2017

Canadian Society for the History and Philosophy of Science

Société canadienne d'histoire et de philosophie des sciences

PROGRAMME

27-29 May 2017

Ryerson University, Toronto

Model of Hermann von Helmholtz's Theory of Hearing
University of Toronto Scientific Instruments Collection

FRIDAY MAY 26

18:00 - 20:00 Executive Meeting / Réunion du Comité Exécutif — Room: Jorgansen 502

SATURDAY MAY 27

8:45 - 10:15
TRSM 2-099

HUMAN AND SOCIAL SCIENCES

Chair: Tara Abraham, University of Guelph

Before Attachment Theory: Separation Research at the Tavistock Clinic, 1948-1956
Bican Polat Johns Hopkins University

The 'Disadapted' Animal: Niko Tinbergen on Human Nature and the Human Predicament
Marga Vicedo University of Toronto

Disciplining the Social Sciences during the Reagan Revolution
Mark Solovey University of Toronto

8:45 - 10:15
TRSM 2-119

FROM NATURALISM TO METAPHYSICS

Organizer and chair: Catherine Stinson, Western University

Naturalized Metaphysics and Fundamental Physics
Lucas Dunlap Western University

Should We Be Pluralists about Natural Kinds?
Muhammad Ali Khalidi York University

Abstract Mechanisms and Causal Powers
Boris Hennig Ryerson University and **Catherine Stinson** Western University

8:45 - 10:15
TRSM 3-099

CANADIAN SCIENCE

Chair: Jordan Howell, Harvard University

Canada's Legacy in the United Nations' Food and Agriculture Organization (FAO)
Jennifer Hubbard Ryerson University

The 1913 Crisis at Hell's Gate: Contextualizing the Decline of Sockeye Salmon
Callum C. J. Sutherland York University

8:45 - 10:15
TRSM 2-149

ARISTOTELIAN THOUGHT

Chair: Daryn Lehoux, Queen's University

Aristotle on the Limits of Teleological Explanation in Natural Science
Christopher Byrne St. Francis Xavier University

Aristotle on the Causes and Limits of Aging
Adam Woodcox University of Western Ontario

What's Odd About Euclid's Definitions of 'Odd' and 'Even'? Aristotelian Dialectic and Ancient Arithmetic
Benjamin Wilck Humboldt-Universität zu Berlin

10:15 - 10:30 COFFEE BREAK

10:30 - 12:00
TRSM 2-099

PHILOSOPHY OF BIOLOGY

Chair: Antoine C. Dussault, University of Toronto and Paris I

A Continuum of Integration Accounting for Populations and Individuals in the Context of Darwinian Explanations
François Papale University of Montreal

A framework for philosophical biology
Sepehr Ehsani University of Toronto/MIT

The proximate-ultimate distinction: cause and explanation in evolutionary biology
Felix Walpole University of Toronto

Causation and Information Flow in Biological Systems
Oliver Lean University of Calgary

10:30 - 12:00
TRSM 2-119

QUANTUM MECHANICS

Chair: Vivien Hamilton, Harvey Mudd College

When did particles become “indistinguishable”? Quantum cultures and the interpretive flexibility of mathematical-theoretical apparatus in the emergence of quantum statistics
Daniela Monaldi York University

The Bell twins: divergent views on John S. Bell's philosophy of quantum mechanics
Federico Laudisa Universita' di Milano-Bicocca

Wave function collapse theories of consciousness and physicalism: The Chalmers-McQueen model reexamined
Guy Kagan University of Haifa

10:30 - 12:00
TRSM 2-149

CONCEPTUALIZING HISTORICAL CHANGE

Chair: Andrew Ede, University of Alberta

Moving Far and Wide Beyond the Text: The Graeco-Arabic “Translation” Movement and the Making of “Science.”
Zaheeda P. Alibhai University of Ottawa

Paleo Perspectives on the Nature of Historical Change
Melissa Charenko University of Wisconsin-Madison

On the Hermeneutical Revolutions of Scientific Revolutions: Re-Examining Kuhn’s The Structure of Scientific Revolutions Through the Framework of Gadamer’s Hermeneutical Philosophy
Anthony Nairn Carlton University

Le rôle de la philosophie dans l’émergence des sciences humaines dans l’Europe, la Chine et le Japon du XVIIIe s
Vincent Citot Université Paris Sorbonne

12:15 - 13:15

LUNCH BREAK

13:30 - 15:00
TRSM 2-099

SOCIAL AND NATURAL KINDS

Chair: François Papale, Université de Montréal

Three Concepts of Gender for Different Social Aims
Esther Rosario and **Ingo Brigandt** University of Alberta

Beyond Racial Constructivism: Racial Realism Reconsidered
Joshua Mugg Indiana University Kokomo

Giving Up On Natural Kinds
Jody Tomchishen University of Western Ontario

13:30 - 15:00
TRSM 2-119

VALUES IN SCIENCE

Chair: Hans Radder, VU University Amsterdam

Trustworthiness of science in the nexus between science, society and policy
Marina Pražetina Wirth Institute, University of Alberta

Rethinking the Adaptationist Debates: Values at Theory Appraisal in Evolutionary Biology
Margaret (Greta) Turnbull Boston College

Inductive Risk and Extrapolation in Medicine
Adrian Erasmus The University of Johannesburg

13:30 - 15:00
TRSM 3-099

ROBUSTNESS

Chair: François Claveau, Université de Sherbrooke

How to Determine Protein Structure: Challenges for Integrative Pluralism
Agnes Bolinska and **Julie-Anne Gandier** University of Wisconsin-Stevens Point and University of Toronto

Epistemic Progress in Cognitive Neuroscience and Neurobiology: How, If at All, Can Functional Triangulation and Integration Contribute to this Process?
Jaclyn Lanthier Western University - Cancelled

Two Types of Robustness in High Energy Physics Experiments
Koray Karaca University of Twente

13:30 - 15:00
TRSM 2-149

HISTORY OF PHYSICS

Chair: Daniela Monaldi, York University

Hertz's Propagating Electric Waves and Selected Replication of Experiments
Chen-Pang Yeang, Noah Stemeroff, Jenifer Barton, Quinn Harrington University of Toronto

L'environnement scientifique italien du jeune Albert Einstein, de 1895 à 1901
Christian Bracco l'Université de Nice

15:00 - 15:15 COFFEE BREAK

15:15 - 16:45
TRSM 2-099

SOCIAL EPISTEMOLOGY

Chair: Marina Pražetina, Wirth Institute, University of Alberta

Evaluating socioeconomic expertise: central banks in the post-2007 era
François Claveau Université de Sherbrooke

The Epistemic Structure of Climate Science
Michael Thicke Bard College

Trust, credibility, and the scientific consensus on childhood vaccines
Maya Goldenberg University of Guelph

15:15 - 16:45
TRSM 2-119

EVIDENCE AND EXPERIMENTAL PRACTICES

Chair: Samantha Copeland, Norwegian University of Life Sciences

Evidence Enriched
Nora Mills Boyd University of Pittsburgh

Induction and Necessary Connections in Scientific Practice
Marius Backmann Universität Konstanz

Causality, Theory Ladenness and Reproducibility in Experimental Science
Hans Radder VU University Amsterdam

15:15 - 16:45
TRSM 3-099

HISTORY OF ASTRONOMY

Chair: Jamil Ragep, McGill University

Measurement by Analysis of Gravitational Perturbation: The Case of Pluto's Mass
Allan Olley

Helen Hogg and Frank Hogg: A Fruitful Personal and Professional Partnership in Astronomy
David Orenstein

John S. Plaskett – Leadership in Early 20th-Century Astrophysics in Canada, 1903-1935
Andrew Oakes University of Toronto

15:15 - 16:45
TRSM 2-149

50 YEARS OF IHPST

Chair: Yiftach Fehige, University of Toronto

IHPST: Stillman Drake's Intellectual Legacy, for IHPST and Beyond
Brian Baigrie University of Toronto

The Origins of the IHPST
Philip Enros

The History of the IHPST: 1980 to the Present
Craig Fraser University of Toronto

Celebrating Fifty Years of IHPST at the University of Toronto
Margaret Schabas University of British Columbia

16:45 - 17:00 — COFFEE BREAK

17:00 - 18:30
TRSM 2-149

INTERNATIONAL KEYNOTE SPEAKER

The Silent Trade: Measurement and Materiality in Cultures of Knowledge

Simon Schaffer University of Cambridge

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.

19:00 - 21:00 **IHPST Reception, 91 Charles Street West (Old Vic), Room 316**

In commemoration of the 50th anniversary of the Institute for the History and Philosophy of Science and Technology at the University of Toronto, its Director, Prof. Craig Fraser, is inviting all CSHPS members to a formal reception being held to celebrate the years of dedication by faculty, students, alumni and other colleagues to the historical and philosophical study of science and technology.

SUNDAY MAY 28

8:45 - 10:15
TRSM 2-099

TECHNOLOGIES

Chair: Isaac Record, Michigan State University

Island-building: Old and New, Far and Wide
Venilla Rajaguru York University

'The Crimson Thread of Kinship:' Telegraphic Nationalism and the Construction of Canada 1867-1903
Claire Oliver University of British Columbia

The History of Computer-Aided Design (CAD) at MIT in the 1960s
Sophie LeBlanc University of Toronto

8:45 - 10:15
TRSM 2-119

NEUROSCIENCE

Chair: David Colaço, University of Pittsburgh

Interpretations of Neuroimaging Data as Explanations of Data Patterns
Jessey Wright University of Western Ontario

The Interaction of Technique and Data: Insights from neural microscopy
David Colaço University of Pittsburgh

Affordance signifiers as the objects of perception
Paul Patton University of Toronto

8:45 - 10:15
TRSM 3-099

VICTORIAN SCIENCE

Chair: James Hanley, University of Winnipeg

Ethnology, Progress, and Working-Class Improvement in Victorian England: The Bethnal Green Museum, 1872-7
Nastasha Sartore University of Toronto

John Herschel's Landscapes and Geology: The Cape Colony in the 1830s
Gregory A. Good American Institue of Physics

Thomas H. Huxley's Epistemological Project behind Agnosticism
Jiwon Byun University of British Columbia

8:45 - 10:15
TRSM 2-149

REPRESENTATION

Chair: Nora Mills Boyd, University of Pittsburgh

Inferring exoplanets, inferring exominds
Marc Champagne Trent University

Giving Voice to Stars: A Postphenomenological Investigation into Data Sonification in Astronomy
Einar Engström York University

A World Without Symmetry: An Account of Symmetry and Mathematical Representation in General Relativity
Noah Stemeroff and **Charles Dyer** University of Toronto

10:15 - 10:30

COFFEE BREAK

10:30 - 12:00
TRSM 2-099

EARLY MODERN SCIENCE

Chair: Ernst Hamm, York University

The Disenchanted Flute? Music, Max Weber, and Early Modern Science
Brandon Konoval UBC

Hume on the Rise and Diffusion of Scientific Inquiry and the Mechanical Arts
Margaret Schabas UBC

Is Mathematics a science?—the seventeenth century debate between logicians and mathematicians on necessary truths and scientific deductions
J. J. MacIntosh University of Calgary

Visions of Species: Perspective and Enlightenment Definitions of Species
William Nelson University of Toronto

10:30 - 12:00
TRSM 2-119

PHILOSOPHY OF MEDICINE

Chair: Maya Goldenberg, University of Guelph

Medicine Lost in 'Translation': The Structure and Aim of Medical Science
Jonathan Fuller University of Toronto

Objectifying the Subjective: Norms and Standards in Ophthalmology and the Epistemological Status of the Vision
Corinne Doria Université Paris 1-Panthéon-Sorbonne

On Pain Experience, Interdisciplinary Integration and Levels of Description, Explanation and Reality
Tudor Baetu University of Bristol

Fleshing Out Agency and Body Ownership
John Jenkinson Western University

10:30 - 12:00
TRSM 3-099

HISTORY OF PSYCHOLOGY

Chair: Mark Solovey, University of Toronto

Quelle(s) méthode(s) pour les sciences de l'esprit? Retour sur l'expérimentalisme singulier du psychologue Alfred Binet (1857-1911) à partir d'un manuscrit inédit
Alexandre Klein Université Laval

How McGill Got Its Psychology Department
Christopher D Green York University

Robert S. Woodworth, Charles H. Judd, and the Problem of Transfer
Michelle Hoffman Bard College

Wilhelm Reich: Visions of a Science of Life
Andrew Ede University of Alberta

10:30 - 12:00
TRSM 2-149

SCIENTIFIC REALISM AND INSTRUMENTALISM

Chair: Dan McArthur, York University

The Entity Model of Disorder
Craig Knox University of Toronto

Being Natural: Three Grades of Naturalistic Involvement
Fermin C Fulda Western University

On de Finetti's instrumentalist Philosophy of Probability
Joseph Berkovitz University of Toronto

Implications of Scientific Metaphor for the Scientific Realism Question
Andrew S. Reynolds Cape Breton University

12:15 - 13:15

LUNCH BREAK

13:30 - 15:00
TRSM 2-099

SYMPOSIUM: THE RELATIONSHIP BETWEEN QUANTUM FIELD THEORY AND HIGH-ENERGY PARTICLE PHYSICS

Chair: Marie Gueguen Rotman Institute, Western University

The possibility of paraparticles
Marie Gueguen Rotman Institute, Western University

Quasi-particles as a template for 'particles' in QFT
Doreen Fraser University of Waterloo

On the common structure of perturbative and axiomatic field theory in Borel summable models
Michael Miller University of Pittsburgh

Confirming QED
Chris Smeenk Western University

13:30 - 15:00
TRSM 2-119

150 ANS DE NATURALISATION DE L'ESPRIT

Chair: Hortense de Villaine, Université Paris Nanterre

Addiction: quelles visions du monde pour quelle naturalisation ?
Anthony Ferreira Université Paris Nanterre

L'épiphénoménalisme et la naturalisation de la conscience
Hortense de Villaine Université Paris Nanterre

Le Moi peut-il être sauvé ? E. Mach et le débat contemporain
Alexandre Charrier Université Paris Nanterre

La mémoire de Ribot à Tulving et au-delà: la naturalisation des processus mnésiques et l'émergence de l'hypothèse constructive
Loraine Gérardin-Laverge Université Paris Nanterre

13:30 - 15:00
TRSM 3-099

THEORY CHANGE

Chair: Molly Kao, Université de Montréal

Reconsidering the Duhem-Quine thesis: a partial resolution of the ambiguity of falsification
Matthew Burns York University

The Role of Philosophy and the a Priori in Scientific Theories and Theory Change
Dan McArthur York University

Scientific Realism, Molecular Bonding, and the Development of Coordination Theory
Amanda J. Nichols and **Myron A. Penner** Oklahoma Christian University and Trinity Western University

Driven toward a Socratic Scientific Realism by the Features of Theory Change
Timothy D. Lyons Indiana University–Purdue University Indianapolis

13:30 - 15:00
TRSM 2-149

PHILOSOPHY OF PSYCHOLOGY

Chair: Marga Vicedo, University of Toronto

The Case For An Alternative Reading of Heraclitean Notion of Soul
Siavash Joushaghani York University

Des usages philosophiques de l'associationnisme psychologique en France dans le dernier tiers du 19e siècle : le cas John Stuart Mill
Vincent Guillin UQAM

Hermann von Helmholtz's physiology between mechanics and philosophy
Nadia Moro Higher School of Economics, Moscow

15:00 - 15:30

COFFEE BREAK: JOINTLY HELD WITH
THE CANADIAN SOCIETY FOR THE HISTORY OF MEDICINE
(PLEASE NOTE SPECIAL JOINT SESSION BELOW)

15:30 - 17:00
TRSM 2-099

SYSTEMS OF KNOWLEDGE IN MODERNITY

Chair: Robert Brain, UBC

Friedrich Max Müller's Objection to Darwin on Language: Beyond Science versus Religion
Kristine Palmieri University of Chicago

Defining Navigational Expertise: The Education and Practice of Navigation in Eighteenth-Century England
Jason Grier York University

The Modalities of the Rational as Social Order: How to make an Institutional and Conceptual History of Sciences and Disciplines in Turkey
Dilek Sarmis Paris

15:30 - 17:00
TRSM 2-119

INFERENCE AND ARGUMENTATION

Chair: Craig Fraser, University of Toronto

Strategic Serendipity: Inferences and Institutions that Enable Scientific Discovery
Samantha Copeland Norwegian University of Life Sciences

Discovery vs. Justification: Unraveling the Context Distinction
Molly Kao Université de Montréal

Everett's Version of Everett
Sheldon Richmond Independent Scholar

15:30 - 17:00
TRSM 3-099

PRENDRE SOIN DE CEUX QUI NE PEUVENT ÊTRE SOIGNÉS. AMBIVALENCES ET PARADOXES DE LA MÉDECINE FACE AUX CADAVRES

Chair: Alexandre Klein, Université Laval

« Dans le ventre du défunt, des bouts de cigares, un tuyau de pipe brisé, des fragments d'allumettes et de la poussière »: constitution d'une éthique des pratiques médicales post mortem en France (XIXe-début XXe siècles)
Sandra Menenteau Université de Poitiers

Le mort dans le corps: personnalisation et réification du cadavre dans un laboratoire d'anatomie
Julien Bernard Université Paris Nanterre

Pratiques et représentations autour des cadavres dans les services palliatifs français. Ou la mise en place d'une nouvelle médicalisation de la mort
Pauline Launay Université de Caen Normandie

15:30 - 17:00
TRSM 2-149

INDIGENOUS HISTORIES AND THE HISTORIES OF SCIENCE AND MEDICINE

Chair and Commentator: **Mary Jane McCallum** University of Winnipeg

The Interwoven History of Mercury Poisoning in Ontario and Japan
Adam Mosa Queen's University

"A Marvel of Nature and Industry": Kitimat and the Global Aluminum Trade
Jordan Howell Harvard University

From Far and Wide: The Sioux Lookout Project, local needs, international scholars and Indigenous health research
Mary-Ellen Kelm Simon Fraser University

The Hudson's Bay Company, the North West Company and the History of Health Care in the Canadian North after WWII
Kristin Burnett and **Travis Hay** Lakehead University

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

17:00 - 17:15 — COFFEE BREAK

17:15 - 18:30
TRSM 2-149

DRAKE LECTURE

J.B.S Haldane's Passage to India: Cosmopolitanism and the Reconfiguration of Knowledge
Gordon McOuat University of King's College

MONDAY MAY 29

8:45 - 10:15
TRSM 2-099

MEDICAL EXAMINATIONS: PRINT AND HISTORY AT THE OSLER LIBRARY OF THE HISTORY OF MEDICINE

Chair and organizer: Christopher Lyons, McGill University

Medical Innovation on the Western Front: The Canadian Army Medical Corps in 1917
Martha Hanna University of Colorado

Medicine's New Teaching Texts: The Artistic, Marketing and Technical Shifts Affecting Anatomical Atlases in the Nineteenth Century
Cindy L Stelmackowich Carlton University

"The Touch Divine of Noble Natures Gone": Sir William Osler and the Power of the Book
Chris Lyons McGill University

8:45 - 10:15
TRSM 2-119

EARLY MODERN SCIENCE

Chair: Brandon Konoval, University of British Columbia

The Background to Copernicus: "Vaine Recherche" or Indispensable Quest?
F. Jamil Ragep McGill University

Baconian Induction or the Experimental Philosophy of the Royal Society
Jagdish Hattiangadi York University

Natural Philosophy, Geometry, and Deduction in the Hobbes-Boyle Debate
Marcus Adams University at Albany, SUNY

8:45 - 10:15
TRSM 3-099

SCIENTIFIC PLURALISM: THEN AND NOW

Organizer and Chair: Justin Bzovy, Mount Allison University

The Historical Turn and the 'Fact' of Pluralism
Jamie Shaw University of Western Ontario

Clines, Demes and Species: An Overlooked Source for Scientific Pluralism
Justin Bzovy Mount Allison University

The Many Faces of Scientific Pluralism
Anjan Chakravartty University of Notre Dame

8:45 - 10:15
TRSM 2-149

PHILOSOPHY OF ECOLOGY: SCIENTIFIC CONCERNS AND CONSERVATION PURPOSES -SESSION I - PHILOSOPHY OF ECOLOGY: HISTORICAL AND THEORETICAL FOUNDATIONS

Organizer and Chair: David Montminy, Université de Montréal

Novel Ecosystems: Do they Really Lower the Bar?
Eric Desjardins University of Western Ontario

Keystone species problem and pluralism
Sophia Rousseau-Mermans Université de Montréal and Université Paris

The Ecosystem Health Research Program and its Theoretical Underpinnings
Antoine C. Dussault University of Toronto and Paris I

10:15 - 10:30 — COFFEE BREAK

10:30 - 12:00
TRSM 2-099

NEW PERSPECTIVES ON SCIENCE IN PRE-MODERN ISLAM

Commentator and Chair: Sally P. Ragep, McGill University

ʿAlī al-Qūshjī in Istanbul: Theoretical Astronomy in the Early Modern Ottoman Empire
Hasan Umut McGill University

Ibn al-Shāṭir's Planetary Latitude Theory
Sajjad Nikfahm-Khubravan McGill University

Plagiarism in Scientific Works of the Islamic Period: Quṭb al-Dīn al-Shīrāzī's Conceptions
Fateme Savadi McGill University

10:30 - 12:00
TRSM 2-119

VISUAL AND LINGUISTIC TECHNOLOGIES

Chair: Andrea Valente, York University

Visualizing Science: Images in Republican China's Periodicals
Noa Nahmias York University

To show improvement": Making medical photographers in post-war Britain
Drew Danielle Belsky York University

Performing Authenticity: The Making-of-Documentary in Wildlife Film's Blue-Chip Renaissance
Eleanor Louson York University

From the Algatron to the Zootron, the history of Science is a world of trons
David P.D. Munns John Jay College, NY

10:30 - 12:00
TRSM 3-099

SCIENCE AND THE BODY

Chair: Delia Gavrus, University of Winnipeg

Potential: Rendering the Body as Machine
Kasey Coholan York University

Negotiating Risk and Responsibility: Radiation Safety in American Hospitals
Vivien Hamilton Harvey Mudd College

The Mind-Twist and the Brain-Spot: The Material Dimensions of Psychopathology in the Work of Neuropathologist Elmer E. Southard
Tara H. Abraham University of Guelph

Drugs, Prosthetics, and Toddlers – How science shaped the lived experiences of Canadian thalidomiders
Christine Chisholm Carleton University - Cancelled

10:30 - 12:00
TRSM 2-149

PHILOSOPHY OF ECOLOGY: SCIENTIFIC CONCERNS AND CONSERVATION PURPOSES - SESSION II - PHILOSOPHY OF ECOLOGY: MODELS, PREDICTIONS AND INFORMATION

Organizer and Chair: Eric Desjardins, University of Western Ontario

Data-Centric Ecology: Integration and Hierarchy of Models
David Montminy Université de Montréal

Prediction in Ecology: Promises, Obstacles and Clarifications
Virginie Maris Montpellier

Informative Ecological Models without General Ecological Forces: a reply to Sagoff (2016)
Justin Donhauser University of Western Ontario

12:05 - 13:25
TRSM 2-149

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

13:30 - 15:00
TRSM 2-099

HOW TO WRITE ON ASTROLOGY AND GEOGRAPHY IN THE GRAECO-ROMAN WORLD?

Chair: Anne-Laurence Caudano, University of Winnipeg

Authority and Graeco-Roman Astrology
Cristian Tolsa Queen's University

Knowledge and Foreknowledge in Ancient Astrology
Daryn Lehoux Queen's University

Ptolemy's Epistemology of Geography
Jacqueline Feke University of Waterloo

13:30 - 15:00
TRSM 2-119

SCIENTONOMY: INTEGRATING HPS IN CANADA

Organizer and Chair: Gregory Rupik, University of Toronto

Why Would Historians and Philosophers of Science Want to Collaborate?
Hakob Barseghyan University of Toronto

The Dis-integration of the History and Philosophy of Science
Gregory Rupik University of Toronto

Towards a Science of Science
Nicholas Overgaard University of Toronto

13:30 - 15:00
TRSM 3-099

CLASSIFICATION AND THE MIND SCIENCES

Chair: Craig Knox, University of Toronto

Natural Classification and Psychiatric Classification
Nick Slothouber Western University

Refaçonner les frontières diagnostiques. L'introduction du diagnostic de schizophrénie à la Clinique Psychiatrique Universitaire de Strasbourg (1922 -1932)
Julie Clauss Strassbourg

What can Science and Technology Studies tell us about ADHD
Andrew Brown York University

13:30 - 15:00
TRSM 2-149

METAPHYSICS AND NATURALISM

Chair: Fermin C Fulda, Western University

Kantian Themes in Philosophy of Science: Hackian Nominalism vs. Chomskyan Metaphysics
J. Mozersky Queen's University

Incompressible Patterns: CRISPR vs. Dennett
Kathleen Creel University of Pittsburgh

Dispositionalism, Naturalism, and the Irreducibility of Determinable Properties
Travis Dumsday Concordia University of Edmonton

15:00 - 15:15

COFFEE BREAK

15:15 - 16:45
TRSM 2-099

THE RATIONAL AND THE EMPIRICAL

Chair: Margaret Schabas, University of British Columbia

No Safety in Numbers? Mathematical Skepticism in Cartesian Physics and Contemporary Environmental Modeling
Guilherme Sanches de Oliveira University of Cincinnati

Empirical versus Rational Abstraction: A Reflection on Carnap's notion of abstraction
Parzhad Torfehnezhad Université de Montréal

Quine's Flight from Analyticity
Yousuf Hasan University of Western Ontario

15:15 - 16:45
TRSM 2-119

FROM AIR TO GASES BETWEEN CHEMISTRY AND PHYSICS: NEW PERSPECTIVES ON THE PRODUCTION AND CIRCULATION OF PNEUMATIC KNOWLEDGE IN THE LONG EIGHTEENTH CENTURY

Chair and commentator: Trevor H Levere, University of Toronto

The "Subtile Aereal Spirit of Fountains": Mineral Waters and the History of Pneumatic Chemistry
Leslie Tomory McGill University

The Aerial State of Physical and Chemical Affairs: The Early Life of "Permanently Elastic Fluids" from Robert Boyle to Stephen Hales
Victor D. Boantza University of Minnesota

Pneumatic Chemistry in the Making: The Writings of James Keir and Pierre-Joseph Macquer, 1766–1779
Kristen M. Schranz University of Toronto

15:15 - 16:45
TRSM 3-099

CAUSALITY AND EXPLANATION

Chair: Oliver Lean, University of Calgary

Causal Selection in Safety Engineering
Brian J Hanley University of Calgary

Monistic Account of Explanations and Explanatory Depth
Erlantz Etxeberria University of Western Ontario

Perelmanian Proofs and the Room for Audiences in Mathematical Argument
Zoe Ashton SFU

15:15 - 16:45
TRSM 2-149

MODELS AND SIMULATION

Chair: Justin Donhauser, Western University

Computer Simulations, Mathematical Models, and Production of New Knowledge
Atoosa Kasirzadeh University of Toronto

Measurement, Computer Simulation and Observational Grounding
Eran Tal McGill University

Scientific Models, Superintuitionisitic Logics and Semantic Anti-Realism
Corey Mulvihill University of Ottawa

ABSTRACTS / RÉSUMÉS

Tara H. **Abraham** University of Guelph

The Mind-Twist and the Brain-Spot: The Material Dimensions of Psychopathology in the Work of Neuropathologist Elmer E. Southard

This paper will explore some of the visual and material practices that defined studies of psychopathology in Progressive Era American medicine, through a close look at the work of neuropathologist Elmer E. Southard (1876-1920). As a discipline sitting at the intersection between laboratory and clinical practice, neuropathology has received relatively little attention from historians of the sciences of mind and brain. Unlike the neurologist, who was almost exclusively interested in treating patients and saving lives, the neuropathologist often encountered patients following death, and studied the brain for signs of pathology during post-mortem analysis and autopsy. Ubiquitous in the asylum context of early twentieth-century America, the autopsy did not render the patient treatable, but rather diagnosable. Shunning the bedside, and operating during a period of fluidity between the brain and mind sciences, Southard dedicated much of his short life to exploring the role of brain pathology in mental disease, and the potential for brain research to shape the development of psychiatry as a field. However, a closer look at Southard's neuropathological technique and rhetoric highlights the challenges of applying such knowledge to clinical practice. Knowledge of the brain's gross anatomy and microscopic appearance and the relation of this knowledge to psychopathological conditions, was neither straightforward nor unproblematic. A focus on Southard's neuropathology illustrates that scientific, laboratory-based research does not exist in straightforward relationship to medical practice.

