by more modest and less philosophical rhetoric.



## Accounting for the Directionality of Mathematical Explanations

**Erlantz Etxeberria Altuna** University of Western Ontario

There has been an increasing interest and acceptance of some kinds of non-causal explanations in the recent years (Reutlinger 2016). Perhaps the strongest case for explanations that explain in virtue of something other than citing causes has come from mathematical explanations, with several compelling examples and case studies. Marc Lange (2013) has championed this view and has provided an account of what makes an explanation distinctively mathematical. According to him, it is the fact that mathematical explanations are modally stronger than causal explanations in that mathematical facts hold in situations where causal laws don't. Craver and Povich (2017) have argued against Lange's approach, noting that mathematical facts alone cannot account for the directionality or asymmetry that we ordinarily find on explanations. For example, the fact that 23 isn't divisible by 3 mathematically explains why I can't divide equally 23 strawberries among my three siblings, but the reverse doesn't hold; the fact that I was able, in another instance, to equally divide my strawberries doesn't explain why I don't have 23 strawberries. Hence, Craver and Povich hold that mathematical relations are not sufficient for mathematical explanations, for they lack the mark of directionality, which, in their account, is provided by ontic facts. In this paper I argue that their criticism of Lange's account relies on the unwarranted assumption that explanations can be interpreted as arguments, in the fashion of the covering law model. If we maintain a modal or counterfactual interpretation instead, the directionality problem seems to vanish.

## Le débat sur l'axiome du choix: Zermelo et Sierpiński contre les semi-intuitionnistes français

**Valérie Lynn Therrien** University of Western Ontario

Il y a deux manières de concevoir les mathématiques : a) on peut concevoir les mathématiques comme un jeu de stratégie – c'est-à-dire, étant donné certaines règles fournies au préalable, on peut élaborer tous les «mouvements» admissibles et enquêter sur tous les résultats possibles; ou b) on peut concevoir les mathématiques comme une théorie scientifique — c'est-à-dire, en se posant la question de la provenance des règles, se préoccupant du bien-fondé des démonstrations et en s'assurant de la valeur des résultats décrétés. La première conception est courante même parmi les mathématiciens de carrière et offre peu de besogne au philosophe. Or seule la deuxième explique la possibilité même des désaccords mathématiques. Plus que tout autre désaccord la controverse sur l'axiome du choix soulève la question philosophique de la nature de la théorie et de la pratique mathématiques. Et c'est bien cette question qui sépare les mathématiciens classiques et constructivistes. L'axiome du choix (AC) introduit à la théorie des ensembles par Zermelo en 1904 fut récusé par les semi-intuitionnistes français Baire, Borel et Lebesgue, mais défendu par Hadamard et Sierpiński). Ce débat est un important présage à la rupture avec les mathématiques classiques (proclamée par Brouwer en 1907) et permet d'accéder au cœur même du désaccord entre les deux camps.

Saturday  
13:30 - 15:00  
FN-1008

## AUTHORITY AND IDEALS IN ENVIRONMENTAL SCIENCE

Chair: **Jaipreet Virdi** University of Delaware

### Marine science, red tide, and the challenges of, boundaries, locations and scale in marine ecosystems

**Jennifer Hubbard** Ryerson University

The problem of location, boundaries and scale of ecosystems in the design and conduct of field studies in ecology has been highlighted in *Spatializing the History of Ecology* (2017), and at the 2017 HSS, where Jeremy Vetter commented, to general agreement, that he could not think of a single case in which an outstanding, localized ecological phenomenon was later found to occur on a larger scale. This observation's validity, however, was perhaps contingent on the overwhelmingly terrestrial examination of this issue. Elsewhere, Stephen Bocking has questioned the value of local science in the marine environment, where boundaries are fluid and undefined, and 'field' and laboratory studies are so interdependent. Nevertheless, the case of a famous local phenomenon, the toxic red tides of the Bay of Fundy, which spurred the paralytic shellfish poisoning program at the St. Andrews Biological Station in the 1920s, raises an interesting but perplexing challenge to Vetter's thesis. This phenomenon, familiar to Algonquin people from before European contact, was only known to occur in the Bay of Fundy. However, the organisms that cause paralytic shellfish poisoning and red tides began to be tracked in oceans world-wide by the 1960s, and today red tides are known to occur globally, albeit in restricted locations. Did this phenomenon only gain global recognition because of the original scientific studies from the Maritimes? Or is this an example of the spread of a harmful invasive species due to global shipping, that then required widespread scientific investigation? These questions will be addressed through a history of the growth of global paralytic shellfish poisoning research programs from their origins at the St. Andrews Biological Station.

### As Clover Killed the Fern: The History and Memory of 'Ecological Imperialism' in Aotearoa New Zealand

**Geoff Bil** University of British Columbia

While surveying in Aotearoa New Zealand in 1859, the German geologist Ferdinand von Hochstetter claimed to have heard a proverb, purportedly Māori in origin, that went as follows: "As clover killed the fern, and the European dog the Maori dog;

as the Maori rat was destroyed by the Pakeha rat, so our people also will be gradually supplanted and exterminated by the Europeans." The saying would prove enormously popular, circulating in numerous scientific and popular iterations by Joseph Dalton Hooker and others, and playing conspicuously into imperialist conceptions of Anglo-European racial destiny. Perhaps surprisingly, it has also proven attractive to contemporary scholars of environmental, scientific and imperial history, as evinced most notably by Alfred Crosby's formative work *Ecological Imperialism*. More remarkably still, no published works survive that call the Māori origin of this saying into question. This presentation contextualizes the imperial origin and circulation of Hochstetter's proverb in the prevailing biogeographical and ethnological discourses of the late nineteenth century. It also discusses the value-neutral fashion in which scholars have incorporated this troubled source material into their own analyses. I conclude by reflecting on the analytical utility of ecological imperialism for conceptualizing historical change, and on the importance of bringing indigenous perspectives to bear on colonial scientific and environmental history.

### Chasing Wildlife Films' Uncertain Impacts

**Eleanor Louson** York University

Wildlife films are among the most prominent source of public representations of nature, but no one knows what their precise impacts are on viewers. The historians, media scholars, and filmmakers interested in these potential impacts have focused on wildlife films' contribution to public knowledge about and expectations of wildlife, to cultural approaches to the relations between man and nature, and especially to public attitudes about conservation; however, this scholarship has not successfully demonstrated what those impacts are or disentangled them from other influences. I explore the difficulties in measuring these impacts using the case of Jean-Michel Cousteau's *Voyage to Kure*. Despite being credited with precipitating the establishment of the Papahānaumokuākea Marine National Monument in Northern Hawaii, close study reveals that instead a confluence of conditions was responsible. In a second case study, I examine Cynthia Moses' INCEF *Gorilla* film project, produced by and for local communities in central Africa. Because this film project was designed to measurably influence conservation attitudes, it offers an alternative, community-driven model for measuring impacts and experiences. These cases, drawn from diverse cultural settings, illustrate what Shapin calls the patchwork of embedded science in daily life (2016). I suggest that Halpern's approach to science communication as experience (2014) offers inroads to making audience's mundane experiences central to the study of wildlife film impacts.

Saturday  
13:30 - 15:00  
FN-1010

### SCIENTIFIC REALISM

Chair: **Greg Lusk** University of Chicago

#### Scientific Realism and Internal vs External Degrees of Truth

**Matthew Howery** University of Western Ontario

Scientific realism relies on the ability to classify scientific theories as approximately true. If, like Stathis Psillos, the scientific realist is going to rely on a notion of approximate truth that relies on the degree of idealization between some theory's model and the world, what standard can the realist use to separate those theories which are approximately true from those theories that are not approximately true? Further, under the realist notion of approximate truth, what is it for a theory to be false? Gustavo Cevolani and Gerhard Schurz (2017) offer an account of truth-likeness and approximate truth that I analyze in terms of satisfying the realist's notion of approximate truth and the ability to explain what it is for a theory to be false. Cevolani and Schurz propose that approximate truth is a function of the nearness of a theory's being true, while truth-likeness is a function of the nearness between a theory and the set of true statements of its domain. This proposal has several interesting entailments for the use of approximate truth in the support of scientific realism. I argue that although neither is sufficient to the task of scientific realism, they do clarify several questions the scientific realism must answer in formulating its claims.

#### Against Van Fraassen's Historical Defense of Constructive Empiricism

**Curtis Forbes and Noah Stemeroff** University of Toronto

Constructive empiricism claims that scientists consider a scientific theory complete so long as it is empirically adequate, i.e. if it accurately represents the actual, observable phenomena in its domain. By contrast, scientific realism claims that a scientific theory is only complete if it also *explains* how the actual, observable phenomena are produced by an underlying reality. Van Fraassen defends constructive empiricism historically, claiming that scientists recently began to consider empirically adequate theories perfectly acceptable. Specifically, the development and orthodox acceptance of the Copenhagen Interpretation of Quantum Mechanics shows "it is perfectly scientific, and scientifically acceptable, to reject the completeness criteria" that realists maintain constrain scientific theorizing (2004, p.803). For while Quantum Theory distinguishes between actual, observable phenomena (measurement outcomes) and an underlying reality (quantum states), the Copenhagen Interpretation treats it as entirely acceptable despite the fact that it provides no explanation of how the former are produced from the latter. However, this instrumentalist interpretation was developed and eventually portrayed as the "consensus" view expressly in order to sell the theory to the public (Beller 2001), for in the public sphere, scientific theories are primarily valued for their predictive rather than explanatory powers. Thus, despite deep disagreement amongst working scientists, the scientific community found it best to publicly promote Quantum Mechanics by suggesting the Copenhagen Interpretation was their orthodox view. So, *pace* van Fraassen, history shows the scientific community does not consider a merely empirically adequate theory complete, even if empirical adequacy may be the minimum requirement for completeness amongst non-scientists.

### What survives theory change

**Aaron Sidney Wright** Stanford University

Can scientific realism be reconciled with the history of science? Will we find that the luminiferous aether was different in kind than quantum fields as entities in scientific pictures of the world? This paper discusses one answer to these questions: structural realism (SR). The key insight, as developed by John Worrall, accepts that the aether and quantum fields are in fact similar, but that a scientific realism can be built around other things than entities, namely structures. Roughly, by structures, Worrall meant laws of nature as expressed mathematically. This paper challenges the dominant philosophy of laws of nature which accompanies contemporary structural realism: the deductive-nomological model of laws as “universal exceptionless generalizations.” Realists should, however, *not* use the DN model because true DN laws are unknowable, in principle. Therefore, there is no optimistic history of true DN laws to which a realist might appeal to counter a pessimistic interpretation of the history of science. Structural realists—such as Steven French and James Ladyman—who appeal to exceptionless generalizations cut the historical support from their own proposal. In place of DN laws, I propose SR adopt a *ceteris paribus* picture of laws of nature. I propose a modification of Nancy Cartwright’s *ceteris paribus* proposal which includes a historical dynamics of *ceteris paribus* clauses over time. I use Fresnel’s laws of optics as an example.

15:00 - 15:15  
FN-1008

COFFEE BREAK

Saturday  
15:15 - 16:45  
FN-1020

### EVIDENCE

Chair: **Kristine Palmieri** University of Chicago

#### What Was Perrin Really Doing?

**Robert Hudson** University of Saskatchewan

In the early 20<sup>th</sup> century, Jean Perrin performed experiments that successfully convinced the community of physicists at the time about the reality of atoms and molecules. These experiments and Perrin’s interpretive analysis of them are discussed in Perrin’s two monographs, *Brownian Movement and Molecular Reality* (1910) and *Atoms* (1916). A great deal has been written about this episode by philosophers attempting to understand why Perrin’s work was so profoundly convincing to the scientific community. My first goal in this paper is to survey various attempts by philosophers to reconstruct the special nature of Perrin’s reasoning. A very natural interpretation of Perrin sees him utilizing a ‘common cause argument’ (in Wesley Salmon’s *Scientific Explanation and the Causal Structure of the World*), or similarly an ‘argument from coincidence’ (in Nancy Cartwright’s *How the Laws of Physics Lie*), and most philosophers interpret Perrin to some extent along these lines. But such a reading, I argue, misleads us as regards the true nature Perrin’s contribution, which is the creation of what I call a ‘realistic model’ of molecular motion. After outlining the scientific basis to Perrin’s ‘realistic model’ and explaining how he uses it in defending the reality of atoms and molecules, I survey various alternative interpretations of Perrin’s reasoning and close by arguing that a ‘realistic model’ interpretation provides the best understanding of Perrin’s work.

#### Data and phenomena: Two challenges from the Epistemology of Measurement

**Greg Lusk** University of Chicago

Three decades ago, Bogen and Woodward (1988) defended an account of scientific reasoning where stable events or processes found in the physical world – what they called phenomena – were inferred bottom-up from data and empirical assumptions. Specifically, Bogen and Woodward denied that predictions, explanations, or derivations of data played any significant role in reasoning to phenomena. In a recent set of articles, Woodward (2010, 2011) has continued to defend this point, claiming that the data-phenomena-theory account of reasoning he and Bogen described has stood well against the test of time. In this paper, I raise two new objections to the data-phenomena theory account based on recent developments in the philosophy of measurement. First, I claim that model-based accounts of measurement developed by van Fraassen (2009) and especially Tal (2014), challenge Bogen and Woodward’s notion of data as non-inferential products of empirical inquiry. Second, model-based accounts suggest that successful measurement requires predictions of measurement readings in order to successfully produce data. Such an understanding of measurement would challenge Bogen and Woodward’s claim that predictions of data play no role in data-to-phenomena reasoning. To address these challenges, I suggest that the notion of data Bogen and Woodward employ needs to be revised.

#### The Method of Hypothesis in the 19th Century: Whewell, Mill, Herschel, Jevons, and Peirce on the Criterion of Consilience

**Klodian Coko** University of Western Ontario

The most important characteristic of the 19th century philosophical discussions on scientific methodology was the dynamic re-emergence of the *Method of Hypothesis*. 19th century philosophers - especially those who were sensitive to the complexities of scientific practice as demonstrated also by the study of the history of science - realized that traditional

scientific methodology, which regarded scientific inferences as inductive generalizations from empirical facts, could not accommodate the new scientific developments, especially those related to the study of unobservable entities (Laudan 1981). Amidst all the criteria for evaluating theoretical hypotheses about unobservable entities, the ability of a hypothesis to explain, successfully predict, and/or be supported by a variety of classes of empirical facts – especially facts that played no role in the initial formulation of the hypothesis – was considered the highest criterion of truthfulness. Support from different classes of facts was thought to give rise to a *no coincidence argument*. Namely, wouldn't it be a remarkable coincidence if a hypothesis (usually about unobservables) can accommodate such a variety of (usually observable) facts, and yet be false? This truthfulness criterion is found more explicitly in William Whewell's notion of the *Consilience of Inductions*, but it can also be encountered in the writings of other 19th century philosophers such as John Herschel, William Stanley Jevons, and Charles Sanders Peirce. It can even be found in the writings of the 19th century philosopher of Induction, John Stuart Mill (Whewell 1840, 1860; Mill 1843; Herschel 1830; Jevons 1874; Peirce 1878, c.1905). In this contribution, my aim is twofold. First, I will look at the Method of Hypothesis in the thought of Whewell, Mill, Herschel, Jevons, and Peirce. I will focus especially on the reasons they give for the epistemic force attributed to the *Consilience* criterion. That is, their response to the question: *why the ability of a hypothesis to explain different classes of facts should be considered (or should not, in the case of Mill) as a criterion for its truth?* Second, I will use the (surprising) conclusions to elucidate more recent philosophical discussions on scientific methodology. Namely, regarding the differences in structure and epistemic import between methodological strategies such as *Robustness* (understood as invariance of an experimental result to variations within the same experimental procedure), *Multiple Determination* or *Triangulation* (understood as the use of multiple, independent experimental procedures to establish the same local result), and *Variety of Evidence* (understood as the offering of multiple lines of evidence in favor of a general theoretical hypothesis).

Saturday  
15:15 - 16:45  
FN-1008

## BOOK PANEL WITH TARA ABRAHAM REBEL GENIUS: WARREN S. McCULLOCH'S TRANSDISCIPLINARY LIFE IN SCIENCE

Organizer and chair: **Vivien Hamilton** Harvey Mudd College

Author: **Tara Abraham** University of Guelph

Discussants:

**Delia Gavrus** University of Winnipeg

**Ernst Hamm** York University

**Vivien Hamilton** Harvey Mudd College

This book panel offers a chance to engage in conversation with Tara Abraham about her recently published book, *Rebel Genius: Warren S. McCulloch's Transdisciplinary Life in Science* (MIT Press, 2016). McCulloch was a central figure in American cybernetics in the mid-20th C, crossing multiple disciplinary boundaries as he drew on questions and methods in neurology, psychiatry, engineering and philosophy. Abraham's work provides a fascinating portrait of McCulloch's self-fashioning while illuminating key shifts in the mind and brain sciences during his lifetime. Even more, she asks us to think critically about models of transdisciplinarity, as well as the role of biography in the history of science. Panelists will offer their reactions to *Rebel Genius* and Dr. Abraham will respond to those comments before opening up the conversation to all attendees.

Saturday  
15:15 - 16:45  
FN-1010

## STRUCTURALISM, UNDERDETERMINATION AND SCEPTICISM

Chair: **Sinan Sencan** University of Calgary

### Empirical Underdetermination, Scepticism and Van Fraassen

**Dan Goldstick** University of Toronto

Bas van Fraassen says, "... there is no purely epistemic warrant for going beyond our experience." That is unsurprising since, if inductive skepticism is to be rejected, and a finite body of observational evidence in hand can suffice sometimes to render probable one out of a plurality of conflicting hypotheses alike *consistent* with that evidence, the unlimited body of all the relevant measurements which it would be possible to make through the past, present and future could then hardly fail to favor any single one of the competing hypotheses (if only a disjunctive one) as against its logically conflicting rivals. However, aside from inductive skepticism, van Fraassen offers two seemingly independent arguments for his underdeterminationism. On the one hand, he argues that his "constructive empiricism" offers a *middle course* between the two extreme positions: "science aims to give us true theories" and "science aims to give us theories which are true in what they say about what is being observed right now". On the other hand, contrary to those who say true theories are the way to get correct predictions, van Fraassen says the reverse: "... we can have evidence for the truth of a theory only via evidential support for its empirical adequacy" – its consistency with the observational results of making all possible measurements.

## Neo-Kantianism and Structural Realism: From a Skeptical Point of View

**Lydia Patton** Virginia Tech

There is a significant difference between epistemic structural realism in philosophy of science and the mathematical structuralism of Ernst Cassirer and Richard Dedekind. Epistemic structural realists tend to argue from the persistence or modal robustness of structure across scientific theories or domains. For instance, the equations of Lagrangian dynamics persist in electrodynamic theories despite the abandonment of the ether. In contrast, mathematical structuralists, whether methodological, set theoretic, or ante rem, tend to argue from the depth of mathematical structures to a demonstration of those structures' existence. Mathematical structuralism allows for a neo-Kantian approach, on which proofs using mathematical structures allow for a demonstration of the mathematical existence of those structures, a Kantian a priori exposition. Epistemic structural realism, on the other hand, appeals to Putnam's inference to the best explanation: structures would not persist if they did no work in the theory, so the theories must be about the structures. Setting aside ontic SR for the moment, this inference to the best explanation is not enough to make ESR a Kantian theory: ESR does not require an a priori definition or exposition of the structures, or concepts, under discussion. This paper will examine Dedekind, Cassirer, and Hilbert, and recent work by Reck, Yap, Heis, Sieg, and Schiemer, to develop criteria for a rigorous neo-Kantian approach to structuralism. The paper will conclude with an argument that ESR in the philosophy of science would benefit from a critical approach based on historical work on neo-Kantian theories of mathematical structuralism.

## Epsilon, Indeterminacy, and Structuralism

**David DeVidi** University of Waterloo

Recently there has been a revival of interest in Hilbert's epsilon operator, as witnessed by conferences and special issues of journals devoted to it. It includes a resurgence of interest in its applications in philosophy of science and mathematics. Norbert Gratzl and Georg Schiemer have recently offered interesting reconsiderations of Carnap's reconstruction of the theoretical content of scientific theories in terms of the epsilon operator. They suggest that carefully attending to the nature of the *indeterminate reference* of epsilon terms allows us to clarify the sense in which authors like Demopoulos, Psillos and Friedman are right to suggest that Carnap's proposal generates an appealing sort of scientific structuralism. In doing so they interestingly contrast epsilon's "Hilbertian" indeterminacy and "Russellian" indeterminacy. The distinctions they draw are interesting, but they within an extensional, classical logic setting. Other research on epsilon shows that this context papers over many philosophically interesting distinctions. In this talk I will look at these sorts of indeterminacy in the setting of constructive rather than classical logic. This considerably clarifies the relationship between those sorts of indeterminacy, reveals additional options, and has implications for the correct understanding of structuralism.