Marcus **Adams** University at Albany, SUNY

Natural Philosophy, Geometry, and Deduction in the Hobbes-Boyle Debate

This paper examines Thomas Hobbes's criticisms of Robert Boyle's air-pump experiments in light of Hobbes's account in De Corpore (1655) and De Homine (1658) of the relationship of natural philosophy to geometry. I argue that Hobbes's criticisms rely upon his understanding of what counts as "true physics." Instead of seeing Hobbes as defending natural philosophy as "a causal enterprise ... [that] as such, secured total and irrevocable assent," I argue that, in his disagreement with Boyle, Hobbes relied upon his view that all of natural philosophy is a mixed mathematical science. In a mixed mathematical science one can mix facts from experience (the 'that') with causal principles borrowed from geometry (the 'why'). Hobbes's harsh criticisms of Boyle's philosophy, especially in the Dialogus Physicus, sive De natura aeris (1661), should thus be understood as Hobbes advancing his view of the proper relationship of natural philosophy to geometry in terms of mixing principles from geometry with facts from experience. In this light, Hobbes need not be taken to reject or diminish the importance of experiment/experience, as he often has by scholars; nor should Hobbes's criticisms in Dialogus Physicus be understood as rejecting experimenting as ignoble and not befitting a philosopher. Instead, Hobbes's viewpoint is that experiment/experience must be understood within its proper place – it establishes the 'that' for a mixed mathematical science explanation.

Zaheeda P. **Alibhai** University of Ottawa

Moving Far and Wide Beyond the Text: The Graeco-Arabic "Translation" Movement and the Making of "Science."

The Graeco-Arabic translation movement has been called one of the most significant pre-modern transfers of knowledge in the world. From a historical, contemporary and epistemological standpoint, the "movement" provides an important case study through which we can apply global patterns of analysis to analyze how diverse ideas from different languages; epistemologies, religions, cultures and worldviews were made compatible with one another and unified into a single language. As such, it provides us with a very early example from the history of science of "the dialogue of civilizations" (Bala, 2006). Drawing on the historical, epistemic and religious context of the Islamic tradition this paper examines the "Graeco-Arabic movement" and argues that it must be re-conceptualized to provide an alternative outlook that sheds important insights into how knowledge from different civilizations was used as a bridge to transcend barriers of difference that included a plurality of worldviews in the "making" of science. This paper concludes by arguing that, a re-conceptualization of the "translation movement" can enable historians of science to go beyond science as a closed world of structure (Taylor, 2007) and move towards a more open and cosmopolitan understanding of science to critically reflect on how to integrate a plurality of worldviews and Indigenous knowledge systems as "science" as Canada moves towards the Next 150 on Indigenous Lands.

Zoe **Ashton** SFU

Perelmanian Proofs and the Room for Audiences in Mathematical Argument

In this paper I argue that there is room for audiences in mathematical proof practice. While argumentation theory has been adopted in the study of mathematical proofs, much of the research has been focused away from the inclusion of audiences. This lack of focus on audiences stems from a claimed distinction between mathematics and arguments. Mathematical proofs are Perelmanian arguments, contrary to Perelman and Olbrechts-Tyteca's own assertion, which must necessarily have audiences and be affected by them. By clarifying Perelman and Olbrechts-Tyteca's definition of demonstration it becomes clear that what they banned from their theory of argument was formal derivations, not mathematical proofs as they are practiced. The acceptance of proof gaps is one area where room is left for audiences. In addition, there is room for audience in two competing conceptions of mathematical proofs: both under Rav's conception of proof as containing irreducible semantic content and Azzouni's derivation-indicator view. By viewing proofs as Perelmanian arguments, we can critically examine the role audiences play in mathematical proof.

Marius **Backmann** Universität Konstanz

Induction and Necessary Connections in Scientific Practice

Some necessitarians have claimed that they could justify induction by introducing necessary connections. By analysing the reasoning in randomised clinical trials (RCTs), I argue that this view does not accurately represent scientific practice. The basic model of necessitarian solutions to the problem of induction is as follows: First we infer from the fact that all Fs have so far been Gs by a (supposedly unproblematic) inference to the best explanation (IBE) that there is a necessary connection between F-ness and G-ness. We then deductively infer from this necessary connection that all Fs are Gs.
Nancy Cartwright and Eileen Munro reconstruct medical research broadly along these lines. First, we infer from evidence that a treatment has a 'stable capacity', i.e. a modal dispositional property, to produce an outcome. From the existence of this stable capacity we deductively infer the efficacy of the treatment outside the test environment.
Against this, I argue that the reasoning in RCTs proceeds differently. We ampliatively infer the causal relevance of the treatment in the sample from the fact that the desired outcome is more prevalent in the test group than in the control group. But the further inference that the treatment will be causally relevant in the population is also ampliative, because we do not have the necessary information to make it deductive. The necessitarian analysis of inductive practice is also inapplicable where there are no modal properties that could be inferred to, as is e.g. in meta-studies.

Tudor **Baetu** University of Bristol

On Pain Experience, Interdisciplinary Integration and Levels of Description, Explanation and Reality

Interdisciplinary models aggregating lower-level biological and higher-level psychological and social causal determinants of a phenomenon raise a puzzle. How is the interaction between the physical, the psychological and the social conceptualized and explained? Using biopsychosocial models of pain as an illustration, I argue that such models are in fact level-neutral compilations of empirical data about correlated and causally relevant factors, and as such they neither assume, nor entail a conceptual or ontological stratification into lower and higher levels. Thus, if inter-level causation is deemed problematic or if debates about the superiority of a particular level of description and explanation arise, these issues are fueled by considerations other than empirical data.

Brian **Baigrie** University of Toronto

IHPST: Stillman Drake's Intellectual Legacy, for IHPST and Beyond

Although Stillman was not involved in its creation, IHPST in many ways is the house that Drake built. My presentation will focus on some of the distinctive features of Drake's work as an historian of science, and discuss how Drake's attention to textual detail and his deep-seated conviction that the scientific revolution was not a philosophical achievement per se but, rather, lessons gleaned from the fusion of experiment and mathematical analysis, was the inspiration for an approach to the history of science (the Toronto style) that made an indelible impression on the many talented historians who flourished at IHPST during the last quarter of the twentieth century.

Hakob **Barseghyan** University of Toronto

Why Would Historians and Philosophers of Science Want to Collaborate?

Despite the continued existence of explicitly integrated History and Philosophy of Science (HPS) departments, there is a notable division between the History of Science (HS) and the Philosophy of Science (PS) evinced by different approaches, methods, and goals. Can HS benefit from a more intentional collaboration with PS, and vice versa? What projects or goals could only be accomplished with such collaboration, and what would success entail? As indicated by recent growth in the digital humanities close to home (e.g. the Newton Project; the Embryo Project) and further afield

(e.g. the Database of Religious History; the Correlates of War), a concerted, collaborative effort between historians and philosophers of science can produce an ambitious database for the history of science, tracking the changes in theories, methods, and communities through time.
But if HS is to start producing organisable data that is semantically meaningful, it needs a unified taxonomy. Further, HS must explicitly formulate the general propositions it uses to explain transitions in science. PS can in turn help to establish the requisite clarity and consistency of terminology by providing a general theoretical framework. By ensuring that this theoretical framework can account for the nuances of science's history, historians and philosophers of science can help to reintegrate HPS, and eventually incorporate HS and PS into the database-driven digital humanities.

Drew Danielle **Belsky** York University

To show improvement": Making medical photographers in post-war Britain

In the immediate aftermath of World War II, the processes of professionalization and specialization in the medical field that had begun around the turn of the century were accelerated, particularly with respect to the proliferation of new technologies. Through articles and correspondence in The Lancet and the British Medical Journal (BMJ), practitioners of medical photography including radiographers, physicians, and professional photographers sought to define not only the role of medical photographs in the practice of medicine, but also the role of medical photographers. Their conversation in the pages of these two prestigious journals is a study in technological self-fashioning. Discourse turned not just around what kinds of photographs were valuable in medicine, but also what kinds of people could best produce them and what material circumstances were required to create such people and artifacts. In carving out a space for photographic technologies in medicine, practitioners defined medical photography in ways that fit their own self-image and professional aspirations as well as their projected hopes for the role of photographic images in post-war medicine.

Joseph **Berkovitz** University of Toronto

On de Finetti's instrumentalist Philosophy of Probability

De Finetti is one of the founding fathers of the subjective school of probability, where probabilities are coherent degrees of belief. De Finetti held that probabilities are inherently subjective and he argued that none of the objective interpretations of probability makes sense. While his theory has been influential in science and philosophy, it has encountered various objections. We argue that these objections overlook central aspects of de Finetti's philosophy of probability and are largely unfounded. We propose a new interpretation of de Finetti's theory that highlights these aspects and explains how they are an integral part of de Finetti's instrumentalist philosophy of probability. We conclude by drawing an analogy between misconceptions about de Finetti's philosophy of probability and common misconceptions about instrumentalism.

Julien **Bernard** Université Paris Nanterre

Le mort dans le corps: personnalisation et réification du cadavre dans un laboratoire d'anatomie

Aujourd'hui, en France, environ 2500 corps sont légués à la science chaque année, ce qui représente environ 0,4 % des décès. Cette communication s'intéresse au rapport aux « corps » donnés à la science qu'entretiennent étudiants, professeurs et chercheurs en médecine. L'observation de Travaux pratiques d'anatomie et des entretiens avec étudiants et enseignants montrent l'existence de diverses formes de mise à distance du « mort dans le corps ». Le rapport émotionnel aux corps fait l'objet de socialisation et de régulation émotionnelle, notamment par abstraction cognitive et ritualisme. Cependant, malgré des formes de réification du mort, s'observent différentes attitudes montrant la résurgence de l'humain dans le cadavre. Plus généralement, les sentiments associés au rapport aux « corps » dépendent de critères culturels établissant la mise en sens de la mort, du devenir post mortem, de l'importance des rituels funéraires « classiques ». Ainsi seulement peut s'organiser une mise en sens de l'activité anatomique, tant du point de vue des scientifiques que de celui des donateurs, de leurs familles et du grand public.

Victor D. **Boantza** University of Minnesota

The Aerial State of Physical and Chemical Affairs: The Early Life of "Permanently Elastic Fluids" from Robert Boyle to Stephen Hales

The notion of a "permanently elastic fluid," which by the late eighteenth century was commonly used by pneumatic practitioners like James Keir, Tiberius Cavallo, and others, encapsulates key aspects of the history of air, as it gradually turned into a chemical species and a physical state of matter. The talk examines the evolution of early conceptions of Air in terms of permanent fluidity and elasticity. The analysis showcases the interplay between theory and practice from Torricelli's exploration of Air's mechanical properties through Boyle's employment of the notion of "springiness" or elasticity, to the subsequent rise to prominence of the concept of fluid, including aerial fluids, based on the work of Isaac Newton. By the 1720s, the notion of elastic fluid, and to a lesser extent the possibility of the existence of different kinds

of airs became relatively common. In the 1730s, in the aftermath of Hales's demonstration that air could be fixed in solid and liquid substances, Newtonian natural philosophers, mathematicians, physicians, and chemists established two main definitions of air. While one denoted sensible atmospheric Air, the other began carving out a theoretical space for understanding air as a physical state. By mid century, increasingly prevalent references to permanently elastic fluids epitomized the culmination of these developments. This reading both complements and complicates the received narrative of the rise of pneumatic chemistry as a predominantly practical story centered on a chain of landmark experiments made possible by technological innovations ranging from the air-pump to the pneumatic trough.

Agnes **Bolinska** and Julie-Anne **Gandier** University of Wisconsin-Stevens Point and University of Toronto

How to Determine Protein Structure: Challenges for Integrative Pluralism

Models of protein structure are predominantly produced using two experimental methods: X-ray diffraction crystallography and solution NMR (nuclear magnetic resonance). Each exploits a different property of the molecule, thus producing a different understanding of protein structure; each also abstracts away different features of the molecule and introduces different sources of error at each stage of the structure determination process.

Mitchell and Gronenborn (2015) argue that the relationship between representations produced by X-ray crystallography and solution NMR is one of integrative pluralism: each technology generates a partial representation of protein structure, so combining data from the two produces an overall better model of protein structure, reducing the underdetermination arising from either method alone.

While such integration is generally possible, we explore an example in which it does not take place. Using the family of hydrophobins as a case study, we show that crystallographic models are sometimes given more evidentiary weight than models produced by solution NMR. As a consequence, the interpretation of data from the latter method is influenced by models produced by the former. Our understanding of protein structure is thus unduly influenced by a contingent factor: an historical preference for models produced by one experimental method, rather than another. We conclude by describing how solution NMR and X-ray crystallography should be given equal evidentiary weight within their respective contexts.

Christian **Bracco** l'Université de Nice

L'environnement scientifique italien du jeune Albert Einstein, de 1895 à 1901

La période 1895-1901 qu'Albert Einstein passe épisodiquement à Milan et à Pavie, dans sa famille, est une période clé pour comprendre ses années de formation et ses premiers centres d'intérêts scientifiques. Elle s'étend de son entrée à l'ETH de Zürich à sa première thèse. Il y retrouve aussi son ami et collaborateur Michele Besso. Nous examinerons les liens du bureau d'ingénieurs de l'entreprise électrotechnique des Einstein, où Albert se prépare à l'ETH, avec le milieu universitaire de Pavie. Nous mettrons en évidence l'influence qu'a pu exercer sur lui l'oncle de son amie Ernestina, le physicien Carlo Marangoni, spécialiste réputé des phénomènes de capillarité. Nous établirons ensuite qu'Albert effectue son travail bibliographique dans la riche bibliothèque scientifique de l'Institut Lombard, Académie des sciences et des lettres, située au palais Brera à Milan. Son accès a pu lui être facilité par Giuseppe Jung, un oncle maternel de Michele. Le contenu de la bibliothèque personnelle de Jung nous livrera au passage des éléments pour apprécier le travail commun de Michele et d'Albert sur la télégraphie sans fil. La mise en perspective des remarques scientifiques, qui apparaissent dans les lettres d'Albert à son amie et futur femme Mileva Marić, avec le fonds de la bibliothèque de l'Institut, nous apportera un éclairage nouveau sur l'orientation de sa thèse en avril 1901 sur les forces moléculaires dans les gaz faiblement comprimés et sur son mode de travail.

Andrew **Brown** York University

What can Science and Technology Studies tell us about ADHD

The classification of Attention-Deficit/Hyperactivity Disorder (ADHD) as a neurodevelopmental disorder is widely accepted by the scientific-medical community. Even so, the syndrome continues to be a source of controversy and debate across a variety of disciplines and fields. The conclusion or answer to these debates is by no means clear. The aim of this paper is to propose why ADHD is thus not only still a worthwhile topic of study, but a severely under-researched one from an empirico-theoretical perspective. To make this argument, I compare and contrast my proposed research with certain strands of literature in the 'field' of Science and Technology Studies (STS), and notably Ian Hacking's (1995) Rewriting the Soul: Multiple Personality and the Sciences of Memory. Both Hacking's work and my proposed work on ADHD focus on 'monolithic' psychological categories referring to specific mental disorders that originated in the Diagnostic and Statistical Manual (DSM). However, I wish to show that I am not merely repeating Hacking's argument in the context of ADHD, but pointing out substantial differences in our approaches to understanding the relation between mental illness and metaphysics. Specifically, I want to highlight how the question of ADHD's 'existence' can be related to historical debates in STS over realism and materiality. I do not mean to suggest that there has been some sort of direct effect of STS

debates on the development of ADHD, but insofar as ADHD is researched and defined by scientists, it is important to think about the role of science in ADHD's constitution.

Kristin **Burnett** and Travis **Hay** Lakehead University

The Hudson's Bay Company, the North West Company and the History of Health Care in the Canadian North after WWII

In 1987, the North West Company's (NWC) purchased the Northern Division of the Hudson's Bay Company (HBC). Using an aggressive strategy of market-share acquisition and building on the foundations laid by the HBC, the NWC expanded and diversified the retailing operations of its 'Northern Store' division over the following years and positioned itself as a primary provider of essential services within Indigenous communities across the provincial and territorial north. Significantly, for the purposes of this study, the NWC began opening retail pharmacies in northern locales in the mid-1990s; more recently, the NWC was awarded pharmacy contracts for public access health information hotlines where 'tele-pharmacists' provide medication information to northern residents who lack access to brick-and-mortar healthcare facilities. In 2009 AMDocs Inc. merged with the NWC to provide primary physician services in northern and rural First Nations. The provision of these services by the NWC builds on the foundations laid by the HBC where the state regularly relied on the company to provide services in the state's absence.

Our paper interrogates these recent retailing operations and provision of health and pharmaceutical services by the NWC as part of a broader history of settler state formation and the making of Canadian healthcare inequality. Building on the work of historian Mary Jane McCallum, we review the multiple meanings and complex histories attached to healthcare provision in regions encoded as Indigenous, northern, remote, and isolated while also placing a particular focus on the way in which tropes of remoteness are recruited by the NWC to construct their profit-making and monopolization of services in northern communities as a benevolent presence in a celebratory rescue narrative.

Matthew **Burns** York University

Reconsidering the Duhem-Quine thesis: a partial resolution of the ambiguity of falsification

The Duhem-Quine thesis states that the refutation of a prediction that is derived from the conjunction of multiple propositions fails to isolate and falsify any part of that system. However, in order to resolve such a falsification problem - by realigning prediction with recalcitrant observation - some component of the falsified system must be isolated and modified. Accordingly, the ambiguity identified by the Duhem-Quine thesis problematizes the rational response to falsification problems. In this paper, it is argued that the orthodox understanding of the Duhem-Quine thesis is incomplete. Conventional conclusions pertaining to the significance of the Duhem-Quine thesis have been compromised by two pervasive and unwarranted assumptions. First, the ambiguity identified by the Duhem-Quine thesis is often conflated with the ambiguity of contrastive underdetermination. Second, it is often assumed that only a single prediction can be derived from a given system of propositions. When these assumptions are corrected, the identifiable logical constraint upon falsification problems can become more rigid than generally assumed. A particular system of propositions may be accountable to numerous observations if prediction can be derived from subsystems of propositions. These additional points of confrontation between prediction and observation add to the complexity of a falsification problem, thereby diversifying the conditions that any successful resolution must satisfy, and logically eliminating problem solving trajectories that would otherwise seem viable.

Christopher **Byrne** St. Francis Xavier University

Aristotle on the Limits of Teleological Explanation in Natural Science

One of the many self-proclaimed accomplishments of the Scientific Revolution was its banishment of teleological explanation from natural science. In so doing, early modern natural philosophers thought they were also refuting Aristotle. Aristotle's use of teleological explanation in natural science, however, was importantly different from the Neo-Scholastic version criticized in the early modern period. This paper considers some of the recent scholarly work in this area and argues that there is more room in Aristotle's natural science for mechanical-physical explanation and less room for teleology than has traditionally been thought to be the case. It also argues that non-teleological physical necessity plays an important role in Aristotle's biology, a conclusion supported by some of the recent work on the relation between Aristotle's physics and biology.

Jiwon **Byun** University of British Columbia

Thomas H. Huxley's Epistemological Project behind Agnosticism

In 1869, Thomas Henry Huxley coined the term “agnostic” because he could not find a proper label for his view. As commonly understood, he endorsed a theory of ignorance or nescience, according to which we cannot know about metaphysical matters due to our conditioned faculties. Yet he also passionately claimed that science is the only way of attaining knowledge. Scholars (including his contemporaries) have been puzzled: how can a humble agnostic declare that so confidently or “unapologetically”? He would have needed to show the reality of axioms of science such as the existence of an external world, which seem to fall under the realm of our ignorance; he should have attacked both scientific and theological assumptions. Huxley’s endorsement of agnosticism has been seen as philosophically naïve and inconsistent.
If we view Huxley’s agnosticism as a theory of ignorance, we cannot understand what he did with it. For example, he used agnosticism to criticize claims that concern what we can know. I will argue that he intended agnosticism to be a guide to knowledge, consisting of an account of evidence and ethics of knowing. To this end, my paper will focus on two points: first, Huxley had an epistemological project of formulating a guide to knowledge that can work regardless of our metaphysical ignorance; second, Huxley thought that science will be the only method for knowledge so long as it strictly follows agnosticism. My interpretation, I believe, helps us understand why Huxley situated agnosticism within the tradition of modern critical philosophy.

Justin **Bzovy** Mount Allison University

Clines, Demes and Species: An Overlooked Source for Scientific Pluralism

Pluralism about important biological concepts has increasingly become the norm. Whether pluralism points to integration or disunity is another matter (Brigandt, 2013). One source for pluralism about scientific concepts is when different theories make use of the same concept. For example, the way “homology” is used in cladistics and evolutionary developmental biology. Another source for pluralism is when one theory uses the same concept in different ways. Throughout the history of biology, the species concept has been governed by different theories, from Aristotle’s teleological essentialism (Lennox, 1987), to Linnaeus’s notion of species in the mind of God, to modern evolutionary theory. About thirty years ago this monistic picture started to be challenged by some biologists (Mishler and Donoghue 1982; de Queiroz and Donoghue 1988) and philosophers (Dupré 1981; Kitcher 1984; Ereshefsky 1992), partly as a way of resolving widespread disputes about species concepts. However, little attention has been given to three earlier and related ways of resolving disputes, all of which are to a certain extent integrative, e.g., Huxley’s (1938) cline, ecocline, geocline and chronocline; Gilmour and Gregor’s (1939) deme, ecodeme, gamodeme, and topodeme; and Cain’s (1954) agamospecies, morphospecies, paleospecies, and biospecies (cf. Winsor 2000). I compare these three integrative approaches to modern debates about pluralism in biology, explain why this earlier source of pluralism might have been overlooked, and connect the aims of these approaches to those of contemporary hierarchical accounts of the species category (de Quieroz 1999, Mayden 1997).

Antoine **C. Dussault** University of Toronto and Paris I

The Ecosystem Health Research Program and its Theoretical Underpinnings

My goal will be to draw the theoretical underpinnings of the ecosystem health research program which crystallized in the works of the economists and ecologists David Rapport and Robert Costanza during the 90s. I will start with a brief historical reconstruction of the development of this research program and of its reception in environmental ethics as an idea around which the project of achieving a mutualistic symbiosis between human activities and the functioning of ecosystems could be articulated. Then, I will present the “VOR index” elaborated by Robert Costanza and which characterizes ecosystem health as the mathematical product of an ecosystem’s vigor (V), organization (O) and resilience (R). My main contribution will be to indicate how this index is derived from the theoretical work of the ecosystem ecologist Robert Ulanowicz on the notion of ascendency, which continues Eugene Odum’s work on the alleged trends which characterize the normal development of ecosystems. Ulanowics’s main claim is that the tendency of ecological interaction networks to form auto-catalytic loops generates a form of ecological-level teleology, directed towards an increase of those interaction networks’ vigor and organization. This will lead me to consider two challenges which the ecosystem health notion faces given its grounding in Ulanowicz’s theorizations: 1) The contingency and historicity objection, which casts doubts on the possibility of formulating general laws characterizing the dynamics of ecosystems; and 2) The heretical teleology objection, which recalls the incompatibility of the idea of teleology at supraorganismic levels of organization with orthodox Darwinian biology.