16:45 - 17:00  
LC Auditorium

COFFEE BREAK

Saturday  
17:00 - 18:30  
LC Auditorium

## INTERNATIONAL KEYNOTE SPEAKER

### ABOUT METHOD

**Jutta Schickore** Indiana University Bloomington

The talk will discuss how researchers in the 19th century conceptualized experimental practice, what rules for proper experimental procedure they endorsed, and in particular, how they thought about causes, uncertainties, complexity, and variability in experimentation. The focus will be on the life sciences (agriculture, plant nutrition, bacteriology).

*This talk is made possible in part thanks to the International Keynote Speaker Support Fund of the Canadian Federation for the Humanities and Social Sciences (CFHSS) / Cette session est rendue possible grâce au support financier du Fonds de soutien des conférenciers internationaux de marque de la FCSH.*

## SUNDAY MAY 27

Sunday  
8:45 - 10:15  
FN-3305

## PHILOSOPHY OF BIOLOGY II

Chair: **Valérie Lynn Therrien** University of Western Ontario

### Is this pluralism? Diversity in biological explanations of behavior

**Eric Muszynski** Université du Québec à Montréal

In the last decades, pluralism has been adopted by many philosophers as relates to scientific explanations in biology. Yet there are many different kinds of pluralisms, each with particular considerations regarding the way scientific explanations

are expected to interact. Various classifications of pluralisms have been proposed, which emphasize different aspects of the plurality (c.f. Longino, 2013; Mitchell, 2004; Van Bouwel 2014). I propose a new tripartite classification which focuses primarily on what the pluralism is meant to apply to. First is “type pluralism”, which claims that there are many types of explanations. The second is “fragmentation pluralism”, which relates to the idea that certain explanations will be impossible to integrate one with the other. The third is “competition pluralism”, which argues that explanations can compete as relates to a given phenomenon, and that the competition can be permanent and non-problematic. This classification has the benefit of clarifying many positions in the literature by making explicit what is at stake. I finish by arguing that some of the strongest forms of pluralism—namely competition pluralism—are not reflected in current practice in biology, and that the philosophical arguments put forward do not justify such a pluralist position.

## Analyse de la construction de l'ethos et de l'identité des collectifs de biohacking

**Guillaume Bagnolini** Centre d'éthique contemporaine

Les nanotechnologies, les OGM, les cellules souches, les technologies que l'on connaît sous l'acronyme des NBIC : nanotechnologies, biotechnologies, nouvelles technologies de l'information et de la communication, sciences cognitives, et du complexe BANG: bits, atomes, neurones, gènes, ou technologies dites convergentes sont autant de mutations techniques qui touchent nos sociétés. Suite au développement de ces techniques, un certain nombre de visions du futur voient le jour. Elles sont potentiellement performative et créatrice de controverses (Chateauraynaud et al., 2012). Parallèlement à ce mouvement, il va émerger les premières critiques fortes contre l'expertise scientifique et la volonté des citoyens non spécialistes de participer aux choix techno-scientifiques. Les sciences citoyennes, la recherche communautaire, les débats publics vont se développer. Cependant, cette participation est jugée insuffisante et non pertinente pour un grand nombre d'acteurs. C'est le cas des biohackers. Ce mouvement est une critique vive contre les institutions officielles et un appel à plus de liberté à travers notamment la constitution de laboratoires citoyens « indépendants ». En effet, la politique des institutions scientifiques est remise en question notamment sur la commercialisation du savoir. Dans cette communication, nous présenterons un historique du mouvement et en se basant sur des entretiens réalisés entre 2015 et 2017, nous tracerons le portrait des biohackers qui à travers une diversité sociale importante convergent vers des valeurs partagées. Dans un second temps, nous présenterons nos analyses sur le contrôle social de la construction d'un *ethos* et d'une identité de certains laboratoires citoyens.

## Épigénétique : Au-delà de l'opposition nature-culture

**Guillaume Pelletier** University of Laval

L'épigénétique désigne généralement la façon dont l'expression des gènes est modulée par certains facteurs n'altérant pas le code génétique lui-même. Certaines modifications chimiques, principalement l'ajout d'un groupement méthyle à l'ADN, conduiront par exemple à la désactivation de certains gènes, pouvant mener à des différences phénotypiques significatives (Jablonka et Lamb, 2005). Suivant l'engouement général pour ces phénomènes, plusieurs travaux de vulgarisation et discours médiatiques ont récemment eu tendance à présenter l'épigénétique comme un renversement complet du déterminisme génétique. Il s'ensuivrait que les individus ne seraient pas ce qu'ils sont sur le plan biologique en fonction de leurs gènes, mais plutôt en fonction de leurs choix, de leur éducation ou de leur style de vie. Cette communication a pour but d'offrir la clarification épistémologique qui s'impose, en situant notre compréhension actuelle de l'épigénétique par rapport à plusieurs de ses représentations et en insistant sur l'importance de ne pas écarter le dynamisme de ces phénomènes. Les recherches en épigénétique, malgré plusieurs controverses scientifiques, tendent en effet aujourd'hui à réorganiser notre façon de concevoir les interactions gènes-environnement et sont susceptibles par le fait même de remettre en question la validité d'un clivage strict entre nature et culture (Keller, 2010; Stotz et Griffiths, 2016). Une telle clarification est essentielle selon nous afin de lever certaines des difficultés relatives à la compréhension générale des recherches en épigénétique ainsi qu'à leur application éventuelle hors du champ scientifique.

Sunday  
8:45 - 10:15  
FN-2007

## BOOK PANEL WITH TERENCE KEEL HOW CHRISTIAN THOUGHT BECAME RACIAL SCIENCE

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

Author: **Terence Keel** University of California

Discussants:

**Jaipreet Virdi** University of Delaware

**Ernst Hamm** York University

**Elizabeth Neswald** Brock University

**Yiftach Fehige** University of Toronto

Terence Keel comes to Regina from the University of California, Santa Barbara, where he serves as an Associate Professor and Vice Chair to the Department of History. Terence is an interdisciplinary scholar with training in religious studies, the history of science, African American history, as well as science and technology studies. The interdisciplinary nature of his inspiring scholarship is well reflected in his book that we will have the privilege to discuss with him in person, namely his "Divine Variations: How Christian Thought Became Racial Science." The book panel will present a wonderful opportunity to discuss with Terence the central thesis of his essay: "racial science" from the beginning in the work of Johann Blumenbach

to current work on the humanity of the Neanderthals greatly undermines the idea that Christianity has lost its influence over scientific thought at the end of the 19th century.

Sunday  
8:45 - 10:15  
FN-3304

## SOCIAL EPISTEMOLOGY II

Chair: **Brian Hanley** University of Calgary

### Influence from Within or Influence from Without: Mutually Exclusive Strategies for Scientists to Impact Policy?

**Garrett Richards** University of Saskatchewan

Except perhaps when doing the most basic of research, scientists often imagine that their work will have some positive social impact on society. In particular, scientists from the disciplines of biology, geography, and environmental science may hope that their findings will influence policy decisions for the better. This motivation is extremely important but is sometimes a little naïve. The policy process is very complex, and influencing it is not as simple as writing and sharing a new article, report, or brief. This presentation first draws upon scholarship in the field of science and technology studies to critique the traditional tendency of researchers to assume (at least intuitively if not consciously) that policy makers will be swayed by scientific evidence. It then draws upon case studies of climate science–policy partnerships in BC to suggest possible modes of influence in spite of the chaos and inflexibility of the policy process. There are two basic approaches that can be taken by a scientist individual, team, or organization: the first is soft, conciliatory, and accommodating of policy maker perspectives, while the second is hard, radical, and openly critical of government. My research suggests that the former (influence from within) is possible but leads primarily to side benefits and incremental long-term impact. The latter (influence from without) is risky and destroys any opportunities for future partnership but may be necessary for certain pressing issues.

### Assessing the Epistemic Reliability of Science Experts on the Internet: A Case Study in Reddit's r/Science

**Devon Moriarty** University of Waterloo

As one of the most popular subreddits on Reddit.com, r/science - or as it is more formally known, "The New Reddit Journal of Science" - boasts nearly 18 million subscribers. The consistent recruitment of established and reputable science scholars willing to host Ask-Me-Anything sessions (AMAs) to discuss their peer-reviewed research, paired with an ever-engaged audience, which actively participates in these virtual question and answer discussions, makes r/science an important site of study for Science Communication, the Philosophy of Science, and the Rhetoric of Science. However, it remains conspicuously absent in emerging scholarship from these disciplines that have otherwise been attuned to how the Internet is changing the way science is communicated and scientific expertise is constructed.

Operating in the field of social epistemology, I use the concept of *epistemic deference*, "the ability to trust external sources of information to form new beliefs" (Taraborelli 1), to guide my examination of how reddit-users (redditors) are persuaded to acknowledge r/science AMA hosts as credible and adopt a deferential stance towards their scientific claims in an environment comprised of experts, non-experts, partial experts, and faux experts. I argue that the actions of r/science moderators' paired with the Reddit architecture—notably voting affordances and sorting algorithms—encourage redditors to adopt particular heuristic strategies for evaluating the epistemic reliability of the AMA hosts that lessen the cognitive load on redditors. Redditors are then able to, with high confidence, assume the trustworthiness of the AMA host, and then defer to their scientific expertise.

### Externality, Pollution, and Economic Policy

**Rebecca Livernois** University of British Columbia

Economic policy is often used to address environmental problems, yet the underlying concept of externality that grounds this policy is problematic. An externality is generally understood as an unpriced spillover effect from production or consumption decisions. A carbon tax, for example, is set at the size of the externality caused by pollution, thus eliminating the externality. It is unclear, however, which spillover effects constitute an externality, especially given that unpriced spillover effects exist everywhere in the social world. Consequently, it is unclear which costs of pollution should be quantified in estimating the externality and the associated tax rate. Lagueux (2010) and Berta and Bertrand (2014) argue that externality is a residual concept; externality is that which is not the market. Hausman (1992) and Claassen (2016) instead understand policy-relevant externalities as unintended and unpriced effects that cause harm. I argue that these accounts do not sufficiently capture what economists mean when they use 'externality' to explain market failure and policies that correct the failure. Instead, externality refers to a specific type of cost or benefit that pertains to resource allocation decisions. Through analyzing cases of market success, I show that externality concerns efficiency loss when a good is traded in a market. I argue that understanding the concept of externality clarifies which costs of climate change need to be quantified in setting the carbon tax rate, according to economic theory. Importantly, a carbon tax cannot accommodate all types of harm caused by climate change; it can only lead to efficient markets.

10:15 - 10:30  
FN-2007 and  
FN-3305

## COFFEE BREAK

Sunday  
10:30 - 12:00  
FN-3305

## PHILOSOPHY OF PHYSICS I

Chair: **Thomas De Saegher** University of Western Ontario

### Comparative Structure

**Isaac Wilhelm** Rutgers University

The following principle represents a popular approach to comparing the structures of spacetime theories. **SUBSET**: let  $X$  and  $Y$  be mathematical objects (e.g., spacetime theories) and let  $A(X)$  and  $A(Y)$  be their sets of automorphisms. If  $X$  has at least as much structure as  $Y$ , then  $A(X)$  is a subset of  $A(Y)$  (Barrett, 2015; North, 2009). The idea behind **SUBSET** is that automorphisms are structure-preserving maps. So, the more automorphisms an object has, the less structure it has to be preserved. I argue that **SUBSET** is not the proper way to compare the structures of even the simplest of mathematical objects. An example illustrates the problem. Let  $P = \{0, 1\}$ . Define the binary operation  $+$ , which acts on  $P$ , as addition modulo 2. Let  $Q = \{r, s\}$ . Define the binary operation  $*$ , which acts on  $Q$ , such that  $r$  is the identity element and  $s$  is a generator (that is,  $r * x = x$  for any  $x$  in  $Q$ , and  $s * s = r$ ). Then  $P$  and  $Q$  are isomorphic, so intuitively, they have the same structure. But since  $A(P)$  contains functions on numbers and  $A(Q)$  contains functions on letters, neither is a subset of the other. Therefore, according to **SUBSET**, they are incomparable. Because of examples like these, I advocate a different principle for comparing structure. **SUBGROUP**: let  $X$  and  $Y$  be mathematical objects and let  $\text{Aut}(X)$  and  $\text{Aut}(Y)$  be their automorphism groups.  $X$  has at least as much structure as  $Y$  if and only if  $\text{Aut}(X)$  is isomorphic to a subgroup of  $\text{Aut}(Y)$ .

### The Status of Classical Physics in Contemporary Science

**Markus Aliik Saar** University of Toronto

According to taxonomy of epistemic stances suggested by Barseghyan (2015), a scientific theory can be *accepted* as the best available description of its domain, *used* in practical applications, and/or *pursued* further. Thus, general relativity (GR) is said to be accepted nowadays as the best available description of its domain. While many currently accepted theories are also *used* in practical applications, there are also theories that are *used* in practical applications without being accepted; Newtonian Mechanics (NM) is believed to be one such theory. This paper argues that the portrayal of NM as merely used but no longer accepted is too simplistic. To appreciate this, I consider the current status of *meteorology*. On the one hand, modern meteorological theory is accepted as the best available description of atmospheric phenomena. On the other hand, meteorology is founded on classical theories, including NM, which are arguably no longer accepted. This apparent paradox can be resolved by applying the distinction between a theory's *ontology* and its *phenomenological laws*. I argue that the phenomenological laws of meteorology are accepted by the scientific community, while the classical *ontology* implicit in the current meteorological theory is not accepted. Thus, the modern meteorological theory can be said to be accepted only as the best available description of the *observable* meteorological phenomena even though its ontology is no longer accepted.

### Philosophy's Epistemic Progress and the Scientific Ideal

**Dustin Olson** University of Regina

"Philosophy...has made greater claims, and achieved fewer results, than any other branch of learning." So opens Bertrand Russell's 1914 *Our Knowledge of the External World*. Such sentiments persist 100 years on. Recent works by epistemologists Hillary Kornblith and Sandy Goldberg, e.g., contend that we shouldn't believe any philosophical claims. Their reasons for this skepticism hinge on the lack of progress in philosophy. The persistence of systematic disagreements over longstanding philosophical problems with no foreseeable resolution serves as evidence for this lack of progress. Contrast this phenomena with science and we purportedly find no such stagnation. In response to the above argument, I offer the following. Concerning the claim that a lack of consensus is evidence of a lack of epistemic progress in a specific discipline, we find that science is often as susceptible as philosophy to this challenge—I use *gravity* in physics as one such example. Accepting the analogue between science and philosophy given this challenge, on pain of inconsistency we should conclude that science doesn't make epistemic progress. Of course, this conclusion is absurd. So, again on pain of inconsistency, we should conclude that philosophy does make progress. I contend that the central mistake in the above skeptical argument is a misconception of epistemic progress. Such progress involves more than simply producing theories garnering consensus. Epistemic progress is also evidenced when we better understand a target concept, its application, where further investigation is needed, and what no longer works or isn't needed for one's theory.



Sunday  
10:30 - 12:00  
FN-2007

## ARCHEOLOGY AND CONTEMPORARY TECHNOLOGY

Chair: **Erich Weidenhammer** University of Toronto

### The archaeology of geophysics: Collecting the history of radiometric dating

**Erich Weidenhammer** University of Toronto

In 2015, the University of Toronto Scientific Instruments Collection (UTSIC.org) was given the opportunity to gather artefacts from a decommissioned laboratory that had, since the 1960s, been the leading centre in developing potassium-argon (K-Ar) radioisotope dating techniques. Two years later, the UTSIC collections space was moved to the subbasement of the McLennan Physical Laboratories building. This space had, from 1982 to 2013, housed the IsoTrace tandem accelerator laboratory that had carried out pioneering work on the development of Accelerator Mass Spectrometry (AMS) used in Carbon 14 dating. The process of clearing the subbasement space has uncovered numerous artefacts that are now being added to the collection and catalogue. The nearly simultaneous disappearance of these two world-class facilities, which had flourished within the same building, has attracted little notice. This paper argues that the process of researching and catalogue this material—the material culture of recent science—has been a means to uncover historical stories of local, national, and international importance. It explores movement artefacts to trace the development of knowledge and technical skills among an international network of laboratories as well as geological and archaeological projects. Finally, it discusses the interesting parallels that emerge when using the archaeology of scientific artefacts to explore scientific endeavours dedicated to sampling the natural world and human prehistory.

### Reaching the Shore: Three Waves of Computer Simulations in Archaeology since the 1960s

**Fan Zhang** University of Toronto

Can computer simulations find wide applications in archaeology as they have in many other disciplines? For the better part of the past few decades the question has been lingering on the margin of archaeology. In the 1970s and 1990s, simulative methods briefly enjoyed broader acceptance among archaeologists who used computer-constructed models to test hypotheses on settlement patterns, population growth and other phenomenon based on statistical sampling of archaeological remains. Such enthusiasm failed to arouse sustained and widespread interest until recently with archaeologists' adoption of emerging digital technologies and techniques from virtual reality, 3-D printing to agent-based modeling methods. A revolutionary new age for archaeological simulations is predicted. My research responds to this prediction. The primary objective of my paper is to examine the two earlier traditions of computer simulations in archaeology in order to explore the conditions for its future success. Specifically, I will explore the possibility that archaeology's reluctant acceptance of computer simulations in the past was a result of insufficient engagement of simulative methods with theory building. The computer modeling and simulation were envisioned as mere scientific techniques and tools but were ineffectively contextualized to answer specific questions important to emerging archaeological interpretations and theorization, which in turn hindered their reception by a wider community of archaeologists beyond simulation enthusiasts. The significance of new simulative technologies and techniques, I suggest, lies in their ability to bridge a scientific archaeology and a value-laden interpretative archaeology.

### Inside the Instrument: Cave Markings of the Late 20th Century

**Victoria Fisher** University of Toronto

When the IsoTrace accelerated mass spectroscopy project at the University of Toronto moved to Ottawa, a large amount of material was left behind in the space the project, and earlier projects, had occupied—the lab instruments and detritus, documents, and infrastructure of fifty years of experimental work. Some of these material traces are easily saved: important documents can be archived, and small artifacts retained in a collection. But what about the space itself? In many cases, particularly in active universities, this is quickly stripped of the internal organisation and character of the science and scientists who occupied it and freshly remodeled for new occupants. Often, only the exterior of the building ultimately survives intact (Sumner 2013). The space that housed the IsoTrace project has a different story. Located in a basement space originally designed to house a larger linear accelerator, it has not been swiftly reoccupied. Instead, the transition of the project to its new home was gradual, and not only has the space retained the general architectural design of the earlier and later projects, many superficial traces—hand-written signs, personal items, damage—have survived long past active occupancy of the lab. My paper will examine the historical contribution of such features through photographs taken during the lab's long transition period and subsequent abandonment. It will argue that these often-erased ephemeral, structural and 'character' traces are an important component of the material culture of a laboratory and deserve deliberate preservation alongside the instruments and documents of the places of science.

Sunday  
10:30 - 12:00  
FN-3304

## INDIVIDUALS AND ELEMENTS IN ECOLOGY AND EVOLUTION

Chair: **Katherine Valde** Boston University

### Bateson on characters, genes, and species as theoretical Elements

**Aleta Quinn** University of Idaho

I argue that William Bateson's analogies between the units of genetics and chemical elements are best understood as analogies to theoretical entities in the history and practice of chemistry. Bateson did not intend that the units of heredity answer to material units that behave in ways analogous to material atoms. His point was that biologists of his day should postulate a theoretical entity, basic to the science as elements once were to chemistry. Bateson matter-of-factly asserted that species fixity was first established as a scientific hypothesis in the eighteenth century and took this hypothesis to be an important scientific advance. Bateson's readers would neither have been surprised at, nor skeptical of, these claims. I demonstrate via history of biology texts written in the early twentieth century that straightforwardly report that Linnaeus' two most important contributions to biology were binomial nomenclature and the concept of fixed species. Chemical elements were reinterpreted during Bateson's lifetime and replaced by electrons, neutrons, and protons as basic units, recognizing that elements can in fact transmute. Comparing characters, genes, and species to chemical elements predicted that scientific progress would be made by positing theoretical entities that would later be revised within a new theoretical framework.