Anjan **Chakravartty** University of Notre Dame

The Many Faces of Scientific Pluralism

It is perhaps fitting that the notion of pluralism regarding scientific knowledge admits of a number of variations. This talk has two aims. The first is to make some distinctions between different forms of pluralism, which seems a crucial starting

point for understanding how specific proposals for pluralism bear (or do not) on both epistemological issues (e.g. concerning whether scientific knowledge is unifiable in principle, or rather disunified), and metaphysical issues (e.g. concerning whether aspects of the world itself must be thought of as, in some sense, disunified). Here I will suggest that purely methodological forms of pluralism – ones that simply advocate the use of different approaches or forms of investigation to ostensibly one and the same subject matter – do not by themselves entail any conclusions regarding the epistemology or metaphysics of science. To derive such conclusions, substantive assumptions must be added which take the relevant forms of pluralism beyond the merely methodological. The second aim of the talk is to evaluate whether the substantive assumptions added by different advocates of pluralism are, in fact, well supported. Here I will contend that most such advocates fail to provide this kind of support. More positively, however, the possibility of doing so remains open, and I will conclude by considering some prospects for progress on this front. Authors considered will include Helen Longino, Sandra Mitchell, and Kenneth Waters.

Marc **Champagne** Trent University

Inferring exoplanets, inferring exominds

Planets orbit our sun, so it takes a modest induction to infer that planets orbit other stars. Recently, planetary scientists have devised ways to confirm this probable inference by tracking the slight variations that planets cause in their respective star's radial velocity. This research is driven in part by the hope of discovering a planet suitable for eventual colonization (Seager 2013), but another motivation can be to contact intelligent neighbours. Such METI (Messaging To Extra-terrestrial Intelligence) research has never enjoyed this much support (Zaitsev 2008). To ascertain the likelihood of civilizations capable of receiving detectable signals, scientists use the Drake Equation. Although the numerical values entered into this formula remain the object of debate (Vakoch and Dowd 2015), one of the hurdles to be crossed is the number of stars orbitted by planets. Naturally, the more exoplanets we find, the more likely it is that "exominds" await our messages. Although there is presently no well-confirmed test against which to check the design of interstellar messages, I argue that a step in the right direction is to recognize that logical reasoning does not have to be couched in a symbolic notation. In diagrammatic reasoning, for instance, inferences are underwritten by transformations of signs whose parts mimic the relations between the parts of their object (Legg 2013). Since diagrams are less dependent on convention and might be generalized to cover non-visual senses (Pietarinen 2010), I argue that it is more promising for METI researchers to employ some form of diagrammatic reasoning.

Melissa **Charenko** University of Wisconsin-Madison

Paleo Perspectives on the Nature of Historical Change

In the first decades of the 20th century, a number of prominent ecologists began to describe a new focus in ecology: "paleoecology," which was concerned about the "environic relations" of the deep past. Paleoecologists sought to describe ecological changes over the past few thousand years and to extend ecological study all the way back to the late Mesozoic (66 million years ago). This paper examines the strategies that ecologists used to expand their gaze, and the consequences of a broader time frame as they interpreted some of most pressing ecological and social problems of their day. I find that as ecologists interpreted past conditions, they promoted different theories of history, particularly different ideas about direction and periodicity of historical events, which led to different interpretations of ecological phenomena. These differences are particularly clear when ecologists interpreted events like the Dust Bowl, and influenced ecologists' visions of the predictive capacity of ecology more generally.

Alexandre **Charrier** Université Paris Nanterre

Le Moi peut-il être sauvé ? E. Mach et le débat contemporain

En 1886, Ernst Mach écrivait dans L'Analyse des sensations que « le Moi ne peut être sauvé ». Ce n'est pas la première fois, dans l'histoire de la philosophie, que cette notion fait l'objet sinon d'une critique vigoureuse (celle de Nietzsche par exemple), du moins d'un scepticisme sévère (comme celui de Hume). La portée de l'énoncé machien tient d'abord au contexte dans lequel il est formulé : celui du naturalisme grandissant au XIXe siècle, qui tente d'appréhender l'esprit et les phénomènes mentaux par le biais de la physique et de la biologie. Le concept de Moi se trouvant par principe évincé de l'explication des phénomènes de la vie mentale, puisqu'en contraction directe avec la nature des éléments et déterminations au fondement de notre expérience. Elle tient ensuite à la manière dont l'énoncé est formulé, puisqu'il semble interpeller en creux notre désir de chercher à maintenir cette notion métaphysique quand il faudrait l'abandonner. Si le monisme neutre que défend Mach s'est essoufflé au XXe siècle, le projet épistémologique qu'il portait (celui d'une unification des sciences) demeure prégnant, et le débat contemporain autour de la notion de Soi (self) en philosophie de l'esprit semble devoir plus que jamais se cliver autour de cette sentence machienne. Plus encore, l'intérêt de la pensée d'E. Mach, c'est peut-être d'enrichir d'une perspective pratique l'appréhension strictement épistémologique de ce problème, en demandant indirectement au moins pourquoi nous voudrions irrémédiablement sauver le Moi.

Christine **Chisholm** Carleton University

Drugs, Prosthetics, and Toddlers – How science shaped the lived experiences of Canadian thalidomiders

The proposed talk will discuss the immense impact of the teratogenic drug thalidomide on families in Canada and the ways that science, which had once failed mothers and babies, was once again recruited in helping to resolve the problems now faced by these families. In the late 1950s and early 1960s, the drug was prescribed to pregnant women and its use resulted in babies born with severe physical disabilities. While the product was advertised as being "completely safe," it instead caused a range of severe birth defects including phocomelia, a form of severe limb malformation. The Canadian press and even a Member of Parliament referred to the children born with these disabilities as "monsters." Next to no academic research about these Canadians who can contribute important insights into the lived experiences of individuals with physical disabilities has been produced. The talk will consider how Canadian officials and medical professionals aimed to help resolve the "scandalous" consequences of a poorly tested drug with scientific advances in prosthetics and rehabilitation strategies. This oral history-based research aims to demonstrate how science and everyday lived experience are inextricably linked in the lives of Canadian thalidomiders.

Vincent **Citot** Université Paris Sorbonne

Le rôle de la philosophie dans l'émergence des sciences humaines dans l'Europe, la Chine et le Japon du XVIIIe s

celles-ci ne prennent leur autonomie épistémologique puis institutionnelle au cours du XIXe s., les grands philosophes du XVIIIe s. ont joué un rôle déterminant dans les débuts d'une réflexion de nature sociologique, anthropologique, psychologique, historique, économique, ou encore linguistique. S'agissant de la pensée "occidentale", la sociologie et l'anthropologie doivent par exemple beaucoup à Voltaire (Essai sur les mœurs et l'esprit des nations), Montesquieu (De l'esprit des lois) et Hume (Essai sur la règle du goût) ; la psychologie a une dette envers Hume (Traité de la nature humaine, Enquête sur l'entendement humain, Dissertation sur les passions), Diderot (Lettre sur les aveugles), Condillac (Traité des sensations) et Smith (Théorie des sentiments moraux) ; l'économie envers Mandeville (La fable des abeilles), Hume (Essai sur la balance), Smith (La richesse des nations) et Condillac (Le Commerce et le gouvernement) – pour s'en tenir à quelques références. Or il se trouve qu'une impulsion décisive en direction d'un discours de type sociologique, historique, psychologique ou linguistique est donnée par les philosophes chinois de la fin du XVIIe s. et du début du XVIIIe s., tels que Gu Yanwu, Wang Fuzhi, Liu Xianting, Hui Dong et Dai Zhen. Leurs contemporains japonais Arai Hakuseki, Dazai Shundai, Aoki Kon'yô, Tominaga Nakamoto et Miura Baien jouent eux aussi un rôle fondamental dans la naissance des savoirs positifs (en histoire, en sociologie, en économie et en linguistique). Il s'agirait donc de comparer ces évolutions intellectuelles pour dégager certaines hypothèses sur le rôle de la philosophie dans l'apparition des sciences de l'homme et sur les effets de l'autonomisation de ces sciences sur la production philosophique.

Julie **Clauss** Strassbourg

Refaçonner les frontières diagnostiques. L'introduction du diagnostic de schizophrénie à la Clinique Psychiatrique Universitaire de Strasbourg (1922 -1932)

Les classifications des maladies psychiatriques sont multiples en même temps qu'elles sont régulièrement remaniées au cours du temps. Cette instabilité doit avoir un impact sur les diagnostics posés, puisque les psychiatres ont recours aux nosographies lorsqu'ils cherchent à nommer les troubles présentés par un patient. La compréhension de cet impact peut s'articuler autour d'une situation historique précise : l'introduction du diagnostic de schizophrénie à la Clinique Psychiatrique Universitaire de Strasbourg entre 1922 et 1932. Le concept diagnostique de schizophrénie a été évoqué pour la première fois par le psychiatre suisse Eugène Bleuler en 1908 à l'occasion de la réunion annuelle de l'Association Allemande de Psychiatrie à Berlin. A la Clinique Psychiatrique Universitaire de Strasbourg, institution « frontière » entre l'Allemagne et la France, ce concept commence à être utilisé par les psychiatres à partir de 1922. Comment ce concept est-il venu s'implanter dans le paysage nosographique « pratique » préexistant ? Il est venu prendre le relais du diagnostic de démence précoce, qui alors qu'il était encore très utilisé en 1922 ne l'est quasiment plus au début des années 1930. Cependant, la situation s'avère être plus complexe. Dans le même temps, d'autres notions diagnostiques ne sont plus autant utilisées ou alors, à l'inverse, le sont d'avantage. C'est donc un remodelage plus général de la cartographie diagnostique dans le domaine des pathologies psychotiques qui s'est alors opéré. Les frontières nosographiques « pratiques » à la Clinique Psychiatrique Universitaire de Strasbourg ont été ainsi refaçonnées selon une dynamique double, diachronique et synchronique.

François **Claveau** Université de Sherbrooke

Evaluating socioeconomic expertise: central banks in the post-2007 era

This paper uses a conceptual framework from social epistemology to evaluate whether central banks in the post-2007 era have the appropriate characteristics to be trustworthy experts in their own domain of specialization (mainly monetary policy).

The conceptual framework is inspired by Helen Longino's norms allowing for a self-correcting epistemic community. The empirical material combines information on the structural characteristics of central banks with computer-assisted text analysis to uncover research patterns in central banks.

I argue that central banks achieve laudable performance on dimensions such as transparency and the existence of venues for structured criticism, but that two issues are worrying: first, bias in the selection of research topics and, second, conflicts of interest that could hinder opinion reversals. I illustrate these issues with the question of whether we should rethink the degree of independence of central banks in the post-2007 era. Although the question is entertained in mass media, central banks themselves do not do research on the topic. Furthermore, highly ranked officials in central banks are unlikely to be willing to change their mind on this topic given that they greatly benefit from their status as independent technocratic experts. The conclusion of the paper reflects on ways to break the intellectual oligopoly of central banks on issues of monetary policy in order to fulfill to a greater degree the norms for a self-correcting epistemic community.

Kasey **Coholan** York University

Potential: Rendering the Body as Machine

This paper explores the relationship between the technoscientific notion of potential and the ways we have come to understand, see and seek the self. Once reserved for the work of 19th-century physicists studying the thermodynamic principles of energy, entropy and labour, today, potential, is uncritically used to describe, evaluate and understand both society and self.

By first looking at the etymology of potential as a noun and understanding this in conjunction with the birth of thermodynamics and then at the practices of chronophotography by Étienne-Jules Marey and stop-motion photography by Eadweard Muybridge the paper aims to answer such questions as: What is the relationship between potential as latent energy in science and technology and as potential as latent possibility in the human body? In the late 19th-century what were the practices and objects used both to assess and to form the potential self?

David **Colaço** University of Pittsburgh

The Interaction of Technique and Data: Insights from neural microscopy

As a result of technical advancements in microscopy, researchers now have the ability to collect increasingly large and complex data sets related to neural systems. In this presentation, I investigate the interaction between the use of techniques and the collection of data in this cutting-edge research, and the driving roles data and technique play in research where a theory of the target system often has yet to be developed. I focus on the studies that have followed the introduction of the preparation technique CLARITY, which makes biological tissue transparent for the purposes of optical and fluorescent imaging. This technique allows researchers to view the structural relationships between neurons, and the findings from these studies provide knowledge of the neural 'mesoscale'. Mesoscale knowledge connects low-level findings from neurobiology and high-level findings from cognitive neuroscience, and thus is considered to be critical for integrating data from these fields. However, theorization of mesoscale biological systems is underdeveloped due to issues in investigating it. These issues are resolved by CLARITY. In cases like these, there may be no theory of the system to be tested, and no wellformulated hypotheses to confirm. Instead, the function and theoretical background of the technique are used to characterize the findings, while analysis of the data draws upon data modeling strategies. I explore the differences of the roles of technique and data, to determine how the two complement one another in research that departs from a theorydriven paradigm.

Samantha **Copeland** Norwegian University of Life Sciences

Strategic Serendipity: Inferences and Institutions that Enable Scientific Discovery

'Serendipity' is a term that highlights discoveries that occur at the intersection of chance and wisdom. Two kinds of inferences occur in instances of serendipity: (1) Someone infers the potential value of something unexpected; the classic example of this is Fleming's insight that the accidental contamination of a petri dish with P. notatum was a valuable finding. (2) Someone unexpectedly infers the value of some previously made finding; for instance, the valuable pain-inhibiting effects of nitrous oxide were not the first use for this 'laughing gas'. Chance can occur at any time, or many times, during a discovery process, but it is the presence of one of these 'unexpected' inferences that makes a case of serendipity.

In this paper, I examine the nature of these unexpected inferences through the lenses of strategic abduction (Paavola) and the defeasibility of inferences. I then widen the scope of 'strategy' by looking to work done in organizational theory—in particular, I utilize Sarasvathy's analysis of effectual, in contrast to causal, thinking (2001). Serendipity occurs in conjunction with contextual factors such as timeliness, contingent networks of epistemic agents, and anomalies. Therefore, I argue, the relevant inferences are strategic, contextual, and multidirectional (forward, backward, and lateral). The inferences involved in serendipity emerge out of the processes of discovery in science, rather than predicting or planning for a particular discovery. In the concluding section, I draw out implications of my analysis for current debates about how innovative science and scientific discovery can and ought to be encouraged.

Kathleen **Creel** University of Pittsburgh

Incompressible Patterns: CRISPR vs. Dennett

Dennett's classic paper defines "Real Patterns" as present in data if "there is a description of the data that is more efficient than the bit map, whether or not anyone can concoct it." (Dennett 1991, 34) However, compressibility is not the right criterion for pattern realism. A better pattern ontology is one based on informational relationships between the pattern and the perceiver of the pattern, whether human, biological, or machine.

A simple compression algorithm such as Huffman coding should be perfect for Dennett's purposes. It can compress text into an efficient lossless binary tree in which letters are assigned unique codes based on their frequency. Instead, Huffman coding illustrates the problem with compression as a metric: lack of generalizability. If the algorithm were only used once, it could compress a novel into one character: "W" for all of War and Peace. But this would be no informational savings. What makes compression work is that the "cost" of the compression algorithm is amortized over many uses.

Further, any discrete chunk of randomness can be recognized as a pattern if it has the right informational relationship with its recognizer. Such recognition relationships between random sequences and detectors occur in our genetic material. New tools for genetic manipulation such as CRISPR use a recognition relationship with sequences of base pairs to snip and replace precise segments of DNA. Using case studies, I suggest that we should think of patterns as representing the informational relationship between pattern and recognizer.

Hortense **de Villaine** Université Paris Nanterre

L'épiphénoménalisme et la naturalisation de la conscience

En 1870, le philosophe Shadworth Hodgson formule pour la première fois la thèse de l'épiphénoménisme, qui stipule l'incapacité des phénomènes mentaux à agir sur le cerveau afin d'initier une action volontaire. Cette thèse a été reprise et rendue célèbre par Thomas Henry Huxley, dans le contexte du naturalisme scientifique victorien. Ainsi, en raison de la clôture du monde physique sur lui-même et de la loi de conservation de l'énergie, on ne voit pas comment une entité immatérielle, qu'elle soit nommée volonté ou conscience, pourrait être la cause de nos comportements. Huxley définit donc l'homme comme un « automate conscient » : toutes ses actions sont explicables de manière purement mécanique et la conscience n'est qu'un accompagnement ou symptôme subsidiaire du fonctionnement cérébral. L'épiphénoménisme, en position de force à la fin du dix-neuvième siècle anglais, a toutefois subi de plein fouet l'effritement du culte de la science et le déclin du naturalisme scientifique qui le portaient. Pourtant, le progrès des neurosciences et le développement des sciences cognitives ont remis cette thèse sur le devant de la scène. L'épiphénoménisme est certes parfaitement indésirable et totalement contraire au sens commun, mais il se présente comme une conséquence nécessaire de toute conception visant à naturaliser l'esprit. S'il est souvent présenté comme un risque ou comme l'écueil que doit à tout prix éviter une solution matérialiste au mind-body problem, de nouvelles voies s'élèvent pour le défendre. La naturalisation de l'esprit impliquera-t-elle l'exclusion définitive des phénomènes mentaux de la chaine causale ?

Eric **Desjardins** University of Western Ontario

Novel Ecosystems: Do they Really Lower the Bar?

This paper analyses the notion of novel ecosystem and one of the concerns that surround this notion in restoration ecology and conservation biology. Introduced at the end of the 20th century to highlight the fact that many ecosystems are shifting toward new compositions and regimes due to human influence, the notion of novel ecosystems has since been the target of criticisms that denounce the lack of conceptual clarity and worry that it will be used as a licence to trash nature instead of finding mitigation solutions for habitat and biodiversity degradation. But what is the ground for thinking that this is the case? Underneath this criticism lies a certain number of assumptions about what it implies to promote novel ecosystems. This analysis focuses on one of them, namely the belief that the promotion of novel ecosystem necessarily means that historical fidelity becomes futile and as such offers a reason for policy-makers to "lower the bar" of conservation and restoration efforts. In visiting this debate, this paper shows that although there are

good reasons to believe that novel ecosystems are not by themselves good enough for conservation purposes, it is only in a very trivial sense that novel ecosystems necessarily lower the bar. In conclusion, I will suggest that the issue lies not so much in the promotion of novelty per se, but in a form of novelty that would fail to contribute to the good functioning of social-ecological systems.

Justin **Donhauser** University of Western Ontario

Informative Ecological Models without General Ecological Forces: a reply to Sagoff (2016)

Leading environmental advisory organizations have bestowed ecology a guiding role in public policy and resource management decision-making, and look to ecologist to provide objective guidance for increasingly urgent political, ethical, and resource management decisions. It is thus important to examine ecology's conceptual foundations and clearly articulate how methods in ecology can and cannot inform such decision-making. In view of this, Mark Sagoff (2016) examines widely-used model-based ecological methods, and argues that those "theoretical" methods rely on problematic metaphysical assumptions and cannot usefully inform practical decision-making. In critical response, I show: Sagoff's interpretation of the workings of such model-based methods is misguided, the main threads of his overall argument are problematic, and his substantive conclusions are therefore unfounded. In the course of doing so, I also make plain numerous ways the model-based methods he criticizes can be, and have in fact been, usefully informative.

Corinne **Doria** Université Paris 1-Panthéon-Sorbonne

Objectifying the Subjective: Norms and Standards in Ophthalmology and the Epistemological Status of the Visio

During the second half of the 19th century, ophthalmology develops itself as a medical specialty in many European countries. This process comes along with the introduction of standards defining the normal eyesight and the characteristics of the normal eye under both the anatomical and the physiological perspectives. The notion of emmetropia, defining the vision of a normal eye, is formulated in 1864 by the Dutch ophthalmologist Francis Donders. International standards are also adopted in this time period for far-sightedness and near-sightedness (Snellen 1875, Parinaud 1909), as well as for optical lenses (Bruxelles, 1875).
In order to establish these norms, physicians went through many debates, mostly related to the difficulties of objectifying and expressing into mathematical terms a subjective and changing sense as the eyesight.
This paper aims to question the epistemological stakes of norms and standards in ophthalmology and to engage a broader reflection about measurement and quantification of the perception.

Travis **Dumsday** Concordia University of Edmonton

Dispositionalism, Naturalism, and the Irreducibility of Determinable Properties

Dispositionalism is the theory that there exist irreducible dispositional properties (causal powers). Metaphysical naturalism involves, minimally, a commitment to the following proposition: the only individual objects in existence (past and present) are physical objects. Its advocates thus affirm that there are no non-physical objects (no God, no angels, no Cartesian egos, etc.). Determinable properties are distinguished from determinate properties: 'shape' is a determinable, 'square' a determinate; 'colour' a determinable, 'scarlet' a determinate, etc. The question of the existence of determinable properties is controversial. Some argue that any determinable property is reducible to (or outright eliminable in favour of) a disjunction of determinates, or a partial identity obtaining between conjunctive universals. Advocates of this sort of view include Armstrong (1978), Heil (2003), LaBossiere (1996), and Gillett & Rives (2005). Defenders of the irreducible reality of determinables include Armstrong (1983; 1997), Christensen (2014), Elder (1996), Ellis (2001), Fales (1982; 1990), Franklin (2015), Johansson (2000), and Wilson (2009; 2011; 2012). Among those cited, there are dispositionalists on both sides of the debate. My claim is that dispositionalists should only be found on the pro-determinables side — or rather, dispositionalists who also affirm metaphysical naturalism should only be found on that side. So:
Premise 1 If dispositionalism and metaphysical naturalism are both true, then there are irreducible determinable properties.
Premise 2 Dispositionalism and metaphysical naturalism are both true.
Conclusion Therefore, there are irreducible determinable properties.
Given that dispositionalism and naturalism are both commonly held, my focus here is on defending premise 1.

Lucas **Dunlap** Western University

Naturalized Metaphysics and Fundamental Physics

Since Ladyman and Ross's seminal book Every Thing Must Go, the project of uncovering a metaphysics of science from our fundamental physical theories has been pursued. This approach is known as "naturalized" or "scientific" metaphysics, and claims to be superior to traditional analytic metaphysics in that it hews very closely to our best physical theories, rather than proceeding from scientifically unjustified a priori principles. The most successful and widely

discussed approach to naturalized metaphysics is ontic structural realism (OSR), which holds that the modal structures identified by our fundamental physical theories are the features of theories about which we should be realists, and we should abandon the a priori assumption that entities are part of the fundamental ontology of the world.
While the motivation is admirable, I argue in this paper that it is often not so clear what counts as the foundational structure identified by our fundamental physical theories. I take the example, frequently cited in the OSR literature, of quantum mechanics. Most OSRists take the structure identified by quantum theory to be the properties associated with the standard model of particle physics. However, there is a parallel tradition of interpreting quantum theory in terms of its information-theoretic properties, which leads to a very different picture of what the basic structure of the theory is. This example serves to demonstrate an under-appreciated challenge for naturalized metaphysics. However, it is not fatal to the project. I conclude by suggesting ways this difficultly can be accommodated.

Andrew **Ede** University of Alberta

Wilhelm Reich: Visions of a Science of Life

In 1957, Wilhelm Reich died in prison, convicted of fraud by the US Food and Drug Administration for selling orgone energy accumulators and writing about orgone energy. It was the tragic end of a life full of disappointments and rejection. As a young man, Reich was a colleague of Sigmund Freud but later was barred from the psychoanalytic world by Anna Freud. His major ideas about psychology revolved around a form of vitalism or concept of an energy of life which was best seen in sex. He even extended his psychology to the political realm, arguing that Fascism (and later Communism) were neurotic belief systems because they suppressed sexual needs. Reich's work has been dismissed as pseudoscience, but re-evaluating his work reveals a much more complex story than the lack of a physical foundation for his theory of life energy. Reich's story illuminates the complexity of the elusive psychology of mind that was being investigated in an historical moment of rapid change.

Sepehr **Ehsani** University of Toronto/MIT

A framework for philosophical biology

Advances in biology have mostly relied on theories that were subsequently revised, expanded or eventually refuted using experimental and other means. Theoretical biology used to primarily provide a basis to rationally examine the frameworks within which biological experiments were carried out and to shed light on overlooked gaps in understanding. Today, however, theoretical biology has generally become synonymous with computational and mathematical biology. This could in part be explained by a relatively recent tendency in which a "data first", rather than a "theory first", approach is preferred. Moreover, generating hypotheses has at times become procedural rather than theoretical. This situation leaves our understanding enmeshed in data, which should be disentangled from much noise. Given the many unresolved questions in biology and medicine, it seems apt to revive the role of pure theory in the biological sciences. This paper makes the case for a "philosophical biology" (philbiology), distinct from but quite complementary to philosophy of biology (philobiology), which would entail biological investigation through philosophical approaches. Philbiology would thus be a reincarnation of theoretical biology, adopting the true sense of the word "theory" and making use of a rich tradition of serious philosophical approaches in the natural sciences. A philbiological investigation, after clearly defining a given biological problem, would aim to propose a set of empirical questions, along with a class of possible solutions, about that problem. Importantly, whether or not the questions can be tested using current experimental paradigms would be secondary to whether the questions are inherently empirical or not. The final goal of a philbiological investigation would be to develop a theoretical framework that can lead observational and/or interventional experimental studies of the defined problem.

Einar **Engström** York University

Giving Voice to Stars: A Postphenomenological Investigation into Data Sonification in Astronomy

Phenomenologist and philosopher of science and technology Don Ihde proposes, "If a movement is possible that gives visibility to the unseen, and a countermovement that gives voice to the mute is possible, a closer listening to the auditory dimension itself is called for." For four centuries, the movement giving visibility to the unseen has sustained paradigm after paradigm in astronomy. Today, ubiquitous computational and acoustic technologies make the countermovement of giving voice to the mute possible, as evidenced by emerging uses of data sonification software. Yet, visual technologies remain the preferred tool of representation in the space sciences. Here it is argued that one factor in visualism's continued dominance is that astronomers lack the skills required to do work in the auditory dimension. That is to say, astronomers may have difficulty apprehending the significance of the content of sound objects in relation to the celestial objects represented—even while they find no difficulty conceptualizing the latter within a visual-perceptual framework. How might sound also be made to contribute to the production and dissemination of astronomical knowledge? This paper uses the tools of postphenomenology to examine the techniques and instruments involved in sonification, the

"embedding" of these instruments in the wider contexts of astronomy, and the "embodying" of sonification practices from the subjective listener's perspective. Following this analysis, a range of skills potentially beneficial to the adoption of sonification in astronomy are suggested, including but not limited to consideration of the social and cultural dimensions of sound in relation to outer space.