### An account of pregnancy in the light of process ontology

**Hannah O'Riain** University of Calgary

Pregnancy is a largely neglected but useful case study for views concerning biological individuality. Existing accounts use substance ontology to define the conceptus as a separate individual (Smith and Brogaard 2003), or as part of its host (Kingma 2018, forthcoming). I argue these accounts are unsatisfactory because they must distort physiology, or do not address important questions, in order to provide a definitive ontology. John Dupré (2014) criticizes both substance-based conceptions of organisms and monist ontology. In this paper, I apply Dupré's critiques to pregnancy. I argue that pluralist ontologies, along with a process-based conception of organismality, better capture pregnancy. Using Dupré's account, I resolve several difficulties that substance-based views of individuality encounter in cases of pregnancy. First, I discuss how there are not clear boundaries between the conceptus and pregnant organism: pregnancy is a complex, intertwined relationship of biological processes. Second, in line with a pluralist ontological account, different ways of conceiving the ontology of the conceptus and gestating organism should be analyzed with respect to their usefulness (or harmfulness). For example, certain culturally predominant ontologies that identify the fetus as an independent individual can be harmful. I conclude that individuality of pregnancy can be approached pluralistically, and accounts should be assessed according to both their usefulness in achieving a certain purpose and the likelihood of harm.

12:15 - 13:15

LUNCH BREAK

Sunday  
13:30 - 15:00  
FN-2007

## SPECIAL PANEL: SCIENCE AND INDIGENOUS WAYS OF KNOWING: SYNERGIES OR SOLITUDES?

Organizer and chair: **Lesley Cormack** University of Alberta

Panelists:

**Kim TallBear** University of Alberta

**Andrew Reynolds** Cape Breton University

**Gordon McQuat** University of King's College

**Theodore Binnema** University of Northern British Columbia

Traditional Ecological Knowledge (TEK, and its variant titles) has long been cited as existing in some sense alongside 'western' or 'European' traditions of 'science' as a source of knowledge that is independent of, distinct from and even opposed to 'science'; the use of the term 'system' to describe either is commonly used (rightly or wrongly) to mark their distinctness. At the same time, TEK is now generally acknowledged as deserving and requiring an equivalent standing in what have otherwise been largely science-based processes of adjudication and management across a broad array of contexts (e.g. medical, environmental, judicial). Characterizing the nature of the boundaries and relations between these two 'systems' is an epistemic challenge with both theoretical and practical dimensions. A seemingly intractable diversity of approaches for dealing with this challenge have ranged from synergistic, co-learning approaches, to bridging strategies, to fierce declarations of the necessary maintenance of independence and solitude between the two 'systems.' Given Canada's post-colonial context, dominated by the recent findings of the Truth and Reconciliation Commission of Canada (TRC) and Canada's commitments to the UN Declaration of the Rights of Indigenous Peoples, the epistemic challenge carries a political urgency.

This panel draws on expertise within both First Nations and non-First Nations scholarly communities in speaking to this challenge. In particular, the fields of STS and HPS have important contributions to make, not least in helping to open up

characterizations of 'science' that can be of use for the broader epistemic challenge described above. A perspective from India will also be included to allow for an international perspective with a very different post-colonial context.

*Joint session with the Canadian Philosophical Association / Session conjointe avec la Société canadienne de philosophie. This panel is made possible in part thanks to the Aid for Interdisciplinary Sessions Fund 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.*

Sunday  
13:30 - 15:00  
FN-3304

## ARISTOTLE

Chair: **Christopher Byrne** St. Francis Xavier University

### The Continuity of Life and Mind in Plato's and Aristotle's Concepts of *Psuchē*

**Zacharia A. Neemeh** University of Memphis

The continuity thesis of life and mind states "the organic even in its lowest forms prefigures mind, and...mind even on its highest reaches remains part of the organic" (Jonas, 1966/2001, p. 1). In ancient Greek thought, "*psuchē*" or soul has a dual valence referring to both biological and psychological phenomena. However, many comparative studies in the ancient philosophy of mind ignore the soul's biological properties and exclusively focus on its psychological aspects. In this paper, I argue this exclusionary approach is mistaken because Plato and Aristotle both express forms of the continuity thesis. First, I discuss three distinct formulations of the continuity thesis: weak, strong, and deep (Godfrey-Smith, 1996; Thompson, 2007). Weak continuity posits that all cognition is a function of living systems, but not all living systems are cognitive. Strong continuity posits that all living systems are cognitive systems, and *vice versa*. Deep continuity adds to strong continuity a commitment to the continuity of affect and consciousness. Focusing on Plato's discussion of plants in the *Timaeus*, I show he implicitly held a deep continuity thesis. Elements of both cognition and affectivity, such as desire, memory, and sensation, permeate all living systems including plants. Focusing on *De Anima*, I then demonstrate that Aristotle implicitly held a weak continuity thesis. For Aristotle, mind is mostly continuous with life, but not all life is minded. Because both Plato and Aristotle hold versions of the continuity thesis, the biological aspects of the soul cannot be abstracted away from its psychological aspects.

### A Cheap Nature? Aristotle on the Many Functions of the Heart

**Adam Woodcox** University of Western Ontario

In *Parts of Animals* 4.6, Aristotle expresses his commitment to monotelism – the principle that nature will whenever possible assign a single use or function to each organ. In this way nature acts for the best instead of assigning several functions to an instrument 'like a coppersmith who for cheapness makes a spit-and-lamp-holder-in-one (ὄβελισκολύχνιον)' (683a25). However, throughout his biological works Aristotle also commits himself to a kind of cardiocentrism, locating the source or ἀρχή of the various soul-functions in the heart. For instance, the heart is identified as the source of growth and nutrition (*De iuv.* 2-4), locomotion (*MA* 10), and sensation (*PA* 3.4). There is a *prima facie* conflict between Aristotle's cardiocentrism and the principle that each organ ought to have one function: by locating the source of the various soul-functions in the heart, it seems that nature acts 'for cheapness', making the heart like the ὄβελισκολύχνιον. This paper addresses the conflict between Aristotle's cardiocentrism and his monotelism. I argue that Aristotle is led to view the heart as a multi-functional organ because nature is constrained by certain principles about unity and centrality, specifically that it is better for something to have a single source rather than many, and that it is better for this source to be located in the center of the organism.

15:00 - 15:15  
CM Aud.

COFFEE BREAK

Sunday  
15:15 - 16:45  
CM Aud.

## DRAKE LECTURE

### How Genetics Succeeds: An Account of Scientific Investigation

**C. Kenneth Waters** University of Calgary

Historians, philosophers, journalists and scientists often assume that investigation in mature science advances by using fundamental theories to explain more and more phenomena. For example, many assume that genetics is based on the discovery that genes are the fundamental actors behind biological processes, and that geneticists are now working out exactly how they direct (or misdirect) those processes.

Waters will use the example of genetics to illustrate a different account. On his account, scientists do not have a fundamental understanding of complex phenomena such as biological development. What they have are effective strategies for intervening on complex biological processes, which enables them to learn

about these processes in a partial and piecemeal fashion. He will conclude with the suggestion that interpreting scientific knowledge in the context of investigation (as illustrated in his talk) offers society a better perspective for understanding both the successes and the limitations of science.

Sunday  
17:00 – 19:00  
CK 122

## PRESIDENT'S RECEPTION

## MONDAY MAY 28

Monday  
8:45 - 10:15  
FN-1016

### PHILOSOPHY OF PHYSICS II

Chair: **Markus Aliksaar** University of Toronto

#### The Dynamics of Entangled States

**Kent Peacock** University of Lethbridge

Current orthodoxy holds that entangled states in quantum mechanics violate kinematic locality (a fact which is demonstrated by the experimental confirmations of Bell's Theorem) but satisfy dynamic locality, which can be expressed as the claim that the Hamiltonians of entangled states are additive. Additivity means that the Hamiltonian for an entangled state would be simply the sum of the Hamiltonians for each particle considered separately, as if the state were actually a product state. This additivity assumption is the basis of certain widely cited "no-signalling" proofs, and it is also an essential assumption in local quantum field theory. I show that on a *prima facie* reading of our current understanding of entanglement, the assumption that a separate Hamiltonian can be associated with each member of an entangled pair leads directly to a contradiction. The argument turns on what we are to mean by saying that a particle "has" a Hamiltonian. On the most straightforward reading, it implies that each particle in an entangled pair has a state that can be expanded as a sum over eigenstates of its suppositious Hamiltonian; such a state would be a pure state, which is impossible if the particles are in genuinely entangled. If this argument is correct, it has challenging implications for the widely-accepted notion of the "peaceful coexistence" of quantum mechanics and relativity. I cite an early argument by Pauli (1933) to the effect that additivity of the system Hamiltonian "corresponds" to the system being in a product state, and discuss the implications of this question for foundations of quantum mechanics.

#### Dynamical Variables and the Structure of Realist Interpretations of Quantum Mechanics

**Thomas De Saegher** University of Western Ontario

I consider an abstract characterization of standard realist strategies for solving the measurement problem in terms of the ways they treat dynamical variables – elements in the  $C^*$  algebra used to construct states. On one side of the spectrum, specific dynamical variables from particular quantum theories are ineliminable to the strategy's account of determinate outcomes (this is true of collapse theories and Bohm type theories), while, at the other end, the interpretive strategy is applicable to any instantiation of the basic framework of quantum mechanics (this is true of modal interpretations and the modern Everettian interpretation). I then formulate general constraints on these strategies that follow from arguments concerning the sorts of propositions that can be associated with dynamical variables in various instantiations of the quantum framework (these include arguments found in Stein (1972, 1982) and Demopoulos (2010, 2012)). The space of possible realist theories structured this way will then suggest two valuable observations: 1) there is an under investigated subset of realist strategies to the measurement problem that seem better motivated in this framework than the standardly discussed ones, and 2) interpretations employing this class of strategies would not satisfy a common conception of what it means to interpret modern theories of physics, where we start with kinematic and dynamic constraints and look for ontology satisfying their symmetries (Caulton (2015), Curiel (2016) and Dewar (2017)). Such observations suggest the need to formulate a different conception of the task of interpretation satisfied by these strategies, which I briefly sketch.

Monday  
8:45 - 10:15  
FN-1011

## PILLARS OF THE EARTH: HISTORY AND PHILOSOPHY OF SCIENCE AND RELIGION

Chair: **Anthony Nairn** University of Toronto

### Science in Islam: Sir Syed the nechari (naturalist)

**Sarah Qidwai** University of Toronto

In 1848, Sir Syed Ahmad Khan (1817-1898) published an article in Urdu, *Firm Assertions with Regards to the False Motion of the Earth*, in India arguing that the Earth did not revolve around the Sun. By 1865 at the latest, he had shifted his position on the topic and attempted to prove why accepting a heliocentric worldview was not against the Qur'an. With a focus on Sir Syed's arguments in his religious commentary, *The Muhammadan Commentary on The Holy Bible (Tabyin-ul-Kalam)*, published in 1865, this paper investigates the changes in Sir Syed's perspective regarding the motion of Earth and the religious implications of his new perspective. *The Commentary* itself is an analysis of the Old and New Testament from the perspective of a Muslim, with references to verses in the Qur'an. In this text he outlined his views on how accepting heliocentrism was not against the Qur'an, but a result of individuals linking geocentrism to it.

Overall, it is hard to make sense of why someone defended geocentrism in the nineteenth century without careful considerations regarding the implications of scientific theories to religious, in this case Islam, beliefs. I argue that Sir Syed presents a relationship between scientific theories and the Qur'an that demonstrate a sense of harmony between the two, but is still closely tied to Islam. Therefore, this is not really about science and religion, but a discussion of the role of science IN religion.

### "Those are some of the things that molecules do, given four billion years of evolution.": Does Cosmos Enchant Science?

**Anthony Nairn** University of Toronto

In the fall of 1980, Carl Sagan took television viewers on a "personal voyage" through the Cosmos. It was the first time that science was educated personally and profoundly, with a message of meaning, purpose, and hope, descending from knowing the Cosmos. In 2014, Neil deGrasse Tyson 'captained' the Ship of the Imagination, updating and retelling the story that is of our discovery of the Cosmos and ourselves — connecting all the creations of the Universe together. Academia is now showing interest in this 'grand cosmic narrative', with disciplines like Big History and Religion and Ecology out of Yale, using this cohesive narrative of the Universe for educational purposes, using the relationship between the Universe and life to us, to promote the stewardship of Earth. The methodology of the *Cosmos* series to portray science both very personally and highly profoundly was exceedingly unique, but it is the message in both presenting an unusually bold spiritual element that is of great interest here. Using Max Weber's, *Science as a Vocation*, with contemporary interpretations of his work, and critical discourse analysis strategies, I will be analyzing two episodes of *Cosmos*, one from each series focusing specifically on evolution. I put forth that the message *Cosmos* uses is in fact adopting the elements of religion that contribute to its longevity and power — awe, reverence, wonder, meaning. By implementing strategies of a religious-like narrative, imagery, and sound, *Cosmos* is enchanting science. Moreover, we can understand this strategy as a reaction to a larger movement, I believe taking shape across Western North America, to enchant science and its education, which, in contemporary Western, young social circles, dismisses religion, yet hungers for depth, meaning, and purpose.

### Atheism vs. Atheism in the Encounter Between Science and Religion

**Yiftach Fehige** University of Toronto

So called "militant atheism", such as advocated by Richard Dawkins, continues to play an important role in discussions about the relationship between science and religion. Of course, "militant atheism" has been facing a backlash from theists. Theistic responses range from serious engagement to ridicule. Even more intriguing than these responses, in my view, are the reactions from fellow atheists, such as Tim Crane's recent essay on the nature of religious belief. In the literature on science and religion they are not receiving the attention they deserve. In what follows I will discuss some of the most prominent atheistic rejoinders in order to expose the diversity of atheistic views on the relationship between science and religion. At the same time, my discussion aims at a demonstration of the power of a qualified post metaphysical stance on the encounter between science and religion.

After a sketch of militant atheism, I will examine the interplay of a secular and religious metaphysics in Thomas Nagel's philosophical cosmology. This motivates a brief discussion of Juergen Habermas' stance on the position of science and religion in the liberal state. He insists on the need of a process of mutual learning between secular and religious philosophy, and argues that a qualified post metaphysical thinking is the correct mode of secular reasoning, not an atheistic metaphysics. Under reference to recent historical work on science and religion, I will conclude that Habermas' neo-pragmatist proposal goes in the right direction.

Monday  
8:45 - 10:15  
FN-1012

## SCIENCE AND CHARACTERS

Chair: **Rebecca Livernois** University of British Columbia

### « Notre avenir à tous »? Généalogie et critique de la précaution dans l'éthique Jonassienne du futur **Bertrand Guillaume** Dartmouth College

Dans la préface d'un ouvrage collectif d'universitaires de différentes disciplines (philosophes, historiens, biologistes, théologiens, etc.) offrant le premier tour d'horizon complet de sa philosophie en langue anglaise, on attribue à Hans Jonas l'articulation du principe de précaution, en référence à sa prise de conscience des conséquences involontaires de l'agir humain, d'une part, et de son respect profond pour la nature, d'autre part. A l'heure de l'Anthropocène, je reviens d'abord sur l'origine de ces deux motifs relativement à la contribution de Jonas à la pensée écologique du XXème siècle, en identifiant deux sources principales dans l'entreprise philosophique du penseur allemand, à savoir d'une part une critique de la technique et une philosophie pratique (c'est-à-dire une éthique) à l'égard de l'homme et de la nature, et d'autre part une phénoménologie de la vie et un certain fondement ontologique de son évolution. Je discute ensuite l'affirmation de cette préface, puis m'attache à qualifier et, dans un cadre de durabilité forte, critiquer la précaution dont il s'agit.

### The Relevance of Intellectual Character for Scientific Inquiry

**Mark Young** Keyano College

The goal of this presentation is to make the case for an important role for intellectual character in science. More specifically, that to be a good scientist one does not require knowledge only of various protocols, procedures and methods, but must also possess specific character traits that have been identified by virtue epistemologists. The argument will proceed by connecting the role of paradigms in science with literature on self-deception. It will also discuss the historical case of Einstein's reluctance to accept quantum theory as told by Heisenberg. Discussion of these two areas of research will thus support the claim that intellectual character is relevant to the practice of science.

### “Grandfathers of the Ether”: Robert Roberts, Edward Mills, and Astronomical Lecturing in Nineteenth-Century Wales

**Jake Bridges** University of Alberta

The nineteenth century was a period of transformation in astronomy. A study of Welsh perceptions of astronomy helps to understand what science meant to both astronomers and the public, and I examine how astronomical lecturers invoked notions of the sublime to educate and entertain audiences across Wales. Through the use of orreries, planetariums, magic lanterns, and other visual tools, lecturers captivated different groups by appealing to their preconceptions of the universe. First beginning with Sunday school teachings, a demand for astronomical knowledge only increased over the course of the century; with a lack of available astronomical texts, many in Wales turned to lecturers as their source of scientific education. Welsh speaking lecturers combined orreries with eloquent language and transformed chapels, theatres, and town halls into sites for the consumption of scientific knowledge. Spaces became temporary scientific communities, as lecturers engaged in a direct discourse with their audiences over the wonders of the heavens. Robert Roberts was the first Welsh-speaking lecturer in Wales, and his legacy was carried on by Edward Mills, who's 66-foot orrery gained him fame in countless poems. Poetry and astronomy had a unique relationship that demonstrated how astronomy was perceived by Welsh audiences as a cultural practice. Lecturers were elevated as equivalents to antiquarian bards and druids, as they were portrayed as the descendants of a romantic, mystical astronomical tradition.

10:15 - 10:30  
FN-1011

COFFEE BREAK

Monday  
10:30 - 12:00  
FN-1016

## SCIENTIFIC METAPHYSICS

Chair: **Kent Peacock** University of Lethbridge

### Ismael's Objective Modality in light of Chemical Kinds Classificatory Practice

**Ananya Chatteraj** University of Calgary

In “An Empiricist's Guide to Objective Modality,” Jennan Ismael argues that the empiricist can accept an objective account of modality. Her objective account is of alethic modality – reasoning under counterfactual conditions regardless of the state of the actual world. Since counterfactual possibilities cannot be observed, the empiricist struggles with the prevalence of this type of modal reasoning in science. Ismael argues that her type of objective alethic modality can be understood through its role in guiding scientific actions. She uses abstract scientific laws as the objective face of alethic necessities that guide the scientist's decisions about whether a phenomenon should be investigated. Since much of physical science practice is not couched in terms of abstract laws, we should first consider whether a functional explanation of modal reasoning would account for scientific practice. In this paper, I apply Ismael's abstract account to modal reasoning in chemical kinds

classification in organic chemistry. Chemical kinds classification in organic chemistry is based on modal reasoning of how a molecule of a kind would react with other molecules. Theories of molecule reactions are experimentally established, which then employ modal reasoning to classify molecules based on the arrangement of their functional groups. Applying Ismael's account to this practice would mean that the scientist's actions in classification are guided through reasoning that members of kinds necessarily react with members of other kinds in a specific way. I will ultimately examine this practice in organic chemistry to assess whether Ismael's strong objective account of modal reasoning is warranted.

## Understanding McTaggart's Paradox of Time and its Relation to Science

**Richard Feist** Saint-Paul University

McTaggart's paradox, that is, his argument that time's passage is an intrinsically contradictory concept, is one of the most famous and notorious arguments for time's non-existence. Its notoriety is due to the large-scale agreement that the argument fails but large-scale disagreement as to why. Nonetheless, McTaggart's argument is an important one, since it deeply questions the very idea of temporal flow. Understanding arguments requires understanding their historical and intellectual contexts. But what, exactly, is the historical and intellectual context of McTaggart's paradox? Here, too, there is disagreement. Some argue that McTaggart's paradox is independent of his metaphysics, science and thus stands alone: an *a priori* argument against temporal flow. Others argue McTaggart's paradox depends on his metaphysics, but that in turn is independent of science. McTaggart's metaphysics, then, is *a priori*. Simply put, natural science does not figure at all into McTaggart's thinking. I argue that these readings of McTaggart are too strong. McTaggart corresponded with Alfred North Whitehead regarding his system's compatibility with science; he was aware of and concerned about the results of science. I argue that McTaggart's paradox should be seen within the context of his general metaphysics and that his general metaphysics should then be seen within or at least strongly related to the science of his time. McTaggart, often seen as the quintessential British Hegelian/Idealist, is closer to science than is often thought.