Philip **Enros**

The Origins of the IHPST

The University of Toronto's Board of Governors approved the creation of an Institute for the History and Philosophy of Science and Technology fifty years ago, in 1967. That year is commonly taken to mark the beginning of the Institute. However, the emphasis on 1967 tends to mask the fact that the effort to set up a program of study in the history of science took place over a much longer period of time. It began four years earlier, in 1963. And it would take another two years before the Institute was able to conduct its own degree programs in 1969. The activity that led to the establishment of Canada's first graduate program in the history of science involved the interaction of the newly emerging discipline of the history of science, the practices of the University and the perspectives of Toronto's faculty. This presentation reviews that effort and its background. The story of the IHPST's origins adds to our understanding of how the discipline of the history of science was institutionalized in the 1960s, as well as how new programs were formed at that time at the University of Toronto.

Adrian **Erasmus** The University of Johannesburg

Inductive Risk and Extrapolation in Medicine

The rise of the evidence-based medicine movement has led to a standard model of medical extrapolation – inferring probabilistic information about target populations and individual patients from population studies. Two problems with medical extrapolation are determining the quality and amount of evidence required for an extrapolation to be accepted, and whether or not the standard model of extrapolation satisfies these requirements. I defend the view that the degree of confirmation required for the acceptance of a scientific hypothesis is determined by value judgements of the consequences of wrongly accepting or rejecting the hypothesis. This view can be extended to medical extrapolations, where evidence gathered in population studies is used to infer outcomes and effect sizes in target populations and in individual patients. I argue that medical extrapolations are greatly afflicted by inductive risk and therefore non-epistemic values play a significant part in determining the quality and quantity of evidential support necessary for the acceptance of medical extrapolations. After explaining the structure standard model of extrapolation, I claim that, since the consequences of wrongly accepting or rejecting medical extrapolations are serious, the degree of confirmation required for accepting standard extrapolations is high. Extrapolations made using the standard model do not meet these evidential requirements, especially when it comes to how much evidence we have for the necessary assumptions for extrapolations to hold. Because of this, the standard model of extrapolation in medicine is untenable and different methods for inferring outcomes and effect sizes in target populations and individual patients are needed.

Erlantz **Etxeberria** University of Western Ontario

Monistic Account of Explanations and Explanatory Depth

Woodward (2003) has put forth a theory of causal explanation according to which an explanation consists of providing systematic patterns of counterfactual dependence between the explanandum and the explanans. While initially restricted to causal explanations, there have been some attempts to extend Woodward's counterfactual account to explanations that do not cite causes, such as mathematical or geometrical explanations (see for instance Bokulich 2008, Saatsi and Pexton 2013, Reutlinger forthcoming). The merit of such attempts is their ability to provide a monistic account of explanation by locating the common element to all kinds of explanations. However, if providing counterfactual patterns is all it takes to explain, explanations are too liberal, for counterfactual relations can be symmetric whereas explanations are not. For example, in the case of the flagpole and its shadow, it can be argued that there is a symmetric counterfactual pattern between the length of the shadow and the height of the flagpole. Yet, the length of the shadow does not explain the height of the flagpole. A possible answer is that there is a causal asymmetry between the two elements—the flagpole causes the shadow but not vice versa—which would ultimately make the explanation asymmetric. I argue that this move is not warranted in a monistic account of explanation due to its reliance on counterfactual relations. Instead, I propose to focus on a notion of explanation that would allow for degrees of explanatory depth.

Jacqueline **Feke** University of Waterloo

Ptolemy's Epistemology of Geography

Claudius Ptolemy, the second-century mathematician, is remembered most of all for his contributions in astronomy, but just as influential was his Geography, a lengthy treatise, the majority of which consists of a catalogue of approximately

eight thousand localities and their coordinates, which he intended to be drawn on a map of the known part of the world. With its inordinate focus on the production of an image—one that, in conveying the appearance of the globe, is not even mathematically consistent—the Geography appears to be an outlier in Ptolemy's corpus. In this talk, I aim to illuminate the epistemology of Ptolemy's geographical project. I will analyze Ptolemy's discussions of the methodology, as well as the limits and constraints, of geography, its unique aim, and its proper style of exposition. Moreover, I will bring the epistemological features of Ptolemy's geography into conversation with his philosophy in the Almagest and Harmonics.

Anthony **Ferreira** Université Paris Nanterre

Addiction: quelles visions du monde pour quelle naturalisation ?

Le concept d'addiction, comme maladie, est élaboré fin 18ème siècle par B.Rush, un des pères fondateurs de la démocratie américaine. Il s'oppose à la vision d'un alcoolique dépravé. C'est le produit qui est à l'origine de la perte de liberté de son consommateur. Au 19ème siècle, l'origine est recentrée sur l'addict, son corps en porte la responsabilité. Les individus se trouvent intrinsèquement inégaux face au risque d'addiction. Au 20ème siècle, l'incapacité à résister au désir est mise au centre de sa définition. La perte de contrôle, l'inefficacité de la volonté, vont en parallèle avec la naturalisation du phénomène. C'est la physicalisation de la volonté et du désir qui se joue et cette naturalisation pose la question de la liberté.
Nous verrons que la conception de l'addiction comme maladie qui participe de sa naturalisation, veut aussi, à l'origine, protéger et déculpabiliser l'individu. Il est aussi question de protéger la société, puisque tout au long de l'histoire de l'addiction, c'est l'enjeu des rapports entre individu et société qui se joue. Non pas uniquement en toile de fond, mais parce que sa naturalisation touche à des questions comme la responsabilité, l'égalité et la liberté. Le débat contemporain maladie/non-maladie est particulièrement brûlant dans le monde américain, le libre arbitre en est un thème central. Il est plutôt secondaire en France, quoi que nous disposions des mêmes données scientifiques. Deux sociétés dont, justement, le rapport à la liberté est assez différent. Le point de vue scientifique, (scolastique selon Bourdieu), porte et est porté par une vision du monde.

Craig **Fraser** University of Toronto

The History of the IHPST: 1980 to the Present

The Institute for the History and Philosophy of Science and Technology was established at the University of Toronto in 1967, and by 1970 had assumed full status as an active academic unit with a doctoral program and a range of graduate and undergraduate courses. Subsequent points of note in the development of the Institute include the emergence of philosophy of science in the core faculty, the administrative move from the School of Graduate Studies to the Faculty of Arts and Science, increasing involvement with Victoria College undergraduate courses and programs, and the identification of science and technology studies as a field of interest. The talk provides an overview of the history of the IHPST and an insider's perspective on its development.

Doreen **Fraser** University of Waterloo

Quasi-particles as a template for 'particles' in QFT

The consensus view among philosophers of physics is that relativistic quantum field theory (QFT) does not have an ontology that includes particles as fundamental entities. This assessment is apparently at odds with the facts that (1) QFT is the theoretical framework for the Standard Model of particle physics, which presents a taxonomy of particle species (e.g., electron, photon, quarks, neutrinos) and (2) experimental tests of QFT (such as at the Large Hadron Collider) are described in terms of the collision of particles and the discovery of the existence of particles. Historically, the mathematical formalism associated with 'particles' in QFT was borrowed by solid state physics in the 1950's and led to the introduction of quasi-particles (Blum and Joas 2016). Quasi-particles (e.g., phonons) are not part of the fundamental ontology of solid state physics; they are recognized as emergent entities that reflect collective phenomena. It has been suggested that quasi-particles in solid state physics supply a template for the ontological status of particles in QFT as emergent entities (Wallace 2001). In this paper I will argue that this interpretation of QFT is problematic because relativistic considerations played a load-bearing role in the arguments against a particle interpretation of QFT in the first place and the solid state physics models are non-relativistic. I will also suggest an alternative understanding of the relationship between quasi-particles and 'particles' in QFT.

Fermin C **Fulda** Western University

Being Natural: Three Grades of Naturalistic Involvement

Naturalism is the view that reality is exhausted by the immanent, self-contained space of causes that science describes using empirical methods. To be a naturalist about x is to believe that x has a place in this space. Philosophers of a

naturalistic persuasion seek to naturalize mental, moral, mathematical and other putative sui generis phenomena. I argue that there are a number of ways of 'being natural' that suggest different methods of naturalization. First, I outline criteria of naturalness—three grades—that vary in their stringency, each subsuming the previous one: According to the first and weakest grade (G1), for x to be natural is for x to be causally realized. The second grade (G2) holds that for x to be natural x must be causally realized and play an indispensable role in a scientific theory irrespective of its realizer. I argue that emergent phenomena familiar from the dynamics of complex systems are instances of G2. The third and most demanding grade (G3) holds that for x to be natural x must be causally realized, play an indispensable scientific role, and that role be exhaustively specified by its realizer. I argue that fundamental physical and chemical kinds are instances of G3. Then I explore some implications of this distinction for the methodology of naturalism. I argue that the reductionist demands that the standard strategy of naturalization imposes are predicated on its commitment to G3. However, an alternative strategy based on G2 avoids these unnecessary stringent demands.

Jonathan **Fuller** University of Toronto

Medicine Lost in 'Translation': The Structure and Aim of Medical Science

What is the primary aim of medical science? To provide systematic explanations for humanity's ills? To provide true medical theories? Empirically adequate theories? Various philosophers of science have defended similar positions, among others, with respect to science generally. In this paper, I defend a view that I call medical translational empiricism, the thesis that the primary aim of medical science is empirically successful technologies and measures of their empirical success.

Although the question of science's aims is a historically important one in the philosophy of science, surprisingly little attention has been given to what it means for science to have an aim in the first place. I draw on consequentialist accounts of 'function' to propose one useful way of understanding 'the primary aim' of a science as the outcome that the science most contributes to society (rather than, for instance, some goal to which its scientists are committed).

As an approximation, the primary aim of medical science is represented by a popular metaphor: 'bench-to-bedside translation'. Translational research or translational medicine is a recent movement in medical science, yet as a reference to the generation of new biomedical technologies from basic scientific knowledge, 'translation' is a new name for an old aim. The primary outcome – or aim – of medical science as a whole is empirically successful technologies – tests and treatments that have cleared certain scientific bars – along with measures of their empirical success (e.g. test sensitivity/specificity, effect size estimates).

Loraine **Gérardin-Laverge** Université Paris Nanterre

La mémoire de Ribot à Tulving et au-delà: la naturalisation des processus mnésiques et l'émergence de l'hypothèse constructive

Au sujet de la mémoire on a couramment deux présupposés. En parlant de la mémoire, on semble la considérer comme une faculté unifiée. Et on a l'habitude de la penser comme une faculté conservatrice. C'est pourtant une image bien différente qui émerge de la recherche contemporaine. Nous proposerons une histoire de l'émergence de l'hypothèse d'une dimension constructive de la mémoire épisodique. Nous montrerons (1) que le courant naturaliste de la psychologie à partir de la fin du XIXe siècle met en question l'unicité de la mémoire (Ribot 1881) et (2) que la définition de la mémoire comme une faculté de conservation est elle aussi bouleversée (Ebbinghaus, 1885 ; Binet et Henri, 1894 ; Freud, 1896 ; Bartlett, 1932). Si ces recherches sont mises de côté pendant plusieurs décennies, elles reprennent avec Endel Tulving notamment. Tulving est célèbre pour sa distinction entre mémoire épisodique et mémoire sémantique (1972). Par ailleurs, il montre que certaines pathologies de la mémoire, en atteignant la capacité à se souvenir, affectent aussi la capacité à se projeter dans le futur en première personne (1985), et prépare ainsi à l'hypothèse d'une dimension constructive de la mémoire épisodique (Schacter et Addis, 2007). Nous verrons (3) comment les recherches de Tulving invitent à repenser les fonctions de la mémoire avant de montrer (4) que les distorsions mémorielles ne sont pas en elles-mêmes dysfonctionnelles. Au contraire, elles pourraient être le résultat du fonctionnement normal de la mémoire qui recombine ses contenus pour les besoins du présent et en fonction de l'imagination du futur.

Maya **Goldenberg** University of Guelph

Trust, credibility, and the scientific consensus on childhood vaccines

Whereas public mistrust of medical, scientific, and governmental institutions are commonly cited as a major source of vaccine hesitancy and resistance, vaccine outreach and communications are reluctant to address it. This mistrust is derided as tantamount to conspiratorial thinking—a sweeping and insular framework of biased reasoning that makes the mistrusting publics unreachable via risk communications. The problem, therefore, is with the publics. In this talk, I reconsider the scientific and political landscape where public resistance to scientific consensus claims arise. Working with an understanding of science as socially situated highlights the importance of trust and credibility in the successful

operations of scientific institutions—both within research communities and in relation to the publics—and thereby reframes public mistrust of science as a failure of scientific institutions to maintain the credibility required to achieve their social aims. Vaccine hesitancy is thereby a problem of scientific governance rather than a problem of the publics.

Gregory A. **Good** American Institue of Physics

John Herschel's Landscapes and Geology: The Cape Colony in the 1830s

John Herschel (1792-1871) is best remembered now as an astronomer, but in fact his curiosity ranged widely over physics, chemistry, geology, and many other sciences. His interest in geology began with minerals and crystals and soon grew to include a series of extended geological excursions in Britain and Europe. When he relocated to the Cape Colony from 1834 to 1838 to conduct a survey of astronomical objects in the southern skies, he also was thinking of geology. He corresponded with Charles Lyell and Roderick Murchison on geological matters, met with Charles Darwin and Captain Fitzroy, and he drew scores of Camera Lucida landscapes. This talk follows Herschel's activities around the Cape Colony. This geological research indicates a far broader interest in the Earth by Herschel than is usually recognized.

Christopher D **Green** York University

How McGill Got Its Psychology Department

In the spring of 1924, the President of McGill University, Arthur Currie, formally approved the separation of psychology from the Philosophy Department and the formation of a new Department of Psychology. The new unit would be led by William Dunlop Tait, a Nova Scotian who had earned his PhD under the famed Hugo Münsterberg at Harvard the early years of the century. Tait had then been called to McGill in 1909 to establish a new psychology laboratory within the Philosophy Department. After the formation of the new Psychology Department, the Philosophy Department would continue on under the leadership of William Caldwell, a Scottish idealist who had done stints at Cornell, Chicago, and Northwestern before coming to McGill in 1903 to replace the retiring John Clark Murray.

Although McGill was the first school in Canada to officially establish an autonomous administrative home for psychology (about a year before Toronto would do the same), it was hardly out of place in doing so at that time. Many North American schools were recognizing, in the 1920s, that psychologists and philosophers had grown apart over the previous few decades, to the point where they shared a rapidly dwindling number of assumptions, methods, and even research questions. The proximal reasons that McGill, in particular, chose to separate psychology from philosophy may not have been as common, however. Far from a process of rational intellectual deliberation, the split was brought on as much by a desire on the part of administrators to separate up, once and for all, faculty members who had become hardly able to even speak civilly about each other as by any more "elevated" considerations. The clash had even driven another professor of long standing, J.W.A. Hickson, to resign his post and leave the university.

Jason **Grier** York University

Defining Navigational Expertise: The Education and Practice of Navigation in Eighteenth-Century England

When the Royal Mathematical School elected Samuel Newton as the new mathematical master in 1695 the Astronomer Royal John Flamsteed was not happy with the choice. He wrote to Isaac Newton complaining about the decision, which he regarded as an example of the anti-intellectualism of the school's governors. In particular, he recounted a story of how the school's governor had told him that they did not want a University educated scholar because the ship captains to whom the school apprenticed its students had complained of the students putting on airs with their Latin and fancy education. At the time, most navigators in England learned their trade on the job after going to sea as children, while the Royal Mathematical School was founded in 1673 for the purpose of training new generations of navigators who were better educated in mathematics. There was, however, a tension between the school's objective of establishing a standardized method of education that grounded students in mathematics and astronomy and practicing navigators who found the students lacking in practical knowledge. The mathematical students' book knowledge came at the expense of experience at sea. In this paper I will investigate this tension to consider the problem of defining expertise in early modern navigation.

Marie **Gueguen** Rotman Institute, Western University

The possibility of paraparticles

Paraparticles are usually considered as a surplus structure, removed from Quantum Mechanics via the Symmetrization Postulate. As this postulate is stronger than required by the indiscernibility of quantum particles, the problem of paraparticles has become one of deriving the Symmetrization Postulate, otherwise considered as the mere stipulation that paraparticles do not exist. Though this approach is consistent with the traditional definition of a surplus structure, I argue that the opposite approach is equally well-supported. In particle physics, the classification of particles based on

irreducible representations of the permutation group shows that paraparticles constitutes a genuine physical possibility. Greenberg actually thought that the quarks discovered in 1964 were the paraparticles he had been looking for.
In this paper, I argue that our concepts of physical and mathematical possibility are ill-defined, thus leading to a case of weak underdetermination regarding the nature of the possibility of paraparticles. Second, I show that these two distinct approaches lead to different research programs which often get confounded; one focusing on how to implement the indiscernibility of particles without introducing any ad hoc clause within the formalism, the other on explaining why paraparticles have never been observed. As some have recently argued that the Bohmian and the Newtonian interpretations of Quantum Mechanics possess a greater explanatory power than others since they can rule out paraparticles (Baciagaluppi, 2003; Sebens, 2016), I show that no decisive claim can be made on this account without first providing a more accurate definition of what constitutes a possibility in physics.

Vincent **Guillin** UQAM

Des usages philosophiques de l'associationnisme psychologique en France dans le dernier tiers du 19e siècle : le cas John Stuart Mill

Dans cette communication, on s'appuiera sur une analyse de la réception française de l'associationnisme psychologique de John Stuart Mill pour mettre en évidence certains des problèmes ou des controverses qui ont structuré le champ philosophique français dans le dernier tiers du 19e siècle. Ce faisant, on contribuera, d'une part, à rappeler le statut crucial de la psychologie comme lieu et objet de débat et de confrontation dans le champ philosophique français d'alors et, d'autre part, à rendre visibles les caractérisations « idéologiques » et « nationales » qui opèrent dans les discussions et les controverses qui le structurent.
A ce double égard, il est révélateur que les idées psychologiques de Mill aient été interprétées en France comme relevant d'une tradition empiriste typiquement anglaise (allant de Hobbes jusqu'à James Mill, en passant par Locke, Berkeley, Hume et Hartley), qui se distingue non seulement par sa conception de la vie de l'esprit comme mécanisme régi par les lois de l'association des idées, mais qui aboutirait aussi à des conséquences métaphysiques caractéristiques (notamment la dissolution du moi substantiel), qu'on jugera, c'est selon, inacceptables ou bienvenues. L'associationnisme psychologique pourra alors être considéré, selon le bord où l'on se place, soit comme le présent spéculatif qui concrétise une manière d'entente cordiale philosophique (comme chez Taine par exemple), soit comme le cheval de Troie ontologique de la Perfide Albion (comme chez Ravaisson et Vacherot). C'est cette réception différenciée, et les différentes opérations historiographiques ou doctrinales auxquelles elle a donné lieu, qu'on tentera d'esquisser.

Vivien **Hamilton** Harvey Mudd College

Negotiating Risk and Responsibility: Radiation Safety in American Hospitals

The diagnostic and therapeutic promise of x-rays drew Americans into hospitals at an unprecedented rate in the early 20th century, and yet the dangers associated with medical x-rays were significant and well known. Anyone walking into an x-ray room --- patients, doctors, technicians --- risked electrocution from high voltage power sources, fire from tremendously flammable x-ray film and even blunt trauma from falling apparatus. Even more, they risked exposure to unwanted radiation. The same X-rays that could produce images of the hidden body, and shrink cancerous tumors, could also cause horrific burns, blood changes and even new cancers. As soon as an x-ray tube was turned on, it transformed its surroundings into a toxic environment.
In this paper, I trace negotiations between radiologists, physicists and x-ray manufacturers concerning who was ultimately responsible for ensuring safety in these spaces. I focus in particular on conversations surrounding the publication of the 1931 National Bureau of Standards handbook on x-ray safety, the first formal, national guidelines for radiation safety. This guidebook offered clear, quantitative recommendations for appropriate thicknesses of lead shielding and seemed to bolster the authority of the physicists who researched the transmission and absorption of x-rays in different materials. I show, however, that these recommendations masked deep uncertainty about the physiological effects of radiation. Manufacturers, physicians and even physicists ultimately agreed that it was not the lead shielding but the radiologist in charge of the x-ray room who was responsible for the safety of each of the bodies who entered into that space.

Brian J **Hanley** University of Calgary

Causal Selection in Safety Engineering

Safety engineers analyze causes of accidents, and determine how best to prevent accidents in the future. Many accidents are highly complex, involving many causal factors that differ in kind, in relation to other factors, and in relation to the outcome. To analyze causes of accidents, and prevent accidents in the future, engineers rely on different methods of distinguishing among causes of accidents and singling out important causes. In other words, engineers rely on causal selection to analyze and prevent accidents.

Following John Stuart Mill's (1843) conclusion that selecting causes is "capricious", unscientific, and lacking a single objective basis, many philosophers of causation do not take causal selection seriously. Those who do tend to take a narrow approach to analyzing causal selection, looking for the objective basis Mill denied. In either case, philosophical work on causal reasoning is disconnected from genuine problems engineers have when analyzing causes of accidents and identifying important causes. Ignoring causal selection leaves philosophy out of touch with causal reasoning found in engineering, while pursuing a single objective basis often leads to ignoring the diverse purposes, goals, and techniques engineers have when using causal reasoning.
I present a pragmatic approach for analyzing causal selection that can be used to examine how diverse purposes guide causal selection in engineering. I use the Bhopal disaster as a case study. I analyze how different purposes, for example, seeking explanation, avoiding liability, preventing future accidents led engineers and others to select different types of causes among the many causal factors that led to the disaster.

Martha **Hanna** University of Colorado

Medical Innovation on the Western Front: The Canadian Army Medical Corps in 1917

During their years of service in France and Belgium, the nurses, physicians, and surgeons of the Canadian Army Medical Corps (CAMC) produced an abundance of written records about their experience of and contributions to the war. Letters and diaries coexisted with (and in many cases complemented) the professional documents of wartime medicine: case books and unit diaries which captured the raw, unfiltered experience of medical care on the Western Front, and which became the evidentiary foundation upon which professional publications would subsequently be built. When read as a corpus, these private and professional writings bring to light a story of incremental but very real improvement in the care of the sick and wounded. Equally importantly, they reveal how Canadian physicians, surgeons, and nurses contributed to and benefited from an inherently collaborative, transnational enterprise of medical innovation and education which came to characterize the practice of medicine in Allied armies on the Western Front. This collaborative venture is clearly documented in the extant records of the #2 Canadian Casualty Clearing Station which in 1917 was located in the very shadow of the Ypres salient. These sources provide a full picture of medical practice in the First World War by reminding us of the prevalence of illness when the front-lines were quiet and of the ghastliness of surgical cases when they were not. And they reveal how extensive and innovative the Allied network of medical expertise had become by 1917.

Yousuf **Hasan** University of Western Ontario

Quine's Flight from Analyticity

According to the received view on Quine's Two Dogmas (1951), his challenge to Carnap was legitimate and one that Carnap failed to meet. It was commonly understood that for Quine, the analytic/synthetic distinction was unintelligible. After all, Quine did characterize it as a "metaphysical article of faith". But such an understanding is misleading especially once we take Quine's later works in 1960, 1973, and 1991 as elaborations of his Two Dogmas. The main challenge with the distinction was not intelligibility per se but rather that it could not play a useful role in Carnap's scientific program. Quine himself proposed empirical concepts of analyticity in his later works, but argued that the concepts were at best ersatz or "vegetarian imitations" of analyticity. I argue that Quine's challenge to Carnap should best be viewed as a distraction for Carnap and not a real worry. More balanced viewpoints of the debate between Quine and Carnap have already been given in current scholarship especially after 1990's (Stein 1992; George 2000; Creath 2006; Lavers 2012). But even within this literature, I suggest a sharper answer is needed to the question, "Should Carnap have even accepted Quine's challenge"? For my talk, I suggest, "No".

Jagdish **Hattiangadi** York University

Baconian Induction or the Experimental Philosophy of the Royal Society

It is widely assumed in the study of the sciences that a method of induction is logically impossible. It is assumed that the method of hypothesis is the only possible method open to the study of science. Under the influence of Henri Poincaré, this makes theoretical truth a conventional truth, and under the influence of Pierre Duhem it makes theory underdetermined by experimental facts for logical reasons. I suggest that they were mistaken. Our study of science is hobbled if we assume that they were right, and that science must give way to relativism. There is a method of induction or of the "experimental philosophy" that was proposed by Francis Bacon and adopted by the Royal Society that is not undercut by logical considerations. The key to this new method of modern science was that it relied on erroneous judgments rather than on error-free judgement as its basis to perform induction. It uses sceptical techniques to assemble erroneous judgments, and then assembles them into puzzles that have unique solutions. Because the solutions are unique, they are not merely hypotheses, even if their logical status with respect to the category of

observations is that they are hypothetical. When we restate the unique solution in terms of the language of cause and effect, we find out how they can give us “power over nature” in some domains.

Boris **Hennig** Ryerson University and Catherine **Stinson** Western University

Abstract Mechanisms and Causal Powers

Discussions of mechanistic explanation are stuck on the problem of abstraction. It is agreed that abstract mechanisms are necessary for scientific explanation. However, there is no satisfactory account of what abstract mechanisms are or how they work. Mechanisms explain what they explain by virtue of the causal powers of the entities that make them up. Abstract entities, however, are not material, and only material entities can push, pull, attract, repel, etc., which implies that abstract entities can have no causal powers.

If mechanisms must have causal powers, then it seems that there can be no abstract mechanisms. At best, there can be abstract depictions or blueprints of mechanisms. Because this conclusion raises other problems for mechanistic explanation, we look for an alternative solution. We argue that what are needed are not abstract mechanisms per se, but rather generally applicable, non-particular mechanistic explanations. Inspired by Platonic and Aristotelian metaphysics, and supported by the views of practicing scientists, we introduce the notion of a generic mechanism: a mechanism that is non-particular but can nonetheless have causal powers. These generic mechanisms, we argue, can supply the generally applicable explanations required.

Michelle **Hoffman** Bard College

Robert S. Woodworth, Charles H. Judd, and the Problem of Transfer

This paper will examine the problem of transfer of training as presented in two major psychology textbooks of the 1930s, Robert S. Woodworth’s Experimental Psychology (1938) and Charles Hubbard Judd’s Educational Psychology (1939). The problem of transfer examined, to quote Woodworth, whether “skill in practicing one performance spreads to other performances—whether the mastery of one situation is a good preparation for another situation” (1939, p. 176). It was an important theoretical question among learning theorists and a divisive practical question for teachers and educationists. Most crucially, for educationists, it called into question whether skills learned in specific school subjects transferred readily to other domains and into civic life. As historians of education have noted, preliminary transfer research was quickly, if unwarrantedly, absorbed into the rhetoric of educational reform.

In 1901, Woodworth had co-authored, along with E. L. Thorndike, three pivotal papers that concluded that transfer was minimal and that there was no reason to believe that specific learning tasks led to general changes in any given mental function. These papers prompted hundreds of subsequent studies over the next four decades, including a seminal 1908 paper by Judd that was often cited as a foil to Thorndike and Woodworth’s conclusions. In their later textbooks, both Judd and Woodworth reviewed the current state of transfer research, but applied starkly different approaches and emphases. My paper will examine the implications of these two treatments of transfer research for educational thought and practice in 1930s America.

Jordan **Howell** Harvard University

“A Marvel of Nature and Industry”: Kitimat and the Global Aluminum Trade

At the head of one of the many fjords scattered along the coast of British Columbia lies the world’s first aluminum city: Kitimat. How does a place become an aluminum city? In the 1950s, Kitimat became a node in the Aluminum Company of Canada’s (Alcan) global aluminum empire. Alcan’s executives and the popular press imagined the project as an extension of the American frontier into Canada’s “Northern wilderness.” The land east of Kitimat was re-engineered to produce hydroelectric power for the aluminum smelter, displacing the Cheslatta Nation. At Kitimat, Alcan hired New York urban planners Clarence Stein, Julian Whittlesey and Albert Mayer to design a town for the workers, which Architectural Forum called the first “completely new, completely modern New Town” in North America. Stein and the philosopher of technology Lewis Mumford saw the Kitimat project as an opportunity to design and build a city in harmony with nature and technology, life and work. Yet the fantasy of an aluminum future repressed the colonial past and present that continue to shape life in Kitimat. Kitimaat, meaning people of the snow, is also home to the Haisla Nation, whose land and ways of life have been altered by missionary and aluminum colonialism. But forms of resistance have emerged: Haisla Nuuyum and Ootsa, ways of being and knowing, are being recovered, and the Haisla community has negotiated partnerships with local industry. Thinking through the different threads of Kitimat’s history is instructive for Canada’s “next 150.”

Jennifer **Hubbard**

Canada's Legacy in the United Nations' Food and Agriculture Organization (FAO)

The Food and Agriculture Organization of the United Nations was formally instituted during an early United Nations meeting held in Quebec City in October, 1945. The FAO was created to fight world hunger, spread technological and scientific improvements to improve food production in developing nations, rebuild European agriculture and fisheries in the aftermath of the Second World War, and stimulate economic development in developing nations. The FAO's several departments included Agriculture, Economic and Social Development, Fisheries, Forestry, and Technological Assistance, all under the oversight of the first two Directors-General, William Nobel Clark (US) in 1948, and Sir Herbert Broadley (UK) who led the FAO from 1948 to 1958. Broadley quickly appointed a Canadian who had participated in the Quebec conference, Dr. Donald B. Finn, to head up the Fisheries Department.

In terms of his expertise as a biochemist, Finn was an unlikely choice for leading a department dedicated to creating international cooperation for fisheries development around the world. However, Finn's expertise had been developed at the Fisheries Laboratories of the Fisheries Research Board of Canada, where he investigated the biochemical processes that affect fish processing. While at the FRB, he had absorbed the ethos and philosophy that drove the development and expansion of Canadian fisheries research. This paper will argue that D.B. Finn's unexpected rise to a leading position in an organization that exerted considerable influence on post-war fisheries science meant that the fisheries science and management being promoted by the FAO around the world until 1994 (when significant restructuring occurred within the FAO) had a strong Canadian imprint, reflecting his Canadian origins and fisheries science background.

John **Jenkinson** Western University

Fleshing Out Agency and Body Ownership

Human experience normally involves the overlapping of one's sense of agency and one's sense of body ownership. A significant amount of empirical research, however, suggests that agency and ownership are dissociable to varying degrees, which has motivated an understanding of agency and ownership as, to some extent, independent and sometimes in opposition. I argue that this understanding of the relationship between agency and ownership relies on problematic phenomenological assumptions about the nature of subjectivity. Specifically, understanding agency and ownership as independent relies on an account of pre-reflective self-consciousness that implicitly dichotomizes the body-as-subject and the body-as-object in a manner that is problematically dualistic. I argue that we need to adopt the more radically embodied philosophy found in Maurice Merleau-Ponty's later texts to resolve this dichotomy. His later philosophy of flesh posits the sensing body (body-as-subject) and sensible body (body-as-object) as deeply intertwined through the activity and passivity inherent in our embodied relation with the world. This philosophy of flesh provides a framework for understanding the relationship between body-as-subject and body-as-object in a way that overcomes their dichotomy, and casts doubt upon the framework that bifurcates sense of agency and sense of ownership. Beyond showing the problems inherent in such articulations of agency and ownership, this paper demonstrates the need for greater attention to phenomenological research in the cognitive sciences.

Siavash **Joushaghani** York University

The Case For An Alternative Reading of Heraclitean Notion of Soul

If the Milesians are the first scientists, Heraclitus is the first psychologist. In this paper I suggest an alternative reading of notion of soul (psyche) that has not been considered despite the wide range of ancient and modern interpretations on the extant fragments. I suggest that Heraclitean notion of Psyche is just the process of change from water to earth and vice versa. If this reading is lacking from the colorful range of interpretations of Heraclitean psyche, it is because the scholarship has found a tripartite view of cosmos necessarily connected to psyche. According to the tripartite view, universe is made of three elements earth, water and, the third fire, or air. Psyche, in the philologically secure fragment 36, is grouped with water and earth, and so Heraclitus must have found psyche a fire-like entity or warm dry air. The view that psyche is fire comes from fragments where fire appears with water and earth. However, nowhere the notion of fire appears alongside psyche. Air and psyche appear together only once in a fragment discredited by modern philologists. In the end, interpretation of psyche may not need to depend on Heraclitean notion of cosmos. I show how a consistent notion of psyche is not only possible just from the nine psyche fragments, but also that it can cohere with the key Heraclitean doctrine of unity of opposites.

Guy **Kagan** University of Haifa

Wave function collapse theories of consciousness and physicalism: The Chalmers-McQueen model reexamined

I discuss a recent proposal made by D. Chalmers and K. McQueen to recover measurement regularities in quantum mechanics on a purely dynamical basis, using a novel spontaneous collapse model (GRW-style) in which consciousness is taken to be an internal property of quantum mechanical systems which determines its rate of collapse. This new

direction in quantum foundation aims to reveal the structural correspondence between consciousness and its physical (neural) correlates. Prima facie, one could expect from a research project of this type to reveal the physical magnitude of consciousness which can be introduced as new physical degree of freedom. After all, a research program which combines GRW-style theory with neuroscience does not need to contain any contradiction and, thus, seems to be perfectly compatible with a physicalist outlook; and this is exactly what Chalmers and McQueen have in mind. But a closer examination reveals that this might be wrong.

Molly **Kao** Université de Montréal

Discovery vs. Justification: Unraveling the Context Distinction

The "context of discovery" of a scientific theory is traditionally contrasted with the "context of justification." This distinction was originally intended to distinguish between processes that contribute to the evidential justification of a theory, which are taken to be epistemic, and the processes that lead to the discovery of a theory, which were described as purely psychological. One imprecise way of characterizing this difference is to include in the context of discovery all the steps of scientific inquiry that lead to the final articulation of a theory, with the context of justification applying to the stages at which a developed theory is tested in different ways. While the majority of authors agree that a simplistic chronological division of a theory's development into such stages is an inaccurate description of scientific work, there is debate on the proper characterization of this distinction, as well as its philosophical significance. I will argue that the two contexts are even more enmeshed than is generally recognized, not only in terms of chronology, but also in terms of reasoning patterns used during each stage. I support this claim by showing how one particular example of theory development – Millikan's studies of the photoelectric effect - can be interpreted as being an example of both discovery and justification. I conclude that while we can maintain the distinction between the two contexts, they must be understood as applying relative to a specified domain.

Koray **Karaca** University of Twente

Two Types of Robustness in High Energy Physics Experiments

In this paper, I show that two different types of robustness have figured in the practice of experimental high-energy physics (HEP). To this end, in the first part, I revisit a case study (Franklin 1998) concerning data selection in the branching ratio experiment that was performed in the 1960s to test the V-A theory of weak interactions. I point out that in the foregoing experiment, robustness in the sense of multiple, independent determination of experimental results (Wimsatt 1981) was appealed to as a criterion to validate the results of the experiment. I thus call the foregoing type of robustness validatory robustness. In the second part, I examine the process of data selection in the ATLAS experiment at CERN's Large Hadron Collider, where the long-sought Higgs particle was discovered in 2012. I argue that in the case of the ATLAS experiment, robustness in the sense of the ability of an experimental procedure to fulfill its intended function is appealed to as a criterion to ensure that the data-selection procedure is exploratory and thus able to yield the data sets that will serve the entire range of objectives that the ATLAS experiment is aimed to achieve. I call the foregoing sense of robustness functional robustness. I point out that while functional robustness is an attribute of experimental procedures, validatory robustness is an attribute of experimental results. I conclude that in the history of HEP experiments, validatory and functional types of robustness have served different epistemic purposes, namely, validation and exploration, respectively.

Atoosa **Kasirzadeh** University of Toronto

Computer Simulations, Mathematical Models, and Production of New Knowledge

The question of whether and if so, how, computer simulations produce new scientific knowledge has been subject to an on-going debate in philosophy of science. In this debate, it is assumed this is new data which is transformed into new knowledge. To respond to this question, then, one needs to understand whether computer simulations can produce new data. In this paper, I argue that the emphasis on the production of new data does not exhaust all the ways in which computer simulations can play a role in production of new knowledge. In particular, I argue that in certain scientific practices, computer simulations alongside with mathematical models engage in the production of new knowledge for informed action.

Mary-Ellen **Kelm** Simon Fraser University

From Far and Wide: The Sioux Lookout Project, local needs, international scholars and Indigenous health research

In February 1969, the Hospital for Sick Children in Toronto and the Faculties of Medicine and Dentistry of the University of Toronto signed a tripartite agreement with Medical Services Branch of the National Department of Health and Welfare to improve health care delivery to status Indians in the remote region of northwestern Ontario known administratively as the Sioux Lookout Zone. A visit by federal Minister of Health, John Munro, to Sault Saint Marie in the fall 1968 prompted local

advocates for Indigenous health to demand action to improve health services to that region's over 15,000 Cree and Anishinaabe people. The plan, which emerged in the early days of 1969, gave Medical Services a way to increase health service coverage in the over 100,000 square kilometer region at a reduced cost while pursuing its overall agenda of integrating status Indians into provincial health care institutions. To the University of Toronto and the Hospital for Sick Children, the agreement granted opportunities for training and research in areas of expertise including pediatrics, otolaryngology, ophthalmology and psychiatry.
Medical historians Mary Jane McCallum and Maureen Lux have characterized Indigenous health as a field of study that is isolated and kept separate from mainstream medicine. The Sioux Lookout Project brought University of Toronto medical, nursing and dentistry faculty and students from around the world to Indigenous communities in northwestern Ontario. For some, it was a life-changing experience, but they struggled to fit what they were seeing in the "Fourth World" into development paradigms generated from "Third World" experiences. Others found compelling local cases of global health crises, mercury and PCB contamination, for example, to research. This paper will examine the conceptual practices, methods and results of research conducted through the Sioux Lookout Project in the 1970s by asking how, or if, research generated at the intersection of international and local health interests generated new knowledge that met the needs of Indigenous people.

Muhammad Ali **Khalidi** York University

Should We Be Pluralists about Natural Kinds?

Many philosophical theories about natural kinds are monist, in the sense that they expect natural kinds to conform to a single uniform template. Essentialists, for example, think that all natural kinds have essences, and those kinds that don't have essences are not natural kinds at all. Similarly, some of those who hold that natural kinds are homeostatic property clusters (HPC) rule out candidates for natural kinds that do not correspond to a cluster of properties held in equilibrium by a common mechanism. Some philosophers, who may be skeptical of a uniform template, have shifted to discussing natural kind categories and investigating the role of these categories in scientific inference and inquiry, remaining agnostic when it comes to their metaphysical grounding. But if some natural kinds have different metaphysical grounds from others, this is likely to show up in their use in inference and inquiry, and be reflected in the categories that correspond to them. In this paper, I will explore the difference between natural kinds that are individuated on the basis of causal powers and those individuated on the basis of causal history or etiology. While acknowledging important differences between these two kinds of natural kinds, I will argue that their causal grounding provides a commonality among them, and that many kinds combine elements of the two. Hence, the metaphysical and epistemic similarities among the two kinds of kinds outweigh the differences, favoring monism over pluralism.

Alexandre **Klein** Université Laval

Quelle(s) méthode(s) pour les sciences de l'esprit? Retour sur l'expérimentalisme singulier du psychologue Alfred Binet (1857-1911) à partir d'un manuscrit inédit

Célèbre pour avoir inventé, avec son disciple le psychiatre Théodore Simon (1873-1961), la première échelle métrique de l'intelligence, le psychologue Alfred Binet (1857-1911) fut également, on le sait moins, l'un des fondateurs de la psychologie scientifique en France. Ardent défenseur de la méthode expérimentale, il consacra en effet son existence à trouver le moyen d'en adapter l'usage à l'étude des fonctions supérieures de l'esprit. Si sa mort prématurée ne lui permit pas de produire une synthèse de ces travaux, ses archives nous offrent aujourd'hui l'opportunité de reconstituer l'expérimentalisme original qu'il pratiqua, revendiqua et constitua tout au long de sa carrière. C'est sur ce dernier que nous entendons revenir dans cette communication en nous fondant sur l'étude d'un manuscrit épistolaire inédit intitulé « Nouveau programme de psychologie individuelle ». Nous pourrons ainsi retracer la spécificité de l'approche scientifique d'Alfred Binet et finalement mettre en lumière l'importance de sa contribution épistémologique à l'histoire des sciences de l'esprit.

Craig **Knox** University of Toronto

The Entity Model of Disorder

In Representing and Intervening, Ian Hacking asserts that mental disorders are entities. This paper explores just what being an entity means and examines what criteria disorders must fulfill in order to be considered as such. Changes in psychiatric nosology which have occurred throughout the history of psychiatry and specifically throughout the various editions of the Diagnostic and Statistical Manual of Mental Disorders, prima facie, seem to preclude the entity model of disorder from being tenable. However, upon investigation these are shown to not be serious obstacles for it being a useful model of disorder or for the entity realist interpretation of science, more broadly. Additionally, the entity model of disorder is contrasted to the biopsychosocial model and is shown to offer a possible escape from value-ladeness at the societal level.

Brandon **Konoval** UBC

The Disenchanted Flute? Music, Max Weber, and Early Modern Science

With Absolute Music and the Construction of Meaning (1999), among other writings, the musicologist Daniel K. L. Chua proposed a theory of "rationalization" to account for key developments in western music that corresponded with Foucauldian epistemes. Chua derived this theory from Max Weber's incomplete, posthumous work on the history and enthnology of music, The Rational and Sociological Foundations of Music (1911/1921), anachronistically characterized by Chua as promoting Weber's concept of Entzauberung/de-enchantment. On Chua's account, a Weberian "rationalization" demonstrated by the history of occidental music theory and musical practice is held to correspond with developments in the history of science; above all, with the "disenchantment" of a "Pythagorean" worldview in the late sixteenth and early seventeenth centuries, through the application of calculations of temperament to traditional, untempered ratios of tuning.
Careful examination of early modern sources—including texts on music by Vincenzo Galilei, Marin Mersenne, and Johannes Kepler—reveals an epistemic terrain that robustly resists such convenient demarcation, whether conceptually or chronologically, and whether in the domain of music or of science. Furthermore, Weber's account of distinctive principles of rationalization in music—a domain of frequently conflicting rationalizations, rather than of uniform "disenchantment"—provides a model more attuned to the challenges confronted by early modern science in its engagement with mathematical empiricism and music.

Jaclyn **Lanthier** Western University

Epistemic Progress in Cognitive Neuroscience and Neurobiology: How, If at All, Can Functional Triangulation and Integration Contribute to this Process?

This paper is concerned with the epistemic status of claims and explanations in neuroscience and the ways in which this status can be strengthened. With respect to structure-function claims in cognitive neuroscience, Adina Roskies (2010) has argued that a methodology called functional triangulation increases the likelihood of a given claim being true; with respect to mechanistic explanations in neurobiology, Carl Craver (2002) has argued that the methodology of integration similarly increases the chances of a given explanation being true. While the two fields (cognitive neuroscience and neurobiology) and their respective goals (structure-function claims and mechanistic explanations) traditionally work in parallel with little interaction, I argue that they should not be conceived of nor practiced independently of the other. Specifically, I argue that the relationship between structure-function claims and mechanistic explanations is such that it ought to interdependent in virtue of their epistemic merits being mutually-dependent. Conceiving of the methodologies as an interdependent unit enhances the epistemic status of the claims and explanations that are the result of its application. While this relationship advances the debate, there remain problems about the convergence of evidence that need to be addressed; I close by highlighting some of these issues.

Federico **Laudisa** Universita' di Milano-Bicocca

The Bell twins: divergent views on John S. Bell's philosophy of quantum mechanics

The work of John S. Bell is unanimously recognized as an invaluable source of insight in the long-standing debate on the conceptual foundations of quantum mechanics. The scope of Bell's contributions, however, is much more controversial since, although Bell strongly supported an observer-free formulation of quantum theory, his work is often conceived as one of the major sources of inspiration for the idea that an observer-independent quantum reality has been shown to be untenable once and for all. A noble forerunner in being subject to such Ianus-faced representation was no less than Albert Einstein, whose worldview seriously challenged the role of quantum mechanics as a fundamental theory. In fact, there are deep reasons of interest in the Einstein-Bell relationship and we will consider such relationship as a sort of unifying thread in assessing the main contributions of Bell to the foundational debate on quantum mechanics. First, we will focus on the two main claims (locality and a certain form of realism) concerning which the Bell analysis shows the untenability of the Einstein expectations. We will then attempt to show in what sense Einstein and Bell share a common concern for a realistic stance in the foundations of physics, although the precise formulation of this sort of realism must be carefully qualified. We will then turn to one of the most widespread misunderstanding of the Bell theorem, according to which what the theorem rules out is not simply locality but the so-called local realism, and finally we will focus on the Bell notion of beable, that will be seen to play both an ontological and methodological role.

Pauline **Launay** Université de Caen Normandie

Pratiques et représentations autour des cadavres dans les services palliatifs français. Ou la mise en place d'une nouvelle médicalisation de la mort

Depuis son institutionnalisation en 1986, la médecine palliative française trouble le rapport dialectique du soin et de la guérison au sein du champ médical contemporain. Née d'une critique de la gestion médicale du mourir qui avait alors cours, elle confronte nouvellement l'art de guérir aux « incurables » et aux « mourants », jusqu'alors signes de l'impuissance médicale. À travers la comparaison de type ethnographique de différents types de services palliatifs français (Unité fixe, Équipe mobile, Lits Identifiés), il s'agit de mettre en lumière les pratiques que ces équipes dites « pluridisciplinaires » (mêlant professionnels et bénévoles) mettent en place autour des décès qui closent les accompagnements palliatifs. Plus particulièrement, nous insisterons sur les pratiques médicales et symboliques à l'oeuvre dans ces équipes autour des cadavres de leurs anciens patients devenus cadavres, de l'entretien ou non de leur mémoire par les différents professionnels et bénévoles, ainsi que sur les motivations qui les sous-tendent ; ces gestes ayant pour destinataires tout autant les intervenants palliatifs eux-mêmes que les patients et les proches. De par sa position liminale, le cadavre cristallise ici des désirs ambivalents de maîtrise et de déprise, et devient un double support cette fois de sa destinée post mortem et des différents deuils qu'il enclenche. Au-delà, se pose la question de la médicalisation de la mort et du monopole actuel de la médecine sur la mort dans ses dimensions plurielles.

Oliver **Lean** University of Calgary

Causation and Information Flow in Biological Systems

Philosophers of biology disagree about the nature and value of the concept of information. In particular, recent work by Paul Griffiths and colleagues has argued that "informational" processes in biology such as gene translation are simply causal relationships that are highly specific, i.e. that have fine-grained control over their outcomes. In effect, this reduces information-talk to a particular kind of causation-talk. Indeed, it's easy to see why reduction might be a reasonable approach: although information in the mathematical sense is correlational and not causal, the flow or transmission or processing of information does presume a role for causation.

I propose a different way to think about the relationship between causation and information. Using Woodward's well-known interventionist account of causation ("WIC") as a model, I propose a pragmatic analysis of what it means to treat something as a carrier of information. In the same way that WIC grants a central role to intervention to make sense of causal claims, I propose that information should involve an equivalent concept of an observation. Looked at in this way, causation and information are mutually irreducible alternative perspectives one can take on a biological system. What's more, this offers a principled rationale for taking one perspective or the other in a given case, which relates to the role of agency in our reasoning about that system.

Sophie **LeBlanc** University of Toronto

The History of Computer-Aided Design (CAD) at MIT in the 1960s

In this presentation I examine three historical projects happening at MIT in the 1960s, which played a crucial role for early developments relating to computer-aided design (CAD). The CAD project in 1959-1970 was a collaboration between Electrical and Mechanical Engineering Departments, and evaluated the roles of machine and new computational tools in the design process. Ivan Sutherland's Sketchpad, presented as his PhD thesis in 1963, was the first design program to run as an interactive graphical interface. The Architecture Machine group founded in 1967(which eventually became the MIT Media Lab in the 1980s) examined the role of computers and electronic systems in architecture and urban planning. In examining these three cases, I elaborate on the novel tools and skills employed by the researchers in question, the kind of discourses they developed in relation to human-machine interactions, and the intellectual traditions which influenced the socio-technical context in which they operated.

Daryn **Lehoux** Queen's University

Knowledge and Foreknowledge in Ancient Astrology

In his monumental synthesis of ancient astrology, the Anthology, Vettius Valens introduces a number of case studies as empirical evidence for the astrological theories, forces, and relationships at play in the universe. He also lambastes rival practitioners who, he says, are bringing the discipline of astrology into disrepute by providing incorrect predictions. This paper aims to unpack the epistemology that underlies Valens' sophisticated text, in order to understand how Valens saw and characterized the foundations of his own knowledge, a disciplinary knowledge of the cosmos that in itself permitted an accurate (he thought) foreknowledge about the fate that awaited individual human beings.

Eleanor **Louson** York University

Performing Authenticity: The Making-of-Documentary in Wildlife Film's Blue-Chip Renaissance

21st-century wildlife films promote the authenticity of their representations of nature through the extensive use of making-of-documentaries (MODs), showcasing filmmaker trustworthiness and innovations in filmmaking practices and equipment. Enjoying recent prominence as promotional trailers, bonus features on DVD releases and websites, and televised segments within wildlife broadcasts, MODs work to make public the practical and technical conditions of wildlife film production to an unprecedented degree. Through a case study of the MOD from the Disneynature wildlife film Chimpanzee, this paper explores MODs' participation in a transformed public representation of natural history, and how the digital media landscape affords filmmakers new modes of transparency which counterintuitively conceal the necessary mediation in wildlife films' historically-influenced constructions of nature. My work extends Gouyon's (2016) analysis of MODs; he characterized the Winged Migration MOD as employing a stance of "claimed artificiality" through its thorough disclosure of the film's extensive staging techniques. In contrast, the more recent wildlife films I examine deliberately participate in a rhetoric of observational realism, which does not allow such prominent disclosures of staging techniques.

Chris **Lyons** McGill University

"The Touch Divine of Noble Natures Gone": Sir William Osler and the Power of the Book

Sir William Osler (1849-1919) is one of the best known doctors in the Anglo-Saxon world. For many, he represents the ideal physician, combining a humanistic approach to caring for patients with a thorough knowledge of medicine. That said, Osler was also a fervent bibliophile. The history of his bibliomania is an excellent case study of bibliophilia during the late nineteenth and early twentieth centuries. Osler believed in the importance of the past, as conveyed through books, as a source of inspiration for both himself and for the medical profession. During his life he accumulated approximately eight thousand books which he considered critical to understanding the history of medicine and science. For this collection to play the inspiring role he had imagined, he had to make them accessible through the creation of a library and publication of a catalog raisonné. A decade after his death, the Bibliotheca Osleriana was published by the Oxford University Press, while McGill University (Osler's alma mater) established the Osler Library of the History of Medicine. These two achievements had a profound effect on defining the field of medical history.

Timothy D. **Lyons** Indiana University–Purdue University Indianapolis

Driven toward a Socratic Scientific Realism by the Features of Theory Change

Scientific realists claim 1) science seeks truth, including truth about unobservables; and 2), we can justifiably believe that successful scientific theories at least approximate that aim. The epistemological tenet of realism, (2), is threatened by a set of strong arguments—including those regarding the nature of theory change in science. Such arguments have prompted antirealists to reject not only (2) but also (1), the realist's axiological tenet. And they've forced realists to deplete their position to such an extreme that realists now fail to account for most of what goes on in science. Breaking from both camps, I embrace an attitude going back at least as far Socrates: I advocate (1) while discarding the realist's epistemological tenet, (2). This requires the refinement of the realist's (largely neglected) axiological thesis: in particular, it requires specification of the subclass of true claims at which scientific theorizing is directed. Although antirealists may account for more of science than can the now very restricted epistemic realists, I argue that my non-epistemic, purely axiological—what I call "Socratic"—scientific realism fares better in both explaining and justifying a set of agreed upon features of theory change. I then show that the thesis that theory change in science is rational—accepted by both sides of the debate—requires an axiology, i.e., requires specification of an end toward which theory change and its primary features are directed. And, I contend, it is the axiology of Socratic scientific realism that is the best among the live options.