## Scientific Metaphysics, Justification, and Fuzzy Disciplinary Boundaries

**Amanda Bryant** Trent University

In previous work, I have argued that metaphysics that proceeds independently of science is epistemically deficient. Here, I will argue that what I call *scientifically responsible metaphysics* — metaphysics that engages conscientiously with the theories and practices of science — has relative epistemic merit (but since I maintain that scientific anti-realism should be kept a live option, I don't claim that such metaphysics produces knowledge). I will argue that the more robustly science constrains metaphysics, the more epistemic warrant metaphysics receives. But as support grows among philosophers for the naturalization of metaphysics, as the discipline of scientific metaphysics continues to burgeon, and as metaphysicians look with increasing regularity toward scientific evidence, the border between science and metaphysics grows continually fuzzier. The more closely we tie metaphysics to science, the less clear it is that metaphysics is its own distinct form of inquiry. In fact, I will argue that naturalized or scientific metaphysics and highly theoretical forms of science are roughly continuous both in their domain and in their methods. But then, what role, if any, should philosophers play in the pursuit of such an inquiry? I argue that philosophical training lends itself particularly well to a number of tasks that are integral to the construction of a scientifically-informed worldview.<

Monday  
10:30 - 12:00  
FN-1011

## 19<sup>TH</sup> CENTURY SCIENCE AND MEDICINE

Chair: **Jennifer Hubbard** Ryerson University

## Richard Whately's Elements of Logic and Its Popular Discontents

**Jared Neumann** Indiana University

The Archbishop of Dublin, Richard Whately (1787-1863), is widely credited with the revival of formal logic in Victorian Britain. Modern scholars and Whately's contemporaries have typically agreed that the success of his revival was not due to any particular innovation, but rather to two other factors. First, he issued a powerful defense of the subject against centuries of attacks. Second, his work, *Elements of Logic* (1826), elicited constructive reactions from prominent thinkers like George Bentham, William Hamilton, and John Stuart Mill. Whately's defense hinged on redrawing the boundaries of logic so it was properly construed not as a failed account of scientific method or the faculties of human reason, but as a strictly formal science of more limited scope. However, not everyone believed that the Victorian public needed the revival of a subject once considered pedantic and useless. In this paper, I explore one such reaction to Whately and formal logic primarily through the works of James Gilbert, Samuel Neil, and George Holyoake. These men provided alternative expositions of logic for a new audience--the working class--whose needs, they believed, extended beyond the walls of the traditional university and into the realm of civil discourse.

## The Artist-Patient: The Visual Archive of the Crichton Royal Institution, 1839-1857.

**Katie Powell** University of British Columbia

Victorian alienist W.A.F. Browne was employed as the Medical Superintendent at the Royal Crichton Institution in Scotland between 1838 and 1857. Like a number of his contemporaries, Browne was invested in the "moral therapy" ideals of the time and placed a particular emphasis on the production of art as a part of treatment in the asylum. This paper argues that an archive of patient art works against the medical category of the case file to create opportunities for representation of the often silenced patient experience. While such visual sources were created under the control of an asylum infrastructure, they

sit adjacent to top-down medical case records which often serve to reinscribe a patient/doctor dichotomy of power. This paper examines a series of portraits that Browne commissioned one patient to produce; these images depict the patient-artist's fellow asylum patients and were used by Browne to educate Crichton staff on physiognomic diagnosis. Such portraits further complicate the artist-patient's own gaze and the resulting art itself, through a collapsing of therapy-based initiatives of care and efforts to expand and reify visual classifications of mental illness. Browne's patronage breaks from the confines of the restrictive patient-doctor narrative of the case record to offer a complicated instance of the *sufferer's gaze* which both subverts medical authority while also contributing to the dissemination of formalized medical knowledge.

### Temporary Measures: Women Astronomers at Greenwich in the Late 19th Century

**Kane Mullen** University of Alberta

In the late nineteenth century, the Royal Greenwich Observatory was being significantly expanded. William Christie, then Astronomer Royal, was keen on increasing the number of staff, buildings, and capabilities of the Observatory. As part of his scheme, Christie began a short-lived and cost-efficient program of paying highly educated women as supernumerary computers to perform instead the tasks of his assistants. Between 1890 and 1895, five women were hired at the Observatory, and these were among the very first paid women astronomers in Britain. This example warrants attention as it adds new layers to the popular discussion of "women's work" so common to Victorian era studies. That the Greenwich women quickly moved into roles normally exclusive to men merits analysis as it suggests a localized expression of gender and one that is in some ways at odds with conventional understandings. The practical space of the observatory, whose nature is normally considered a dividing agent in regards to personnel, science, and work, was continually traversed as the new hires performed their work as computers, astronomers, and as women. Using archival records, I situate the fleeting program in historical context, expost the details of these computers and the work they performed, and describe why and how the full participation of women at Greenwich was possible. I conclude with a comparison to similar programs and to the current gender discussion.

Monday  
10:30 - 12:00  
FN-1012

### TRADITION AND TRANSFORMATION IN SCIENCE

Chair: **Justin Bzovy** University of Alberta

#### The transformation of 18th century philology: Göttingen and the «archelogy» of texts

**Kristine Palmieri** University of Chicago

This paper examines the changing function and status of philology at the University of Göttingen in the Eighteenth Century. It does so through an analysis of the kinds of philological work that were being carried out within the University as well as on their perceived cultural and intellectual significance. This approach illuminates the ways in which philologists established themselves as researchers concerned with the production of original scholarship and how philology came to be valued for the new kind(s) of knowledge that it produced. Crucially, such knowledge was overwhelmingly historical in its orientation and can be identified by its focus on matters that were culturally specific. I argue that this constituted a transformation in the scope and orientation of philology as well as a reformulation of the role of the philologist. In this paper I emphasize the ways in which this transformation was brought about through the interaction of three distinct features of eighteenth-century scholarship: an emerging appreciation of the historicity of texts, the establishment of new tools of critical analysis, and the formulation of new tools of judgement. It was the independent but braided development of these features that led to the reconceptualization of texts as objects with their own histories and the subsequent articulation of a new mode of philology that can be framed in terms of an "archaeology" of texts.

#### Abraham Sharp on the Margins of the Republic of Letters

**Jason Grier** York University

In the preface to his *Course of Experimental Philosophy* (1745), John Theophilus Desaguliers wrote that his audience was those "little versed in mathematical sciences."<sup>1</sup> Yet, that did not mean that he intended his course simply to satisfy casual curiosity. Instead, Newtonian physics was "supported by mathematics, yet its physical discoveries may be communicated without."<sup>2</sup> What Desaguliers offered was an experimental demonstration of Isaac Newton's mathematical theories that allowed the expansion of Newton's audience beyond the tiny group of mathematicians for whom Newton had originally written. In my paper, I will contend that Desaguliers' argument that Newtonian philosophy could be demonstrated without the math is a profound example of a transformation in how Newtonian philosophy was conceived as a philosophical framework. Desaguliers is indicative of a change from a philosophy which derived its authority from the strength of mathematics to one that was expressed in the material reality of the physical experimental demonstration. There was a transition from Robert Boyle's matters of fact, grounded as much in social status as in physical demonstration, to Newton's mathematical model of certainty, and finally to Desaguliers' experimentally demonstrated, physical and objective fact. This shift was crucial for the final establishment of the Newtonian hegemony in eighteenth-century Britain. Desaguliers showed, rather than told, the matters of fact he wished to prove. In doing so he reconciled the demonstrability of Newton's experimental philosophy with the mathematical difficulty that had previously made Newton unapproachable. By removing the mathematical veil that had obscured Newton's philosophy, Desaguliers suggested that anyone could participate.



## A Bibliometric History of the Human and Social Sciences

**François Claveau** Université de Sherbrooke

Science is divided in disciplines and specialties, which change through time thanks to internal dynamics, interdisciplinary ventures and factors external to science. Advanced bibliometric methods and network analysis allow us to map this dynamic structure. This paper reports on our project of mapping the evolving cognitive structure of the social and human sciences since the 1950s. We construct a dynamic network based on the references of more than 5 million documents from Web of Science. Nodes in this network are clustered using a community detection algorithm and the resulting structure can be analysed using various methods. For instance, we can track through time the focus and proximity of disciplines and specialties. The talk will briefly present some of the results of the completed project on economics (see [digitalhistoryofscience.org/economics/](http://digitalhistoryofscience.org/economics/)) and a few preliminary results from our ongoing project that covers all the human and social sciences.

Monday  
12:05 - 13:25  
LC-100  
(Luther College)

LUNCH SERVED AT:  
ANNUAL GENERAL MEETING & HADDEN PRIZE CEREMONY  
DÎNER SERVI À:  
ASSEMBLÉE GÉNÉRALE ANNUELLE & REMISE DU PRIX HADDEN

Monday  
13:30 - 15:00  
FN-1016

## MODEL THEORY AND LOGICAL STRUCTURE

Chair: **Hannah O'Riain** University of Calgary

### F.P. Ramsey as Proto-Model Theorist

**John Lehmann** University of Western Ontario

In this paper, I will consider Ramsey's contention that his paper *Theories* is an attempt to "describe a theory simply as a language for discussing the facts the theory is said to explain" (Ramsey, 1929). Contrary to the Carnapian reading (Demopoulos 2013; Psillos 2006) that the formal tool, called the 'Ramsey-sentence', is a means of reconstructing our theoretical knowledge and eliminating theoretical vocabulary, I argue instead that Ramsey's concern is to investigate the formal properties of a theory once it has been formalized into a logico-mathematical language. In this sense, Ramsey's remarks throughout the paper concerning the equivalence of theories, definability, translation, and containment, foreshadow important discoveries in 20<sup>th</sup> century mathematical logic such as the theorems of Beth, Craig, and Robinson. Demopoulos (2013) has shown that Newman's objection to Russell's structuralism can be applied to Carnap's use of the Ramsey-sentence as well as other views which consider scientific theories as abstract structures satisfied by sets of objects. Understanding Ramsey's work in *Theories* in the way I suggest provides a way of bypassing the Newman-style objection. When understood as an investigation into the formal properties of a language structure, and not as a rational reconstruction of our theoretical knowledge, the Newman objection need not arise for Ramsey because he is not employing the device of the Ramsey-sentence to the same ends.