J. J. **MacIntosh** University of Calgary

Is Mathematics a science?—the seventeenth century debate between logicians and mathematicians on necessary truths and scientific deductions

Various early modern logicians suggested that some mathematical demonstrations were scientifically unacceptable since, unlike proper demonstrations, they failed to enlighten the understanding. This was a minor skirmish in the century's more general discussion about the kinds of demonstration that were scientifically acceptable or desirable, but it is a skirmish with an interest of its own, since there were good, and philosophically interesting, arguments on both sides. In this paper I look at these arguments and the background to them. The tendency on both sides was to view the discussion through Aristotelian or theological eyes—typically, though not inevitably it was the logicians who invoked Aristotle, and the mathematicians who enlisted God on their side. I also look briefly at earlier discussions of

demonstration such as Ockham's which are important and interesting, but which, in the early modern period, were overlooked.

Virginie **Maris** Montpellier

Prediction in Ecology: Promises, Obstacles and Clarifications

Researchers in ecology feel increasingly responsible for reliably predicting the effects of global changes, notably on the future of biodiversity. In this talk, we will investigate the epistemological basis of the concept of prediction as it is currently used in ecology. In the first section, we investigate the role of prediction in the historical developments of ecology. We then distinguish two main epistemological dimensions that characterize the formulation of predictions: one is linked to the validation of theories (we name it corroboratory-prediction) and the other is linked to the need to anticipate futures (we name it anticipatory-prediction). The second section is dedicated to the epistemological obstacles to predictions in ecology and the way these obstacles differently affect corroboratory-prediction and anticipatory prediction. We use Species Distribution Modelling (SDM) to illustrate the interactions between the two kinds of prediction. Finally, we investigate in the third section how these two dimensions of predictions are related one to the other and what role they play in the ability of ecology to make policy recommendations.

Dan **McArthur** York University

The Role of Philosophy and the a Priori in Scientific Theories and Theory Change

Michael Friedman, in his Dynamics of Reason and in a number of other venues, and David Stump in his recent Conceptual Change and the Philosophy of Science have both advanced related visions of the role of a priori principles in scientific theory that differs in striking ways from many familiar articulations of theoretical holism. They both, for example, argue that holism can mask important non-empirical theoretical commitments. However, they differ from each other in important respects. In times of conceptual change Friedman takes philosophy to provide a background framework within which rationality can be recovered via a form of communicative rationality whereby shared principles of rationality ground discussion. Stump on the other hand sees more continuity during periods of conceptual change such that the rationality of the change can rely on pragmatic and more local commitments. He rejects an extra-scientific, constant, background framework. I will contend that Stump is correct that rationality is in less need of recovering than Friedman thinks and more continuity can be identified by more local and pragmatic means. He is also correct in finding articulations of less universalist accounts of theory change in Laudan and others. However, I will argue that there is nevertheless a philosophical aspect to negotiating theory change, even if it does not form a constant shared background framework. Further, I will also contend that a communicative rationality, not unlike the one advanced by Friedman, has an important role to play.

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

J.B.S Haldane's Passage to India: Cosmopolitanism and the Reconfiguration of Knowledge

Recent developments in the history and philosophy of science have come to question received "centre-periphery" models of scientific structure, development, and dissemination. We can now speak of "circulations", "confluences", and "silk roads". Down these roads we are also coming to re-examine the meanings of local knowledge, knowledge in transit, while revisiting the contentious issues of cosmopolitanism and universalism.

In 1957, smack in the middle of the Suez Crisis, the world's leading population biologist, co-discover of the "Neo-Darwinian Modern Synthesis" in population biology, and noted political radical, J.B.S. Haldane, renounced his British Citizenship and moved to India, taking up a leading part in the development of the science, statistics, and biopolitics, of the newly independent nation. This lecture will examine Haldane's passage to post-colonial India as a specific and challenging example of cosmopolitan knowledge circulation, by looking closely his encounter with local science and knowledge, and the effects this interaction with Indian styles science, logic, and philosophy, had on ways of re-conceiving science, statistics, and evolution. Here knowledge translation and exchange travelled both ways. In this examination of cosmopolitan exchange, we might garner a few general lessons about objectivity and modern views of evolution and science.

Sandra **Menenteau** Université de Poitiers

« Dans le ventre du défunt, des bouts de cigares, un tuyau de pipe brisé, des fragments d'allumettes et de la poussière »: constitution d'une éthique des pratiques médicales post mortem en France (XIXe-début XXe siècles)

Au mitan du XIXe siècle, le principe d'une déontologie appliquée à l'art de guérir émerge en France. Ces règles déontologiques, établies en priorité pour régulariser et moraliser les comportements des praticiens de l'art de guérir à l'égard de leurs confrères et de leurs patients, visent aussi à définir les bonnes manières de table de dissection. Carabins, médecins, chirurgiens et autres garçons d'amphithéâtre sont en effet régulièrement fustigés pour leur attitude

indécente, voire irrespectueuse, vis-à-vis des dépouilles qui passent entre leurs mains. Et si l'arsenal législatif et réglementaire instauré par les autorités tant publiques qu'hospitalières a mis fin à des comportements irrévérencieux, la réputation d'« équarrisseurs de chair humaine » de ceux qui s'adonnent aux activités cadavériques perdure. Cette communication, issue d'une étude en cours, ambitionne donc d'aborder en premier lieu comment la notion d'éthique influence les pratiques anatomiques et anatomopathologiques, notamment dans leurs aspects les plus techniques. En outre, il s'agit, à travers quelques exemples de « scandales cadavériques » impliquant des médecins et leurs collaborateurs, d'appréhender la perception populaire de cet exercice médical singulier. À l'occasion de ces affaires, au cours desquelles d'aucuns n'hésitent pas à affabuler sur les agissements des protagonistes médicaux, le voile déposé par le corps médical sur le corps disséqué est soulevé. Une vision frontale de la dépouille explorée avec plus ou moins de délicatesse est alors offerte à tout un chacun.

Michael **Miller** University of Pittsburgh

On the common structure of perturbative and axiomatic field theory in Borel summable models

There are multiple formalisms for capturing the content of quantum field theory. The perturbatively characterized models used by practicing particle physicists are the basis for the empirically successful standard model of particle physics. These perturbatively characterized models are subject to three problems in their mathematical foundations. Axiomatic field theory was designed to overcome these problems, but the axioms have not been shown to admit empirically adequate models. This has led Fraser and Wallace to claim that perturbative and axiomatic field theory should be thought of as competing research programs. In this paper I undermine this view by showing that perturbative and axiomatic field theory share a common mathematical structure. In particular, I argue that in every case where a model of axiomatic field theory is available, the corresponding perturbative expansion exactly and uniquely determines the model. I then show that this analysis also reveals why empirically adequate models do not satisfy the currently available axiomatizations of quantum field theory. I conclude by showing that the failure of empirically adequate models to satisfy the axioms is completely unproblematic if one is willing to entertain the idea that the empirical content of a theory can have limited precision.

Nora **Mills** Boyd University of Pittsburgh

Evidence Enriched

Good scientific theories should be consistent with all of the available evidence. Unfortunately, standard accounts of evidence fail to accommodate this prescription. Philosophers of science often represent evidence as detached from the manner in which it was produced. However, bare results are conditioned on myriad presuppositions introduced in data collection, processing, and interpretation. The conditioned nature of empirical results needs to be adequately represented in philosophical accounts of science in practice. I suggest that concerns about the theory-ladenness and incommensurability are symptoms of detached views of evidence. If theory-laden results were used to constrain theories for which they were mal-adapted, then scientists would risk mistaken adjudications of the empirical viability of those theories. If results unshakably calcify the commitments of the paradigm in which they were generated, then they are doomed to perish with it. This loss of evidence would pose an epistemic risk also insofar as any abandoned evidence haunts subsequent theories as an un-checked liability. I argue that these concerns can be dissolved by adopting a non-detached view of empirical evidence. Enriching our conception of evidence to include auxiliary information about the manner in which results are produced makes sense of how results can be repurposed across diverse theoretical contexts. I illustrate this conception of evidence with an example from astrophysics: the observations of the Hulse-Taylor pulsar in the 1980s that were interpreted as the first indirect evidence for gravitational radiation. Evidence, in the purposed sense, is both riddled with theory and genuinely cumulative.

Daniela **Monaldi** York University

When did particles become "indistinguishable"? Quantum cultures and the interpretive flexibility of mathematical-theoretical apparatus in the emergence of quantum statistics

Quantum physics has changed the concept of particles profoundly. This change—commonly referred to by the formula "particles have become indistinguishable"—did not stem from a deliberate theoretical choice or a single experimental finding. It was, rather, the result of prolonged efforts to arrive at a unified interpretation of the mathematical-theoretical apparatus of the quantum statistics and the quantum mechanics of multi-particle systems. Several interpretations were sketched in the 1920s and 1930, as the possibilities, limits, and conditions of the quantum theoretical technologies were probed on different physical systems in different contexts of theoretical and experimental practice. This paper examines some of the early formulations and uses of quantum statistics by Albert Einstein, Enrico Fermi, Paul Dirac, Edwin Schrödinger, Werner Heisenberg, and others, showing how professional cultures and traditions shaped diverse theoretical approaches. I will tentatively argue that, although important remarks were made early on, especially in the

context of the wave-particle debates following the formulation of matrix and wave mechanics, the first extended articulations of a new conception of particles that aimed at reconciling the different uses and views emerged only after WWII, in connection with the reconfiguration of fields such as nuclear physics and particle physics, low temperatures, and solid state physics, and their instrumental-experimental-theoretical cultures.

David **Montminy** Université de Montréal

Data-Centric Ecology: Integration and Hierarchy of Models

The rise of Big Data techniques is often said to set the stage for enhanced integration (Marquet et al. 2014) and more accurate predictions (Evans 2012) of ecological models. While these enthusiastic accounts rightly point to the limits of data alone, insist on the necessity of theories and the incompleteness of correlations, they all rely, more or less, on a classic view of scientific theories, i.e. the semantic view in which theories are set of models, models are intermediaries between scientists and a target system and data are thought to represent phenomena. Challenging this view, Sabina Leonelli (2016) puts forward a new framework in which data do not simply represent phenomena, but are themselves prospective evidence, i.e. the function ascribed to data is what determines their scientific status. This talk will show how Leonelli's relational account of data, combined with her conceptualization of bio-ontologies as a form of classificatory theorizing, is in a privileged position to answer several epistemic and ontological queries regarding modelling practices in data-centric sciences like ecology. More precisely, I will demonstrate that the application of Leonelli's framework to ecology is compatible with the notion of hierarchy of models, as developed by Suppes (1969), but only at the expense of a repositioning of priorities from theoretical model to data model.

Nadia **Moro** Higher School of Economics, Moscow

Hermann von Helmholtz's physiology between mechanics and philosophy

Nineteenth-century organic physics aimed to establish scientific physiology by introducing mechanical concepts such as matter and force and using physical methods of investigation and experimentation. Organic physics was pursued, among others, by Johannes Müller's pupils Ernst Brücke, Emil du Bois-Reymond and Hermann von Helmholtz. Helmholtz succeeded, for instance, in measuring the conduction velocity of the nerve impulse and proved the temporal dimension of sensation, which challenged the common view of sensation as something immediate.

Presuppositions, goals, methods, and achievements of organic physics have been widely discussed in historical literature and STS. Argumentative strategies and explanatory models have been reconstructed. Likewise, the profound impact of physiological investigation and discoveries upon philosophical, psychological, and aesthetical theories of perception has been analysed.

This paper integrates 19th-century physiological literature and secondary bibliography to discuss the relationships between metaphysical conceptions, epistemological issues, and physical methods in the theories of perception developed by Helmholtz. The result is an explanation of the meaning and function of the a priori in Helmholtz's physiology and philosophy of perception and the assessment of its epistemological relevance. In order to investigate the processes of objectification in Helmholtz's theories of perception, descriptive methods, mechanical models, and theoretical results of his psychoacoustic research are compared. This comparison is aimed, firstly, to identify the complex nature of sensation in Helmholtz's accounts and, secondly, to prove the extent to which, using Cassirer's phrase (1944), "perception expands the particular datum," involves the integration of sensation into a "total experience," and is "an objective factor in knowledge."

Adam **Mosa** Queen's University

The Interwoven History of Mercury Poisoning in Ontario and Japan

The history of mercury poisoning among indigenous people in Canada is entangled with a mid 1950's industrial incident in Minamata, Japan, where sightings of ataxic cats heralded a bizarre neurological condition. By 1960, Japanese scientists termed the new condition, Minamata disease, deeming it toxicity resulting from organic mercury poisoning.

As the environmental catastrophe devolved in Japan, another emerged in Dryden, Ontario. From 1962 to 1970, the Dryden Chemical Company's pulp and paper mill dumped more than 10 tonnes of mercury-laden effluent into the English-Wabigoon river. For the Asubpeechoseewagong/Grassy Narrows First Nation, health problems would persist for more than 50 years and they are still grappling with its impact.

Relying on government documents, published and unpublished papers and recent news media coverage, this paper will review the history of Ontario's experience with mercury poisoning and Minamata disease.

Marion and Barney Lamm owned a fishing lodge at the confluence of the English and Wabigoon rivers, 150 km downstream of the factory. They employed 75 indigenous people in many roles, including guiding wealthy tourists. When Ontario imposed a program to restrict fish consumption, the Lamms decided to close their profitable business and sue for compensation of lost income. During the ensuing legal battle, Lamm contacted photojournalist Aileen Smith, who was

documenting the outbreak in Japan. Smith then contacted Dr. Masazumi Harada, an expert from Japan who agreed to analyze Canadian hair samples and later travelled to Northern Ontario to conduct clinical studies.
Harada's investigations revealed that Minamata disease was present, although symptoms were mild: glove-and-stocking neuropathy, balance problems, tremors, and tunnel vision. Mirroring the response seen a decade earlier in Japan, Ontario governmental officials did not recognize a mercury poisoning outbreak.
The remediation remains unfinished nearly 50 years after the order to cease mercury dumping. Negotiations for settlements between Dryden Chemicals and the people of Grassy Narrows were never successful, and Canada, unlike Japan, has yet to make an official diagnosis of Minamata disease in Ontario. This story will continue to unfold as recent protests in Toronto demand action to address mercury contamination and its impact on the Grassy Narrows First Nation.

J. **Mozersky** Queen's University

Kantian Themes in Philosophy of Science: Hackian Nominalism vs. Chomskyan Metaphysics

Ian Hacking's wide-ranging and thought-provoking studies of science contain two well-developed pillars of thought. The first emphasizes the contingent history of our inquiries into nature, focusing on the various ways in which our concepts and styles of reasoning evolve through time, and how their current application is constrained by the conditions under which they arose (e.g. Hacking 1975, 1983, 2002). The second is a persistent mistrust of the idea that the world consists of mind-independent, fixed natural kinds (Hacking 2007), preferring nominalism to what he calls 'inherent structurism' (Hacking 1999, 83). These two pillars of thought might naturally be taken to be mutually reinforcing: the lack of natural structure can help make sense of scientific variability and revision, while variability and revision provide reason to suspect that natural structure is little more than idealization. In what follows, I argue that these two pillars not only fail to support each other, but in fact conflict. One of them must fall, and it is clear which. The lessons to be drawn from this conclusion reach beyond any one thinker's philosophy of science.

Joshua **Mugg** Indiana University Kokomo

Beyond Racial Constructivism: Racial Realism Reconsidered

Regarding the ontological status of race, there seem three options: Naturalism about race says that race is a natural kind. Eliminativism says that there are no races whatsoever. Finally, Constructivism claims that race exists as a social kind (rather than a natural biological kind). I argue that the dialectic between these positions has implicit allegiances to problematic accounts of natural/social kinds and an overly simple levels ontology.
My argument proceeds in three stages. First, I survey arguments against Naturalism about race, arguing that some of them turn on the implausible assumption that there are biological essences. Within biology, we need a more permissive account of natural kinds than essentialism. In part two, I argue that on more plausible accounts of natural kinds, race is a natural kind. First, on Boyd's (1999) homeostatic-clustering-properties account, natural kinds are clusters of properties held in homeostasis by a mechanism. Second, according to Khalidi, natural kinds "consist of highly connected nodes in causal networks" (Khalidi forthcoming, p. 9). The recent psychological and philosophical literature on race (Brownstein and Saul 2016) gives us social-psychological mechanisms holding racial properties in homeostasis and race serves as a node in causal social networks. Constructivists will object that this merely makes race a human kind, and not natural. In part three, drawing on Khalidi (2013), I argue that once we take a more permissive view of natural kinds, the distinction between natural and human kinds becomes fuzzy or disappears. Thus, race is a social/human kind and a natural kind, contra Constructivism.

Corey **Mulvihill** University of Ottawa

Scientific Models, Superintuitionisitic Logics and Semantic Anti-Realism

Michael Dummett has argued that taking a realist view is correct only when the classical logic holds for a domain (Dummett 1991). Intuitionistic logic he argues is metaphysically neutral (Dummett 1992 & 1993) and while this view has been criticised (see, Williamson 2013), his critics do not reject the assertion that stronger logics make greater metaphyical and ontological claims. The scientific realism debate focused originally on the "Miracles" argument, i.e. the truth or approximate truth of our theories is the only explanation for their success (see, Popper (1963), Smart (1968), Putnam (1975 & 1978), and Boyd (1984) for the locus classicus and more recently Musgrave (1988) and Leplin (1997)). In response anti-realists noted that scientific models do not aim at truth (Cartwright 1983 & 1989) and scientists often use several different, often incompatible, models to make predictions (Morrison 2000). Realists have answered that models reveal only aspects of phenomena (Giere 2004), and that models are representations and all representations are idealizations and hence false (Teller 2004; cf. Frigg and Hartmann 2006). That is they argue that models model only specific domains, which brings us back to Dummett's choice of the correct logic for a domain. However there are a provably infinite number of superintuitionisitic intermediate logics between intuitionistic and classical logic (see, Gödel 1932) and likewise more than two positions with regard to realism. Thus while it is true that metaphysical debates over

realism may be broadly sketched using Dummett's semantic approach, we can attempt a more fine-grained analysis of the metaphysical status of scientific models by considering intermediate logical principles and comparing them to relations between different scientific models.

David P.D. **Munns** John Jay College, NY

From the Algatron to the Zootron, the history of Science is a world of trons

This talk concerns the rise and importance of trons in the sciences. The world of modern science is the age of trons. We have all heard of the cyclotron and the Jumbotron, but perhaps not the pryotron, eggatron, or phototron. In following the suffix tron, I take up Robert Proctor's challenge to grapple with the "pragmatics of language." A suffix like tron is, in Proctor's terms, an "embodied symbol." When scientists built and then named their new device a tron, they inscribed a set of meanings for the world to see, as much as ancient knights displayed heraldic shields. In the physical as much as in the life sciences, trons weren't just devices, they were an entire class of cultural objects: It wasn't just a particle accelerator, it was a Cosmotron!; and, it wasn't just a plant research laboratory, it was a Phytotron! While the history of any one of those biological and physical instruments is important in its own right, following the lineages of the trons of physics or biology offers insights into how scientists, governments, industries, and the public understood that strange period of peace lined by imminent nuclear annihilation called the Cold War. Above all, the embodied symbol of the suffix "tron" signals the centrality of modernism to postwar science, namely that technology would solve social problems and that scientists became technologists to master both nature and society. Notably in the life sciences, modernist trons speak of an era that demanded control, be it control over nature, control over populations, or ultimately control over minds and thoughts, and put its hope for that control in technology. Trons evince a people that sought security and salvation in machines and systems.

Noa **Nahmias** York University

Visualizing Science: Images in Republican China's Periodicals

In August 1933, the China Science Society (Zhongguo kexueshe 中国科学社) published the first issue of their new periodical, Popular Science (Kexue huabao 科学画报). In the opening editorial, Wang Jiliang (王季梁 1888-1966) explained the aim of the journal was to use simple language and clear, understandable images to convey common scientific knowledge. However, as Wang and others on the editorial board understood, images are not transparent, and need to be interpreted in their own right. Viewing was a skill as much as reading was, and necessitated interpretation and understanding of conventions.

This paper examines a variety of visuals published in Popular Science between 1933 and 1945, ranging from photographs to illustrations to graphs. I ask what do the images, and the interplay between text and image, reveal about the knowledge that this publication wanted to transmit? What kind of interpretation was necessary, and how did the journal try and equip its readers with an ability to "read" images? Through an analysis of the images, we can also trace how the publishers and writers aimed to represent an image of what popular science meant to them - both accurate and approachable. I argue that the images in Popular Science constituted an important part of constructing a sphere of popular scientific knowledge in Republican China.

Anthony **Nairn** Carlton University

On the Hermeneutical Revolutions of Scientific Revolutions: Re-Examining Kuhn's The Structure of Scientific Revolutions Through the Framework of Gadamer's Hermeneutical Philosophy

When Thomas S. Kuhn's The Structure of Scientific Revolutions was published in 1962, it radically changed the way academia perceived and conceptualized the development of science through time. Kuhn suggested that the development of science is not a continually progressive act of accumulation, addition upon addition, but in fact a series of sequentially eradicating paradigms. Despite generating decades of debate across fields analyzing the history and philosophy of science, hermeneutics, and the philosophy thereof, has yet to be used as an analytical method to scrutinize Kuhn's conceptualized model of paradigmatic change. This essay will re-examine Kuhn's The Structure of Scientific Revolutions using methods outlined by Hans-Georg Gadamer's hermeneutic philosophy from Truth and Method (1995). I will show how Gadamer's tradition, horizon, authority, and historical consciousness, as well as his re-imagined hermeneutical circle, come together to bring the paradigmatic nature of science into a more coherent system. I will use the methods of Gadamer as tools to show that scientific revolutions occur when the horizon – the totality of a finite paradigmatic possibility – of the scientist and the paradigm become at odds. The scientist, as a puzzle solver within the finitude of normal science, must either attempt to stabilize the paradigm or adopt a competing one. This will demonstrate that both science and scientist share a dynamically cyclical relationship, each contributing to the total possibility of the

other. Furthermore, we can observe how the reductive binary between agency and structure can be observed as more equitable through this re-working.

William **Nelson** University of Toronto

Visions of Species: Perspective and Enlightenment Definitions of Species

The famous French naturalist Georges Buffon is recognized by historians of science as being the most important interpreter of biological species in the eighteenth century. His reliance on the criterion of fertile interbreeding to determine biological species set the terms by which most of his contemporaries understood the scientific concept and the natural object. More than a logical universal, or a combination of like individuals, species for Buffon was the historically unfolding succession of individuals linked through reproduction. This immanent and historical approach to species was an important development, yet Buffon never resolved the exact relationship between species as an unchanging and essential category of nature and species as a chain of linked and similar individuals changing and unfolding in time. My paper will analyze Buffon's most brilliant and complex attempt to resolve this problematic relationship, particularly focusing on his use of techniques of imaginative visualization. Employing an unusual mode of philosophical fiction, Buffon created an epistemology of imagined perspectives, asserting that we can only know species through a type of double vision in which we see species as a complex object that can only be grasped through the harmonic mediation of two images. Shifting back and forth between the perspective of an individual human and the entirety of the human species, Buffon attempted to draw readers into an unusual way of seeing that was also a way of knowing.

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

Scientific Realism, Molecular Bonding, and the Development of Coordination Theory

Selective scientific realists argue if one can show that the predictive success of some rejected theory T is a function of theoretical claims consistent with current science, then T's failure doesn't undermine the claim that current successful theories are approximately true. As such, Selective Scientific Realism (SSR) can be tested through historical examples. In what follows, we look at theoretical advances in understanding molecular structures at the turn of the twentieth century which resulted from the Jorgensen-Blomstrand/Werner Debate about cobalt complexes. Both Jorgensen/Blomstrand chain theory and Werner's coordination theory which ultimately replaced it, make predictions about the number of ions that will be dissociated when the molecule undergoes a precipitation reaction. While chain theory makes correct predictions in many cases, Werner's coordination theory correctly predicted the number of ions in cases where chain theory failed.

Both theories follow the bonding rule that the dissociation of chloride ions will occur when they are not directly bonded to the metal atom. When this rule is applied to an assumed chain-like structure, it will make predictions that happen to be correct in some cases but not in others. However, freed from the constraint of thinking about cobalt complexes in terms of chain-like structures, applying the dissociation rule in Werner's coordination theory resulted in correct predictions in cases where chain theory failed. Thus, the feature that resulted in correct predictions in chain theory is a part of the coordination theory that replaced it.

Sajjad **Nikfahm-Khubravan** McGill University

Ibn al-Shāṭir's Planetary Latitude Theory

The planetary longitude theory of Ibn al-Shāṭir (d. 1375 or 1376) has been studied in a number of publications, whereas his latitude theory has not received much attention. It has been over fifty years since Victor Roberts published an analysis of Ibn al-Shāṭir's latitude theory in 1966. His account of Ibn al-Shāṭir on latitudes of the outer planets has two main problems—one technical, the other historical. The technical problem comes from the fact that the model as described by Roberts does not satisfy the observational conditions mentioned by Ibn al-Shāṭir. The historical problem relates to Ptolemy's different latitude theories. It is well known that Ptolemy presents his final latitude theory in the Planetary Hypothesis, having resolved problems of his earlier theory in the Almagest. Ibn al-Shāṭir was well aware of the improvement in Ptolemy's final model compared to that of Almagest, and like his predecessors, presumably wished to employ Ptolemy's new theory for his own model. However, the model presented by Roberts is not consistent with Ptolemy's final one. In this paper, I will discuss the aforementioned problems in detail and provide a revision of Roberts' results.

Andrew **Oakes** University of Toronto

John S. Plaskett – Leadership in Early 20th-Century Astrophysics in Canada, 1903-1935

From the perspective of the science of astronomy, the interpretation of the light spectrum was a fundamental development in the chemical analysis of celestial starlight. The breakthrough discovery with the application of spectroscopy in 1859, inaugurated a new period in astronomy that evolved into astrophysics. It launched a continuing

episode of new astronomy that was later embraced in early 20th-century Canada where it was spearheaded by Canadian physicist and scientist, John S. Plaskett (1865-1941). The research work of John Plaskett at the Dominion Observatory in Ottawa, Ontario, from 1903 and, later, the Dominion Astrophysical Observatory in Victoria, British Columbia, from 1918, brought international recognition to Canada's early efforts in astrophysics. Plaskett's determination and personal boldness led to the establishment of a small cadre of Canadian astronomers who worked on their astrophysical research programs under Plaskett as their collaborator and supervisor. Despite its small population at the time and a relatively tiny number of professional astronomers, Canada did become recognized for its early spectroscopic work in astrophysics. Plaskett improved the techniques of celestial spectroscopy during his scientific work at the Dominion Observatory and, again later, at its newly-built sister facility, the Dominion Astrophysical Observatory. Historically, Plaskett found himself to be the right person, in the right place, at the right time, and with the right temperament during the review period spanning 1903 to 1935.

Claire **Oliver** University of British Columbia

'The Crimson Thread of Kinship:' Telegraphic Nationalism and the Construction of Canada 1867-1903

The telegraph represented an entirely new capacity for simultaneous, long distance communication in late nineteenth century Canada, foreshortening the spaces between remote inland settlement areas and linking the isolated Pacific coast with Atlantic Canada and Europe. For a relatively young and undefined nation, the telegraph served as a structural conduit for political authority and a social medium for simultaneous communication, creating a shared environment of Canadian identity and experience. This essay uses a conceptual historiography of communications and technology to explore the symbolic and cultural significance of telegraph networks in Canada between 1867 and 1903, using ideas of distance and identity from the Toronto school of communications theory to examine the deep ideological structures embedded in the construction of transnational telegraph lines. These networks diffused a new form of national culture from Eastern population centres into the Western provinces, where the installation of telegraph lines helped to build a spatially organized society with social and political ties to Ottawa and Toronto. Telegraphic infrastructures were made more effective through the legal separation of telegraphic content and carriage, which embodied a distinctly Canadian set of liberal values through a utility model partnering the government with privately owned corporations. This essay provides a new critical perspective in Canadian telecommunications history by addressing the dynamic relationship between regional identity and the cultural and spatial expansion of late nineteenth century nationalism, demonstrating how a new understanding of Canada was actively constructed and extended through the physical structure and conceptual medium of the telegraph.

Allan **Olley**

Measurement by Analysis of Gravitational Perturbation: The Case of Pluto's Mass

Attempts to probe the universe by looking at the perturbations of planetary motion are a recurring method in celestial mechanics. The most famous case is the role of perturbations in the discovery of Neptune. Also often noted is the attempts to use similiar unexplained perturbations of Neptune's orbit to discovery a putative Planet X that led by coincidence to the discovery of Pluto. Less known is the attempts by Dirk Brouwer and others to establish a mass for Pluto based on its perturbation of Neptune and Uranus. First in a set of 1940 numerical integrations and later in the 1951 Numerical Integration of the Outer Planets that became the standard reference on those planets positions for some time. The mass these integrations suggested would be downgraded again and again until the discovery of Charon in 1978 fixed Pluto's mass at a fraction of earlier estimates.

I will discuss the method of inference and mentality that led to the employment of this method and connect the attempts to measure Pluto's mass with a greater tradition in astronomy. I will also give some context for the Columbia computing laboratories, headed by Wallace J. Eckert, where both computations were carried out based on published and archival sources.

David **Orenstein**

Helen Hogg and Frank Hogg: A Fruitful Personal and Professional Partnership in Astronomy

Helen Hogg, nee Sawyer, (1905-1993) and Frank Hogg (1904-1951) met, fell in love and became engaged at the Harvard College Observatory where they had started post-graduate study in 1926; he under Cecilia Payne, she with Harlow Shapley. They married in 1930 and their life and work together occurred in the trough between the first and second waves of feminism. It was strongly impacted by the Great Depression and World War Two.

Based on a rich archival record, I will demonstrate their strong mutual support for each other both personally and professionally despite such challenges as the structural barriers against women that Helen faced and Frank's heart problems. They advanced in their careers, undertook significant research, raised a family and contributed to their communities.

Their relationship was tested. When Frank was travelling through Europe on a fellowship after completing his doctorate in 1929, Helen was stuck at Harvard finishing hers. Shortly after their marriage, in 1931 Frank accepted a post at the Dominion Astrophysical Observatory in Victoria, B.C., but due to Depression era restrictions there could be no paid job for Helen. During the Second World War they both had to shoulder extra burdens at the short-staffed University of Toronto's David Dunlap Observatory where they had both worked since the DDO's opening in 1935.

Nicholas **Overgaard** University of Toronto

Towards a Science of Science

Reintegrating HPS is not only a possibility; it is a reality currently practiced here in Canada. In this presentation, I discuss a new science of science, scientonomy, as the bridge between HS and PS. Like any proper science, this new descriptive empirical science has two closely linked sides – theoretical and observational. Theoretical scientonomy aims at formulating a unified taxonomy and uncovering the general mechanism of scientific change by means of the data provided by observational scientonomy, which in turn attempts to make sense of individual historical episodes by utilizing the taxonomy and explanatory tools of theoretical scientonomy.

Considerable steps have been taken towards establishing scientonomy as a new descriptive science of science. To that end, our team has established a workflow that utilizes open-source content on the Encyclopedia of Scientonomy (scientowiki.com), an annual seminar, a peer-reviewed journal (Journal of Scientonomy), and workshops, all to ensure that scientonomic knowledge can be properly documented, scrutinized, and changed in a piecemeal and transparent fashion. In walking us through the key questions, accepted theories, and practiced workflow of this new discipline, I show that where HPS has failed, we have a reasonable chance to make progress in tracing changes in scientific theories, methods and communities through scientonomy.

Kristine **Palmieri** University of Chicago

Friedrich Max Müller's Objection to Darwin on Language: Beyond Science versus Religion

Friedrich Max Müller's apparent opposition to the Darwinian theory of evolution has led much of his work on language to be discounted as antiquated, narrow minded, and reactionary. This assessment uncritically perpetuates the persistent misconception that there was a fundamental opposition between those who accepted Darwinian evolution and those who rejected it for reasons that were necessarily antiscientific and theological. Yet, Müller neither rejected the theory of Darwinian evolution in its entirety nor did he base his study of language on religious premises. What Müller took issue with in Darwin's work was his approach to language and he was adamant that his own work constituted a new Science of Language that, moreover, was a natural one.

Through an examination primarily of Müller's "Lectures on Mr. Darwin's Philosophy of Language" (1873), this paper reveals that his objections to Darwin's statements about language were motivated by scientific and philosophical considerations rather than religious ones. Above all else, Müller's argument advanced the claim that the Darwinian view was unable to explain facts about man and his faculties that the Science of Language had already established.

By removing this dispute from a framework of pro-Darwinian science versus anti-Darwinian religiosity and through a close reading of Müller's written work, this paper consequently sheds new light on the scientificity of Müller's Science of Language, the status of language as an object of study, and conflicting conceptions of science in the second half of the Nineteenth Century.

François **Papale** University of Montreal

A Continuum of Integration Accounting for Populations and Individuals in the Context of Darwinian Explanations

This paper aims at giving a descriptive account of two keystone concepts of Darwinian explanations: the notions of individual and population. I will argue that the best way to describe those concepts is through the formation of a continuum of integration. Moreover, I will argue that the degree of integration associated to a biological entity is best understood by considering two properties: reproduction and persistence.

I will first review contemporary representations of natural selection in order to clearly highlight the epistemic function played by the concepts under study (Godfrey-Smith 2009; Lewontin 1985). Following this, I will explore the most common definitions of biological individuals and populations (Bouchard 2011; Godfrey-Smith 2009, 2013; Millstein 2010). This will serve to show that in both cases, the capacities to reproduce and to persist are of great importance, and that integration stands as a crucial property for understanding how the notions are used within Darwinian explanations. The continuum of integration will step in as a representation and a heuristic tool.

Giving a proper description of the concepts of population and individual is an urgent matter as recent theoretical work in philosophy and biology has brought to attention a number of borderline cases (e.g. the quaking aspen) that resist the use of traditional Darwinian explanations (Bouchard 2011). By focusing on their degree of integration, it becomes possible to explain why such cases are problematic and to relieve the tension that they illustrate.

Paul **Patton** University of Toronto

Affordance signifiers as the objects of perception

What is the object of perception? For those who see the function of perception as informing our actions, the psychologist J. J. Gibson's concept of an affordance is increasingly attractive. Gibson supposed perception informed animal perceivers about the affordances of their natural environment. He defined the affordances of an environment as that which it "offers the animal, what it provides or furnishes for good or ill". Subsequent work has sought a more precise definition of this potentially useful concept. The notion that affordances are animal/environment relationships is promising, but requires further development. Antony Chemero defined an affordance as a relation between an animal ability and an environmental situation. But this definition fails to capture Gibson's notion that an affordance is "for good or ill". I propose instead that an affordance relationship exists between an animal and an environmental situation due to both its abilities and its needs. Although an animal's occurrent needs are constantly changing, the ability of an environmental situation to satisfy a need is fixed. If an apple is present, it can potentially nourish me, even if I'm not currently hungry. Gibson supposed affordances could be directly perceived. But the sort of relationship under discussion here is not something that could be perceived. I therefore distinguish between the affordance relationship, and an affordance signifier, defined as the perceptible manifestation of an environmental situation that is a member of an affordance relationship. I propose that the objects of perception are potential affordance signifiers.

Bican **Polat** Johns Hopkins University

Before Attachment Theory: Separation Research at the Tavistock Clinic, 1948-1956

Attachment theory is one of the most frequently cited and continuously expanding theories in contemporary psychology, providing researchers as well as mental health professionals with key explanatory constructs for understanding and intervening in intimate interpersonal relationships. The theory was initially formulated by the British psychiatrist John Bowlby (1907-1990) between the years of 1958 and 1969. As important as the formulation of the theory was the systematic research effort of Bowlby's colleague Mary Ainsworth (1913-1999) at Johns Hopkins University in the 1970s that has initiated the ongoing tradition of attachment research in American academic psychology. In this paper, I trace the formation of attachment theory to the pioneering research program of Bowlby and his colleagues at the Tavistock Clinic (London, UK) between 1948 and 1956. Through a discussion of the concepts and practices that informed Bowlby's program, I examine the efforts of his team to reconstruct psychoanalytic objects according to preventive objectives and operational criteria. I discuss how the exploratory techniques that Bowlby and his colleagues were developing during these years ultimately led to the establishment of a hybrid investigative framework, in which the prophylactic requirements of mental hygiene, the psychometric model of personality disturbances, the psychoanalytic theory of object relations, and a direct-observational methodology were brought to bear on the problem of the psychological consequences of early separation experiences. I further show the centrality of this shift in investigative practice to the succeeding theoretical developments, which paved the way towards the establishment of the attachment paradigm.

Marina **Pražetina** Wirth Institute, University of Alberta

Trustworthiness of science in the nexus between science, society and policy

The aim of this paper is to examine the interface between science, society and policy in the light of trustworthiness of science in order to single out the conditions that are needed for scientific knowledge and expertise to be trustworthy. We hypothesize that in devising scientific advice both epistemic and social conditions of trustworthiness have to be met. Our analysis raises several questions related to the objectivity in science and we argue that trustworthy science requires reformulation of the notion of objectivity in science to ensure social responsibility and democratic accountability. Our contribution to the current discussion about the inductive risk argument and the role of contextual values stems from epistemic and social perspective. By illustrating the ways in which race and gender can be represented, we argue for different role of contextual values in normative concepts and further elaboration of participatory approach in scientific process.

Hans **Radder** VU University Amsterdam

Causality, Theory Ladenness and Reproducibility in Experimental Science

In this paper, I put forward three basic philosophical claims concerning, or derived from, scientific experimentation. These claims will be illustrated with examples from several disciplines. My discussion exploits the following core notions for the philosophical analysis of experimental practice: the dimensions of material realization and theoretical interpretation of experimental systems; the aim of realizing stable object-apparatus correlations; the required control of the relevant interactions between environment and experimental system; and the different types and ranges of experimental reproducibility.

On this basis, the following claims will be explained and defended:
(1) The requirement of stable material realization implies that causality is an indispensable aspect of all empirical sciences; this conclusion refutes the empiricist claim that science can do without the notion of causality.
(2) The required interpretation of the object-apparatus correlation entails the impossibility of a complete 'independence' of the different kinds of theories employed in experimentation; although this fact does not imply a vicious methodological circularity, it may cause significant problems for representational forms of realism.
(3) Reproducibility is an important epistemic value in experimental research, but the 'double hermeneutic' limits its role in disciplines like experimental psychology; this point, which is unjustly ignored in the current replicability debate, leads to a critique of the dominance of the one-sided, experimental approach to psychology and to a plea for a more pluralist methodology.

F. Jamil **Ragep** McGill University

The Background to Copernicus: "Vaine Recherche" or Indispensable Quest?

Copernicus and his revolution have never failed to fascinate, and in the last few years a number of books and articles have appeared that have raised new questions, provided new perspectives, and generated a fair amount of controversy. The Islamic background has loomed large in the discussion of "precursors" and "predecessors," but a recent publication has dismissed claims of Islamic (as well as European) precursors as a "vaine recherche." In this paper, I shall give a brief overview of recent research dealing with the background to Copernicus and then present some new findings that show Copernicus's dependence upon a Damascene astronomer named Ibn al-Shāṭir (fourteenth century) and the Warmian astronomer's surprising early adherence to both heliocentrism and homocentrism. As I will argue, this indicates the importance for Copernicus of Islamic technical astronomy and its criticisms of Ptolemy's planetary models (sometimes referred to as the "Marāgha School") as well as the Aristotelian revival (with its insistence on a homocentric astronomy) in twelfth-century Andalusia and its manifestation in fifteenth- and sixteenth-century Italy. This still leaves open the question of "why" Copernicus decided to take the heliocentric turn, a question that demands a fresh look at philosophical and theological changes that occurred in the fifteenth century in both Latin and Islamic contexts.

Venilla **Rajaguru** York University

Island-building: Old and New, Far and Wide

My paper is structured in three parts.
I. The first part is a conceptual discussion of artificial islands i) as an epistemic category of enviro-technological fusions, and ii) as instrumental constructions of the State's national apparatus of resource ownership, objectifying and securitizing territorial boundary imaginaries in water frontiers. In the course of my discussion, I will also be delineating between land reclamation projects and artificial island constructions. My analytical arguments will be based on two major cases of island-building: the case of militarized island-building in the South China Sea region of the Pacific, and the oil production islands built in the 1980s and 90s by sand dredging in the Beaufort Sea region of the Arctic.
II. In the second part, my analytical focus is on probing when, why and how island-building started historically as a technological practice, with references to specific historical sites and geographical locations (that pre-date the Beaufort Sea constructions): this discussion is part of my effort to further explain, i) for what beneficial and historical purposes were the earlier island constructions undertaken, and in comparison to ii) what makes the contemporary island-building practices in the South China Sea even more controversial and problematic than the earlier practices, in the context of the contemporary system of international ocean space governance.
III. The third part of my discussion will focus on how island-building practices in the South China Sea are contesting the norms of the philosophical and legal framework of international maritime order. I use the term 'island-building' to refer to heterogeneous practices of constructing artificial islands, that include engineering practices as well as knowledge production through publishing altered maps, satellite news imagery, political and media rhetoric on environmental asset ownership. I end with a brief analysis of Canadian engagement in the South China Sea-Peace Initiatives throughout the 1990s, and contemporary Canadian policy for peace over disputed national boundaries in the Arctic as well as in the South China Sea region of the Pacific.

Andrew S. **Reynolds** Cape Breton University

Implications of Scientific Metaphor for the Scientific Realism Question

According to an influential statement by Bas van Fraassen, scientific realism is the thesis that "Science aims to give us, in its theories, a literally true story of what the world is like; and acceptance of a scientific theory involves the belief that it is true" (1980, 8). What then are the implications that science relies so heavily on metaphor in both its theoretical and observational vocabulary? In fact, discussions about the realism question tend to conflate the thesis that science aims to provide a literally true account of the world with the quite different, and more philosophically ambitious, idea that it aims

to provide an objectively true account of the world, i.e., a description of reality as it really is independent of us or in its own terms, as it were. These are distinct theses, but both assume that science ought to result in one uniquely correct account of the world. I argue that science cannot provide an objectively true account in that sense; nor should we desire it to seek only a literally true account. Scientists use metaphors to create explanatory models and to solve practical and technical problems, and for such tasks there may be no one best 'story', nor need it be free of metaphor. Moreover, the literal-metaphorical gap is more porous than originally assumed, as the case of polysemy and 'dead' metaphors in science attests. Consequently, it is not always obvious when a scientific term is metaphorical or literal.

Sheldon **Richmond** Independent Scholar

Everett's Version of Everett

The interpretation of Everett as providing a many-worlds interpretation of Quantum Mechanics is not how Everett interpreted his own interpretation. The questions are: 1. How and why did the many-worlds interpretation of Everett gain hold? 2. How did Everett interpret his own interpretation?
My answer to the first question is that mainstream physicists approached Everett's interpretation from the "orthodox" Copenhagen interpretation and consequently misunderstood Everett.
Mainstream physicists attempted to rebut Everett's critique of the Copenhagen interpretation of Quantum Mechanics by arguing that it was based on a misunderstanding of Bohr. Mainstream physicists disregarded how Everett approached the problem of measurement in QM that arises with the use of the theory proposed by Paul Dirac and John von Neuman of the collapse or reduction of the wave packet upon measuring or observing quantum phenomena. They also overlooked how Everett deals with the various famous paradoxes in QM, such as Schroedinger's live-dead cat, Wigner's Friend, wave-particle duality and EPR. Not one asked: how did Everett interpret his own approach to QM?
My answer to the question of how Everett interpreted his own interpretation of QM is that Everett proposed a theory of the universe as static where mind or observers are relative aspects of the static universe.
In Everett's theory, the Observer is a recursive feed-back loop within quantum systems relative to the Universal Wave Function. There is only one World—the Universal Wave Function. Observers and their observations are wave functions relative to the singular wave.

Esther **Rosario** and Ingo **Brigandt** University of Alberta

Three Concepts of Gender for Different Social Aims

Examining previous discussions on how to construe the concepts of sex and gender, we argue that at least three different concepts of gender are needed. This is analogous to the idea that a plurality of species concepts is needed, as different species concepts answer to different epistemic aims, but in our case social aims are at stake. We assume that also several concepts of race are to be utilized for different contexts (as another instance of what we dub strategic conceptual engineering), but in this presentation we focus on gender, by sketching three distinct concepts of gender and arguing that all of them are needed, as they answer to different social aims. The first concept serves the aim of identifying and explaining gender-based discrimination. It is similar to Sally Haslanger's well-known account, except that rather than offering a definition of 'woman' we focus on 'gender' as one among several axes of discrimination. The second concept of gender is to assign legal rights and social recognitions, and thus is to be trans-inclusive. Against Katharine Jenkins' recent proposal, we argue that this cannot be achieved by any concept that includes substantial gender-related psychological features, such as awareness of social expectations. Instead, our concept counts someone as being of a certain gender based on the person's mere self-identification with this gender. The third concept of gender serves the aim of personal empowerment by means of one's gender identity. In this context, substantial psychological features and awareness of one's social situation are indeed involved.

Sophia **Rousseau-Mermans** Université de Montréal and Université Paris

Keystone species problem and pluralism

The keystone species concept (KSC) was introduced by Robert Paine (1969) in order to denote a predator species whose predation upon a strongly competing species is crucial for maintaining the structure of its community (Paine 1974). Since then, the KSC has been used and defined in various and often conflicting ways, both in ecology and conservation biology, leading some ecologists to call for its abandon (e.g. Mills, Soulé, Doak 1993). Some ecologists (e.g. Menge et al 1994) have tried to solve such "keystone species problem(s)" by clarifying Paine's original definition, that is, the keystone predator species concept. Others, adopting a more pluralist stance (e.g. Power et al 1996), have proposed a broader definition of the concept according to which keystone species consist in species whose impact on some community or ecosystem trait is significantly disproportionate with their abundance (e.g. biomass). It remains to be seen, however, whether a pluralistic account of the KSC is possible and whether in can be relevant to ecological research. To address this issue, I will first question to what extent the various definitions and epistemic aims of the KSC really differ

from each other, and from Paine's original usage. Then, I will discuss two conceivable pluralistic ways of solving one the "keystone species problems", which both draw connections between this problem and the better known "species problem" in philosophy of biology. The first one based on DeQueiroz's (2005a, 2005b) approach to that latter problem, the second one, based on the Homeostatic property cluster (1999) approach.

Gregory **Rupik** University of Toronto

The Dis-integration of the History and Philosophy of Science

In the 1960's the prospects for an integrated discipline of HPS seemed bright. Implications of Kuhn's Structure provoked philosophers to take the history of science seriously, and historians began to use Kuhn's taxonomy as either a guide or foil. For all intents and purposes historians and philosophers interested in science appeared to be entering a mutualistic relationship, and even established research programmes, faculty positions, and departments to cultivate its benefits. But what accounts for the fact that, despite this early enthusiasm, history and philosophy of science stand so distinctly apart from one another today, and, evidently, have struggled to reach any satisfying integration since the discipline's inception?
I propose that the dis-integration of HS and PS is grounded on a general failure on the part of philosophers to distinguish the descriptive theoretical question of how science changes through time from the normative methodological question of how theories ought to be evaluated, regardless of time period. The persistent conflation of these two questions has led to the repeated whiggish shoehorning of actual historical episodes into purportedly ahistorical normative schemes—resulting in historical reconstructions which historians rightly balk at. By tracing the origins and consequences of this conflation between descriptive theories and normative methodologies in PS, I hope to show how a purely descriptive theory of scientific change is possible, and how it may open the door to the mutualism and integration once envisaged for HPS.

Guilherme **Sanches de Oliveira** University of Cincinnati

No Safety in Numbers? Mathematical Skepticism in Cartesian Physics and Contemporary Environmental Modeling

In stark contrast with the formalism of his earlier work, Descartes' mature physics seems to be purely qualitative, providing only pictorial and verbal descriptions of physical phenomena. While some commentators have interpreted this shift as revealing Descartes' disillusionment with mathematical physics, Garber (2000) argues that it was instead due to Descartes' dissatisfaction with the specific mathematical tools available at the time and with Galileo's alternative paradigm. In this paper I contrast the "mathematical skepticism" found in Descartes' mature physics with contemporary discussions about the failures of mathematical modeling in environmental science. Using mathematical equations and computer simulations to study environmental phenomena has yielded many tragic results, including the collapse of entire animal populations and preventable material loss to floods and coastal erosion. Some modeling failures are due to the inaccuracy and/or excessive simplicity of the particular models in use. In other cases, however, the notable ineffectiveness of the models raises the question of whether mathematics is capable of capturing the phenomena at all. Drawing from "mathematical skepticism" in environmental science, I argue that recent debates mirror the clash between the Cartesian and the Galilean paradigms in seventeenth-century physics and can help illuminate Descartes' approach in his later work. In support of the idea that Descartes' mature physics was still thoroughly mathematical, I characterize his apparent skepticism as resulting from an underlying representationalist bias, which, I propose, corresponds to doubts about deriving "strict predictions" from "quantitative mathematical models" while nonetheless still trusting the "broad predictions" generated from "qualitative mathematical models."

Dilek **Sarmis** Paris

The Modalities of the Rational as Social Order: How to make an Institutional and Conceptual History of Sciences and Disciplines in Turkey

My paper will emphasize on a large period of construction of sciences and disciplines in the ending Ottoman empire and the beginning Republican Turkey, from the end of the 19th century to the 1940s.
Transition from imperial period to republican era in Turkey is marked by discursive changes and disruption of knowledge (increasing of encyclopedias, dictionaries, the holistic vision of a transmissible knowledge, the development of conceptual frames of reflections on society inspired by Comte and Le Bon for instance) : they produce patrimonialisation of social thought and gives tools to engage with political projects, by producing fundamental modes of rationality. These both institutionnal and discursive evolutions support the configuration of sciences as disciplines in a changing university, with two main moments, in the 1910s (end of the Ottoman era) and in the 1930s (first republican period).
More specifically and parallel to the distinction between humanities and hard sciences, the gradual institutional distinction between philosophy, sociology, psychology and psychiatry in Turkish university is the result of conceptual framings that have to do with socio-political issues and concerns, giving evidence of a porosity of conceptual, intellectual and political fields.

Far from the transferential paradigma of knowledge (from Europe to Turkey) that is shared by classical historiography, my aim is to contribute through this paper to both a historical and a social epistemology of rationalities in a country under construction.

Nastasha **Sartore** University of Toronto

Ethnology, Progress, and Working-Class Improvement in Victorian England: The Bethnal Green Museum, 1872-7

This paper demonstrates that the working classes of London's East End were also important actors and subjects in Britain's museological project. It examines the food and animal products collections permanently stationed in London's Bethnal Green Museum in the late-nineteenth century, and the collection of ethnological artefacts on loan from A.H. Lane Fox to this same museum during the period 1874 to 1879, using evidence from the heretofore unexplored museum archive and catalogues. It argues that the items in these collections and their arrangements in the museum space linked the improvement of the working classes to broader anthropological concerns rooted in contemporary notions of progress and empire. By focusing on a cultural space built with the aim of instructing and moralizing the labouring classes, this paper sheds new light on the museum experience and situates the working classes in existing narratives on Victorian museums and urban imperial culture.