### On the Application of Carnap's Internal/External Distinction to the Realism/Anti-Realism Controversy

**Yousuf Hasan** University of Western Ontario

In *ESO* (1950), Carnap introduces a distinction between what he calls "internal" and "external" questions. The internal questions for Carnap are relatively straightforward since they arise within a language and are amenable to our ordinary methods of proof. In contrast, external questions are interpreted as practical questions that ask whether we should adopt a certain language based on its expected benefits. While Carnap had originally made this distinction to avoid metaphysical worries that the use of semantics posed to empiricist philosophers (1950), he later extended the application of the distinction to speak about theoretical entities as well (1966/1974). However, a straightforward application of the distinction to the Realism/Anti-Realism controversy may be more problematic than what Carnap may think. In recent scholarship, Penelope Maddy, made an objection to Carnap's extended use of the distinction using the example of the atomic hypothesis and argued that not only the internal/external distinction was unsuccessful for talking about atoms, but that it should be dismissed altogether (2008). According to William Demopoulos, however, we can develop an understanding of the distinction that does not reduce the atomic hypothesis to a mere linguistic proposal (2011). In my talk, I will use Crispin Wright's pluralist account of truth (1992) to propose other semantic ways that realists and instrumentalists differ from each other beyond what Demopoulos has already suggested. I will also respond to a worry that both Wright and Carnap ought to share: "Won't the significance of the realist/anti-realist debates be undermined if they are not understood metaphysically?"

### Realist Intuitions: The Logical Structure of the Theoretical Virtues of Scientific Theories

**Corey Mulvihill** University of Ottawa

Philosophers and scientists have long admitted there are multiple qualities important in theory choice, but it was Kuhn who asserted that these "criteria or values deployed in theory-choice are fixed" and are "unaffected by their transition from one theory to another" (Kuhn 1977). The discussion of what these values are and how they should be categorised has been long and continues to the present day (see Kuhn 1977, McMullin 1983, 1987, 2012, 2014, Laudan 1984, 2004, Lacey 1999, Douglas 2009, 2013, and Keas 2017). Within this debate some have argued that the evaluation of theories from the

perspective of their theoretical virtues should lead one to a realist view (see e.g. McMullian 1996) while others have argued that seeing theories in such a manner leads one to an anti-realist perspective (see e.g. Laudan 2004). This paper will argue that the fixed nature of these values over different theories implies that there are at least some realist intuitions presupposed on the assumption of such values, though perhaps not enough to assert a full blown metaphysical realism. This paper's argument is an extension of Dummett's that the realism debate in any area of philosophy can best be understood as a debate over philosophical logic (Dummett 1991) i.e. that realism is assumed when classical logic is accepted, and intuitionistic logic is correct for anti-realist domains (Dummett 1992 & 1993). However, since there are infinitely many logics between intuitionistic and classical, and since stronger logics make stronger claims, this paper will argue that we can investigate whether or not a domain is realist to a great or lesser degree by asking if we accept certain intermediate axioms with regard to that domain. If one considers the comparison of theories by reference to fixed values, one is not necessarily presupposing classical logic, that is, we don't establish that the claims of one theory are definitely true and the other false, but neither is one admitting that one theory is not better. While the "algebra of truth-values" for classical logic is a linear two valued model, when dealing with a more complex property, such as quality of a scientific theory with regard to a specific array of values, one may wish to consider more complex models. As the authors have argued elsewhere there is a dimension of realism whenever values are arranged linearly and suggest L-algebras, such as those described in Horn (1969), are more descriptive of multi-dimensional properties (see Author(s) 2015, 2017). In such circumstances the axiom of linearity holds, even if the law of excluded middle does not, and while one cannot make the argument that one is being completely realist about such a domain where this holds, one is significantly more metaphysically committed, than if one were not to admit such an axiom.

Monday  
13:30 - 15:00  
FN-1011

## TEACHING HPS

Chair: **Isaac Record** Michigan State University

### Opening the Black Box of Teaching

**Isaac Record** Michigan State University

In 2014, Hardcastle and Slater shared "A Novel Exercise for Teaching the Philosophy of Science" in *Philosophy of Science* (81:5, 1184-1196). I am hopeful it signals a growing movement to take teaching seriously within our field. At MSU, my colleagues and I have adapted their "box" exercise — which we now call the "Black Box" — to a set of introductory HPS classes for STEM majors. In this hands-on workshop, I share lessons gleaned from half a dozen or so courses, with particular attention on how to structure course activities to resonate with and reflect various aspects of scientific practice drawn from history, philosophy, and sociology of science. While Hardcastle and Slater note the advantage hands-on experience with the box confers to non-science majors, I emphasize the strengths of the box for teaching STEM majors. Rather than science on training wheels for non-majors, the Black Box becomes an occasion for radical reflection and self-discovery for budding scientists. Hardcastle and Slater discuss a few applications of the box, including realism and antirealism, Kuhnian puzzle-solving, and science funding. I focus on the social and ethical structure of science. In particular, I suggest some ways to modify the structure of the project to align activities and evaluation to explore and trouble particular models and values for science, such as communalism, diversity, objectivity, and openness. I hope that my examples and experiences inspire conversation among the attendees and I expect to learn a few new variations along the way.

### Teaching Disability Through Materiality

**Jaipreet Virdi** University of Delaware

Disability is unique in the extent to which it is bonded with technology, tools, and machines as a medium of social interaction. Artefacts used by, and made for, people with disabilities serve as tangible evidence of an individual's life with disability. They also define and shape social and medical meanings of "disabled" and "abled" as much as the relationship between innovation and commercialization, or between identity and stigma. Further, as scholars of material culture know all too well, object biographies—especially of neglected artefacts—can dictate patterns in larger historical trends. This paper demonstrates how I used disability artefacts in my "A History of Disability Technologies" seminars to shift discourse away from a "diagnostic-centric" perspective of disability towards a rigid focus on the construction of disability identities and the nuances involved in shaping user-narratives of disability experiences. Students learned to perceive the centrality of disability experience through artefacts, even bringing artefacts—sometimes their own—to enhance their presentations with a hands-on material analysis. We examined prosthetic legs, glass eyes, walkers, hearing aids, fidget toys, alongside textual and visual sources. By examining the artefacts, students learned how the materiality can highlight the varied ways disability has been (re)defined: they are more than tools to "fix" or "normalize" an impairment. Indeed, they are personal objects for navigating (sometimes literally) and engaging with challenges of usability and adaptation.

Monday  
13:30 - 15:00  
FN-1012

## PLURALISM

Chair: **Tiernan Armstrong-Ingram** University of California

### Integrative Pluralism and Holobiont Individuality

**Sinan Sencan** University of Calgary

In this paper, I focus on recent discussions about holobionts and evolutionary individuality to evaluate the merits of integrative pluralism. Holobiont stands for an obligatory multi-species symbiotic relationship, which is observed between an individual host and its microbial community (Theis et al. 2016). Whether holobionts are good cases for evolutionary individuality is controversial because there are both supportive cases (Zook 2016) and negative cases (Douglas & Werren 2015). I suggest that holobionts are genuine candidates for evolutionary individuality by using an interactor account of individuality (Ereshefsky & Pedroso 2015). If holobionts are evolutionary individuals, then there must be multi-species individuals in addition to single-species individuals (Gilbert et al. 2012). Since both approaches are needed, a pluralistic view can help us better understand holobiont research. However, the term 'pluralism' refers to different positions (Price 1992). I argue that a form of pluralism called 'integrative pluralism' is the wrong approach to take when it comes to holobiont research. Because it is not liberal enough to accommodate both multi-species and single-species individuals. According to integrative pluralism, an integration of multiple explanations is preferred for particular cases because an explanation for a particular complex case invokes integration of various approaches focusing on different factors (Mitchell 2009, Brigandt 2010). However, holobiont research requires a non-integrative pluralistic approach, since the applications of two accounts of individuality for particular cases precipitate incompatible results. To sum up, I suggest two points. First, a pluralistic view helps us better understand holobiont research. Second, the case of holobionts helps us develop a better account of scientific pluralism.

### What could Scientific Pluralism be ?

**Cristian Larroulet Philippi** CU Boulder

In this paper, I introduce the main claims of SP (Section I), and review the question of its justification in light of two criticisms that have been suggested in the literature (Section II). The first criticism is epistemological; it claims that we can never (fully) justify taking a pluralist position since the plurality observed in the sciences may be temporal. In Section II I argue that although we can never be certain, certainty is not the adequate epistemic standard for assessing science's products. I draw from debates on anti-reductionism to make my case. In light of the above, I argue that we indeed can justify taking a (provisional) pluralist position to the extent that there is enough of the right evidence for it. In section III, I target the second criticism, which is methodological/practical. It says we shouldn't take a pluralist position, even if epistemically justified, since it can only obstruct finding (when possible) unifying accounts. I argue that this point is less acute once we have dealt with the previous argument, and that it overlooks the unproductiveness of monists positions (when not justified by the evidence). I illustrate the last point with cases in biology and economics. Hence, I conclude that SP can be justified epistemically and methodologically.

### Lyme Disease in Canada

**Justin Bzovy** University of Alberta

Lyme disease in Canada is on the rise in recent years, yet our means of dealing with this disease have been severely handicapped by narrow-minded philosophical assumptions, which stem from an undue commitment to scientific monism. Scientific monism is the view that there is one unique method for addressing or explaining a particular scientific problem. A commitment to such a philosophical position typically involves dismissing alternative or novel methods or approaches as "pseudo-science." I argue that these assumptions need to be rejected in order to effectively deal with how this disease is diagnosed, treated, and researched. The unjustified belief that there is a single "scientific" approach unnecessarily limits how Lyme disease has been addressed in Canada. My aim is to outline how several recent initiatives, spearheaded by the Lyme Research Network at Mount Allison University, attempt to move past these problematic assumptions. This is shown, for instance, in a commitment to treating Lyme disease as a problem warranting an interdisciplinary solution, but also by a commitment to welcoming the patient community as a partner in research. Given the rapid spread and over-wintering of the ticks (*Ixodes scapularis*, and *I. cookei*) that carry the bacteria (*Borrelia burgdorferi*) that causes Lyme disease in recent years, incorporating citizen science into research is an important way of furthering awareness among both medical practitioners and patients, and for broadening the scope and efficacy of existing research.