Fateme **Savadi** McGill University

Plagiarism in Scientific Works of the Islamic Period: Quṭb al-Dīn al-Shīrāzī's Conceptions

It is extremely difficult to establish cases of plagiarism within Islamic scientific texts. Is a scholar who quotes a scientific work without referencing it engaged in plagiarism, or rather following the common practice of employing what was held to be shared knowledge? The focus of this paper is Quṭb al-Dīn al-Shīrāzī (d. 1311), a pupil-colleague of Naṣīr al-Dīn al-Ṭūsī (d. 1274). Shīrāzī says in the introduction of one his major astronomical works Nihāyat al-idrāk that he will follow the linguistic style of Ṭūsī's seminal work al-Tadhkira fī ʿilm al-hayʾa, and that he will "incorporate it in the course of the exposition if it is clear, and expound upon it if something in it is obscure." My investigation of the third chapter of the Nihāya revealed that Shīrāzī incorporated almost the entire text of the third chapter of the Tadhkira, most often verbatim or slightly paraphrased. On the other hand, in his later work Faʿalta fa-lā talum (You've done it so don't blame [me]), Shīrāzī makes an allegation of plagiarism against a certain al-Ḥimādhī, a commentator of the Tadhkira who apparently criticized Shīrāzī. Based on Shīrāzī's two works, it is not my intention to establish a case of plagiarism against him, nor to prove his allegation of plagiarism against al-Ḥimādhī, but rather this paper aims to understand Shīrāzī's conception of plagiarism and his attitude towards it contextually.

Margaret **Schabas** University of British Columbia

Celebrating Fifty Years of IHPST at the University of Toronto

Institutes that grant doctoral degrees in the History and Philosophy of Science do not grow on trees. There might be fewer than twenty such institutes or departments in the Anglophone world. IHPST remains the only one of its kind in Canada and, apart from the IHPST at the Sorbonne, is unique in its mission to include technology. It also recognizes medicine in the mix, in the form of faculty appointments and course offerings. Whatever the motivations behind these construals, it is fair to say that the IHPST over the course of fifty years has sought to be inclusive of a wide range of pursuits. How well has the IHPST managed this juggling act? Some might say well, others poorly. Is HPS(T) best characterized as interdisciplinary, transdisciplinary, or as a discipline all its own? I will argue that HPS(T) is its own unified discipline and that, notwithstanding the persistent professional disputes between historians of science and philosophers of science, IHPST at the University of Toronto does much to foster a clear and unified path.

Margaret **Schabas** University of British Columbia

Hume on the Rise and Diffusion of Scientific Inquiry and the Mechanical Arts

In a series of essays (1741-52), David Hume developed a detailed account of the factors conducive to scientific inquiry. Why are there periods of intense scientific inquiry and other periods of neglect, particularly given the universal disposition toward curiosity? Genius, Hume submits, is randomly distributed across time and space, but needs to be cultivated in a supportive milieu if it is result in lasting scientific contributions. One key factor is the degree of political freedom and implicit social hierarchies. He compares and contrasts the pursuit of science under republics and monarchies, and argues that a person blessed with genius will succeed best in a republic. Monarchies, by contrast, need to foster politeness and refined tastes, as well as a "superstitious reverence to priests and principles," in order to uphold the "long train of dependence from the prince to the peasant." These predilections in turn supresses scientific inquiry. Hume also believes that republics, especially small republics, will promote more trade and thus more innovations will transpire. Progress in the mechanical arts and scientific knowledge thus move in tandem. Moreover, our human propensity for

emulation prompts their respective diffusion. Hume casts an eye far and wide, back to the pre-Socratics, but also to the rise of science and artisan practices in the early modern period.

Simon **Schaffer** University of Cambridge

The Silent Trade: Measurement and Materiality in Cultures of Knowledge

Stories of a silent trade, in which separate partners in cross-cultural encounter exchange materials without the need for immediate social communication, are present, from far and wide, in the origin myths of market relations from south Asia and west Africa to Atlantic Canada. Such tales embody a pair of salient assumptions about the connexion between measurement and materiality: that exact measures offer means of communication without and prior to social relationships, and that material objects' values speak for themselves. These assumptions play a fascinating role in many debates within the field of history and philosophy of science, and their genealogy allows a re-examination of how better to make sense of materials and of measures within different knowledge systems.

Kristen M. **Schranz** University of Toronto

Pneumatic Chemistry in the Making: The Writings of James Keir and Pierre-Joseph Macquer, 1766–1779

Most widely acknowledged eighteenth-century pneumatic 'developments' appear to prepare the way for the Chemical Revolution by French chemists in the late 1780s. Yet the making and circulating of pneumatic knowledge was often untidy and convoluted, rendering a linear progression of knowledge from Boyle to Lavoisier via various British chemists incomplete and untenable. The 1770s was a pivotal decade for pneumatic chemistry as natural philosophers, physicians, manufacturers, and civil servants on the Continent and in Britain attempted to capture, study, and validate pneumatic productions despite a lack of consensus about the nature of air(s) and the absence of a universal terminology to describe apparatus and observations. In order to understand the nuances and difficulties of pneumatic knowledge 'as it happened' in the 1770s we need to look beyond the iconic figures in the traditional narrative. The Scottish-born manufacturer James Keir and the French physician and lecturer Pierre-Joseph Macquer played an important role in summarizing, annotating, translating, and circulating chemical knowledge in this era. By tracing iterations of concepts, experiments, and theories in their published texts, the talk shows how Keir and Macquer represented the growing interface of pneumatic discussions between Britain and France. An examination of Macquer's and Keir's contributions and treatises on air(s) throughout the 1770s confirms the rapidly changing dynamics in pneumatic chemistry to show its dependence on prompt knowledge sharing via dictionaries, letters, translations, private notes, experiments, as well as networks of personal and institutional connections.

Jamie **Shaw** University of Western Ontario

The Historical Turn and the 'Fact' of Pluralism

The historical turn in philosophy of science focused a great deal on what is now called the 'fact of pluralism' (Mitchell 2003). The diversity of methods, concepts, and theories poses serious problems for the very idea of general philosophy of science. In this paper, I discuss how philosophers of the historical turn, specifically Kuhn, Feyerabend, Lakatos, and Toulmin, managed this fact of pluralism.

I argue that these philosophers provide distinct conceptions of the relationship between philosophical accounts of pluralism and the fact of pluralism. Kuhn and Toulmin offer descriptive views of science but come to different conclusions. Kuhn (1959, 1962) restricts pluralism to periods of revolution between paradigms or as a feature of immature sciences. Toulmin (1967, 1972) understands science as inherently pluralistic since each scientific community can only operate with their own rationality. Because of his Wittgenstenian roots, Toulmin believes the fact of pluralism is inevitable because scientists will be unable to renegotiate their basic commitments. Feyerabend and Lakatos, by contrast, offer normative accounts: pluralism may not always be a fact of practice but should be promoted regardless. For Lakatos (1968, 1970), pluralism of research programs is necessary for maximizing empirical content. For Feyerabend (1970, 1975), pluralism becomes unconstrained by epistemic considerations. I close with a comparative analysis to show the relative strengths and weaknesses of these approaches in their attempts to manage the fact of pluralism. This recovers some ways of conceiving of the relationship between pluralism and practice.

Nick **Slothouber** Western University

Natural Classification and Psychiatric Classification

Philosophers of psychiatry have defended the Homeostatic Property Cluster (HPC) view of natural kinds (Cf. Kender et al., 2011; Tsou, 2007, 2008, 2012, 2013, 2016) as a way of conceptualizing and classifying mental disorders. I contend that, while kinds of mental disorders can certainly be conceptualized as HPC kinds, philosophers of psychiatry have fundamentally misunderstood the explanatory nature of the HPC theory. The HPC theory is a post-hoc explanation of the success of our inductive practices. In particular, it provides an explanation of how some of our concepts can be seen as

natural categories despite being heterogenous and vague. Far from being “useful models for psychiatric classification” (Kendler et al., 2011, 1143), HPC kinds place no constraints whatsoever on classification.
The upshot of this, I argue, is that conceptualizing kinds of mental disorder as natural kinds in the HPC sense of ‘natural kind’ provides no way of revising psychiatric classification in the way that proponents of the HPC theory expect. In particular, I argue that Diagnostic and Statistical Manual of Mental Disorder (DSM) categories are already HPC kinds, and, as such, the DSM is already a natural classification system in some limited sense. Yet, DSM categories are heterogenous, and so are unlikely to inform precise treatments for mental disorders. It would seem that the HPC theory of natural kinds will be of no help in revising current mental disorder categories, if such revisions are meant to pick out more homogenous kinds.

Chris **Smeenk** Western University

Confirming QED

One of the spectacular triumphs in the early history of relativistic quantum field theory was Schwinger's successful calculation of the magnetic moment of the electron. Schwinger found the first term in a perturbative expansion of this quantity in quantum electrodynamics (QED), and this correction to the result obtained earlier by Dirac agreed with experimental results to extremely high precision. This result is often cited as compelling evidence in favor of QED. Yet there are reasons to have qualms about taking this as a straightforward example of a successful prediction. First, as Dyson (1952) argued shortly after Schwinger's work, the perturbative expansion Schwinger had used actually diverges. This argument undercuts the idea that the perturbative expansion converges towards an ever more precise value of the magnetic moment as the number of calculated terms increases. Second, how did the experimentalists achieve such exquisite precision, given uncertainties in the detailed models of the experimental apparatus? I will briefly argue that the answers to these questions depends on a richer picture of how QED is compared with phenomena, based on treating it as an effective field theory. Precision tests of QED exploit experimental settings in which the measurement of particular quantity (such as measurement of the fine-structure constant via the quantum Hall effect) is insensitive to many details of the apparatus, due to symmetries.

Mark **Solovey** University of Toronto

Disciplining the Social Sciences during the Reagan Revolution

Shortly after a federal charter established the U.S. National Science Foundationin in 1950, the new agency became a cautious but nevertheless key federal patron for the social sciences, especially for academically oriented investigations and so-called basic research. But the social sciences’ position in the agency also became a common focal point for political and scholarly debate about their scientific identity, their practical value, and the role of public funding for them. In this paper I consider how the social sciences fared at the NSF during the Reagan era. I argue that this period, marked by the surging power of a conservative agenda in American political culture and national science policy, had far-reaching implications for the standing of the social sciences within the federal science establishment and at the NSF in particular. Briefly, funding for the social sciences declined. They became subject to scathing criticisms from powerful natural science leaders. Under these difficult circumstances efforts to fund and promote the social sciences were shaped by a measure of conservative discipline as well. The material discussed here is based on a chapter from my current book project on social science funding, policies, and programs at the NSF from the mid-1940s to the present.

Cindy L **Stelmackowich** Carlton University

Medicine’s New Teaching Texts: The Artistic, Marketing and Technical Shifts Affecting Anatomical Atlases in the Nineteenth Century

At the turn of the nineteenth century new types of illustrated anatomical atlases emerged in France and England at the historical juncture of developments in public health, medicine, art, and publishing. These profusely illustrated anatomical and colorful early pathological atlases worked to establish the efforts of the teaching physician as professional, authoritative, and scientific. This paper considers the varying appearances, format, structures and readership of the anatomical atlas over the first half of the century. It examines the effects that commercial publishers and innovations in the book industry had on large folio anatomical books that appealed, at least initially, to the wealthy and elite clients. It demonstrates how new sets of needs and expectations from middle-class clients, medical students, and circulating libraries, for instance, resulted in major changes in the printing, circulation, and binding of atlases. Medicine quickly and eagerly adopted the innovations in bookbinding and illustrative technique that blossomed in the first half of the nineteenth century. Experimental initiatives led to more serviceable and affordable pedagogical atlases, such as anatomist Henry Gray’s notable1858 textbook Anatomy: Descriptive and Surgical, which became the new standard in medical education by the middle of the century.

Noah **Stemeroff** and Charles **Dyer** University of Toronto

A World Without Symmetry: An Account of Symmetry and Mathematical Representation in General Relativity

Emmy Noether's theorem states that for every continuous symmetry in a set of dynamical equations there is a corresponding conserved quantity. Conserved quantities, in turn, serve as the foundation for a number of conservation laws, e.g. the conservation of energy or momentum. However, Noether's theorem rests on an important assumption. The existence of a conserved quantity not only requires the existence of a continuous symmetry in a set of dynamical equations, but also a symmetry in the underlying metrical structure of the spacetime over which the dynamical equations are defined. These symmetries are known as Killing vector fields. In this paper, we will take a closer look at the mathematical formulation of conservation laws and Killing vector fields within general relativity (GR) and consider whether this example speaks for or against the generally held view of mathematical representation known as the "mapping account" of applied mathematics put forward by Christopher Pincock.

Callum C. J. **Sutherland**

The 1913 Crisis at Hell's Gate: Contextualizing the Decline of Sockeye Salmon

In order to place the Fraser River sockeye salmon crisis in its appropriate historical, political, social, and economic contexts, one must contend with an assemblage of entangled, intersecting histories. The 1913 Crisis at Hell's Gate is, perhaps, the most crucial among them for understanding the present state of the Fraser River fishery. That is, it was in response to this crisis that the Department of Fisheries and Oceans (DFO) assumed exclusive control over the fishery. In this talk, I will argue that this annexation of authority represents a historical rupture point which sets the stage for the present crisis.

Located in the Fraser Canyon, Hell's Gate coincides with an abrupt narrowing of the Fraser River, representing a problematic obstacle for migrating sockeye, past and present. In 1911, the expansion of the Canadian Pacific Railway resulted in the gradual buildup of debris at Hell's Gate, culminating in 1913 with a series of landslides which irrevocably altered the landscape. For migrating sockeye, Hell's Gate was transformed from a difficult hurdle into an impassable barrier. In response, the DFO staked a claim to exclusive authority over Hell's Gate, wresting control away from the indigenous communities who had, for countless generations, shared access to, and presided over, this space. By drawing attention to the features of this annexation, and the DFO's ongoing failure to alleviate this migratory bottleneck, this talk will show that the present-day decline of sockeye salmon in the Fraser River is firmly rooted in the 1913 Crisis at Hell's Gate.

Eran **Tal** McGill University

Measurement, Computer Simulation and Observational Grounding

Recent studies have argued that, under certain circumstances, a computer simulation can produce results that are as evidentially reliable as the results of calibrated measurement procedures (Morrison 2009; Parker 2015; Lusk 2016). A common objection is that, unlike simulation results, measurement results are produced through causal interaction with the system of interest and thus have a higher evidential efficacy (Giere 2009). However, observations of the target system are often involved in the specification of a simulation's initial and boundary conditions and in the selection of model assumptions, making such simulations causally connected to their target systems.

A refined objection could appeal to the inferential or structural closeness of measurement to observation. This refined objection is exposed to two counter-objections. First, more complex inferences do not necessary lead to less evidentially reliable conclusions. Indeed, the accuracy of contemporary measuring instruments tends to increase with the application of complex theoretical error-correction methods. Second, attempts to establish a structural closeness between measurement outcomes and 'raw' observations (Campbell 1920; Krantz et al 1971) fail due to the idealized nature of the axioms of scale.

Building on recent work by Bas van Fraassen (2008; 2012) and Kent Staley (2012), I propose a novel view of the observational grounding of measurement that appeals to coherence between theory and instrumentation. Under this view, measurement outcomes are not categorically more grounded in observation than the results of computer simulations. The reason for ascribing high evidential reliability to measurement outcomes is the high security of the theoretical assumptions involved in designing and interpreting measurement procedures. Nothing in principle prevents computer simulations from attaining a similar level of security and therefore a similar degree of evidential reliability.

Michael **Thicke** Bard College

The Epistemic Structure of Climate Science

This talk examines the epistemic structure of climate science, and discuss some implications of that structure for knowledge production. In Epistemic Cultures (1999), Karin Knorr Cetina argues that the sciences contain a diverse array of "knowledge machineries." In particular, she compares "the communitarian science of physics with the individual,

bodily, lab-bench science of molecular biology" (4). Climate science lies between these poles of communitarianism and individualism. Unlike physics, climate science has no institutions such as CERN coordinating researchers to perform one massive experiment. Instead, climate scientists are organized in relatively small groups much like molecular biologists. But unlike molecular biology, climate scientists do have a unified purpose: to predict the future evolution of the climate. In grant proposals, for example, climate scientists of various disciplines regularly link their research to the goals of the IPCC. As I will discuss, this hybrid structure can have epistemic consequences. For instance, the experimental data required by climate modelers is often not available in a useful form because modelers and experimentalists are not working as a unified team. This and other examples, I argue, suggest that the "knowledge machinery" of climate science could be improved by either adjusting its reward system or funding mechanisms. Finally, I will present some preliminary research on knowledge flows within climate science based on citation analysis.

Cristian **Tolsa** Queen's University

Authority and Graeco-Roman Astrology

During the first centuries of astrology in the Graeco-Roman, astrological writers used a wide variety of stylistic strategies to convey authority in their discipline. It is striking, for example, that the first texts (second century BC) were written under the faked identity of quasi-mythological Egyptian characters such as Nechepso-Petosiris and Hermes Trismegistus, even if the core of the discipline was derived from Babylonian astrology. Astrology was adopted in the Hellenistic world at a time of strong competition among a variety of knowledges that had something to say about individual fate in the "globalized" world subsequent to the Alexandrian conquests, such as Stoic and Epicurean philosophies or salvific religions. Maybe then a good initial strategy could have been to pretend that astrology was indigenous Egyptian wisdom, ancient knowledge from the idealized, newly conquered land, where it was actually being produced. This paper will aim to argue that we can establish a sort of evolution in the style of astrological handbooks from these first times up to the fourth century AD, including the scientific prose of Ptolemy and Valens in the second century AD.

Jody **Tomchishen** University of Western Ontario

Giving Up On Natural Kinds

Work on natural kinds has focused on differentiating natural kinds from non-natural kinds. Features, such as modal necessity, intrinsicality, microstructure, discoverability, and others, are employed by metaphysicians to differentiate putative natural kinds from non-natural kinds. The choice of feature(s) depends on how inclusive or restrictive one wants to be regarding natural kindhood. A reason for being more inclusive is to allow the kinds found in the biological or social sciences to count as natural, which seem to be the types of kinds one would generally consider to be natural. Recent inclusive accounts focus on the importance of scientific purpose and practice, such that the real kinds are those that are discovered within a scientific context (Khalidi, 2013; Spencer, 2016). I will argue that what they take to be discoverability is not sufficient to exclude the kinds of things they take to be putative non-natural kinds. In other words, discoverability does not do the metaphysical heavy lifting they expect it to. One response would be to modify the feature(s) to restrict inclusivity even more, but instead of moving towards a more restrictive account of natural kinds – one that is more deeply realist – I argue that those who prefer to be inclusive should give up the demands of realism entirely. If there is no practical reason to adopt these distinctions, then they should accept a more full-fledged pragmatism and give up their realist inclinations. I conclude by providing a sketch of what a pragmatic account of kinds would look like.

Leslie **Tomory** McGill University

The "Subtile Aereal Spirit of Fountains": Mineral Waters and the History of Pneumatic Chemistry

In the early 1740s, the British physician and natural philosopher William Brownrigg (1711–1800) advanced a robust pneumatic theory claiming the existence of various kinds of "airs," each with its own proper chemical characteristics. The atmosphere accordingly consisted of a mixture of different fluids that shared the characteristic of permanent elasticity. When evaluated against the standard story of the rise of pneumatic chemistry and its role in the Chemical Revolution, the timing of these ideas is outstanding, implying that later elaborations of the multiplicity of airs or the view of air as a third state of matter should be seen as the products of a longer and much more continuous history than previously recognized. The talk focuses on a central thread that contributed to such mid-century claims about the nature of airs: the analysis of mineral waters, especially in the late seventeenth and early eighteenth centuries, in particular regard to what was variously referred to as the airs, exhalations, vapors, or spirits they contained. Prominent natural philosophers, physicians, and chymists like Van Helmont, Robert Boyle, Johan Joachim Becher, Friedrich Hoffmann, Gabriel François Venel and others are shown to have diversely but increasingly considered the presence of an aerial component in mineral waters (or "aerial spirit," to use Brownrigg's phrase). Guided by differing motivations and modes of theoretical and practical reasoning, yet drawing on each other's contributions, an informal community of pneumatic practitioners negotiated the physical, medical, and especially chymical dimensions of such aerial components in mineral waters.

Parzhad **Torfehnezhad** Université de Montréal

Empirical versus Rational Abstraction: A Reflection on Carnap's notion of abstraction

In this paper presentation, I argue that there are basically two different philosophical senses of abstraction: a rational and an empirical one. On the one hand, abstraction might be construed as a mind/experience-independent universal process (ideally, a mathematical operation). This process is capable of producing knowledge regardless of the subject matter, be it science, mathematics or even general propositions. I call this view rational abstraction. It has been advocated by Frege and by contemporary neo-Fregeans like Wright, Fine, Cook, and others. On the other hand, there is another conception of abstraction that identifies it with a subjective process based on the perceptual data (and the properties of our cognitive faculty). I call this view empirical abstraction. In this subjective process, perception constitutes the first level of abstraction and the entire subsequent abstractive process proceeds internally. Although empirical abstraction has its roots in Aristotle's philosophy, I argued (in a previously published paper), that this view is rightfully attributed to the German philosopher Rudolf Carnap. Carnap considered abstraction to be the main constructive process when establishing linguistic frameworks. Although many scholars have shed important light on Carnap's work, the significance of his work on abstraction has not been given proper attention.

Margaret (Greta) **Turnbull** Boston College

Rethinking the Adaptationist Debates: Values at Theory Appraisal in Evolutionary Biology

Gould and Lewontin's (1994) "Spandrels" paper marked the beginning of substantive debates within the philosophy and practice of evolutionary biology over the role of adaptation in the evolutionary development of traits. In this paper, I argue that traditional readings of these debates have neglected to identify their source; debates over the role of adaptation in evolution stem from clashes between differing sets of values in transiently underdetermined theory appraisal.

In the first section, I summarize the current state of the debates sparked by Gould and Lewontin. In the second section, I examine Gould and Lewontin's original exposé of the "adaptationist programme" and show that many of their proposed critiques of adaptationism arise from a deeper claim that adaptationist evolutionary biologists improperly value the epistemic value of "consistency" with evolutionary theory over other epistemic values, including the value of empirical adequacy. I go on to explicate several case studies in evolutionary biology of importance to the adaptationist debates in the third section. I show that in each case, the choice between adaptationist and non-adaptationist rival hypotheses of trait development is not straightforwardly determined by the currently available evidence. Since transient underdetermination is present in the practice of evolutionary biology, divergent and competing sets of values are in turn (explicitly or implicitly) invoked to justify the choice of one rival hypothesis over the other. I conclude that the adaptationist debates can serve the exaptive function of identifying cases in the practice of biology where values are likely to be influencing theory appraisal.

Hasan **Umut** McGill University

ʿAlī al-Qūshjī in Istanbul: Theoretical Astronomy in the Early Modern Ottoman Empire

This paper focuses on the impact of ʿAlī al-Qūshjī (d. 1474) on theoretical astronomy (hayʾa) within the Ottoman Empire during the late fifteenth and sixteenth centuries. A prominent scholar originally from Samarqand, Qūshjī wrote numerous works in various fields including theoretical and observational astronomy, mathematics, kalām (Islamic theology), and Arabic linguistics. He eventually settled in Constantinople/Istanbul, just a few years before his death, having been invited there by the Ottoman Sultan Muḥammad the Second. Although the Ottoman period of his life was brief, his teaching and writings seem to have stimulated a vigorous interest in theoretical astronomy among Ottoman scholars. Based primarily upon his al-Fatḥiyya fī ʿilm al- hayʾa, a treatise he dedicated to the aforementioned Sultan, this paper deals with the extent to which Qūshjī's astronomical enterprises in Istanbul influenced Ottoman astronomy. In so doing, it also addresses intellectual and historical contexts in which he wrote this new work in theoretical astronomy under Ottoman patronage, in spite of the fact that hayʾa was already a well established field at the time.

Marga **Vicedo** University of Toronto

The 'Disadapted' Animal: Niko Tinbergen on Human Nature and the Human Predicament

This paper explores ethologist Niko Tinbergen's path from animal to human studies in the 1960s and 1970s and his views about human nature, as exemplified in his Nobel lecture of 1973. It argues, first, that the confluence of several factors explains why Tinbergen decided to cross the animal/human divide in the mid 1960s: his concern about what he called "the human predicament," his relations with British child psychiatrist John Bowlby, the success of ethological explanations of human behavior, and his professional and personal situation. It also argues that Tinbergen's views on human affairs led him to modify his views about evolution. As Tinbergen's interests gradually shifted towards the application of ethology to humans, he also moved towards a more adaptationist vision of human evolution and towards a

more deterministic view of biology. The paper concludes that Tinbergen's vision of human nature constitutes another version of what anthropologist Clifford Geertz (1973) called the "stratigraphic" conception of the human: a view of human nature as a composite of levels in which a universal ancestral biological core is superimposed by psychological and cultural layers that represent accidental variation at best and pathological deviation at worst.

Felix **Walpole** University of Toronto

The proximate-ultimate distinction: cause and explanation in evolutionary biology

Two fundamental objectives of the "extended evolutionary synthesis" are to (i) identify and explain the complex mechanisms that occur in the process of organismal development, and to (ii) explore their relation to the evolution of form (Pigliucci and Muller 2010). It is in the context of these ongoing discussions that the "proximate/ultimate" dichotomy (henceforth PUD) has resurfaced as a provocative topic of debate. As perceived by several detractors, the PUD is thought to provide an outdated, inaccurate, and therefore inappropriate model through which to conceive of biological causation.

Ernst Mayr's "Cause and effect in biology" (1961) has been particularly criticized in these regards. Mayr's highly influential paper proposed that an adequate explanation of adaptation required an "ultimate explanation" that adverts to the process of selection, as opposed to "proximate explanations" that account for the development of a trait within an individual. As the 'epistemological statement of the modern synthesis' (Dickins and Barton, 2013), Mayr's account has become the default target for theorists eager to showcase the relevance of proximate processes to ultimate evolutionary questions.

In this paper, I examine a recent and highly controversial proposal to replace Mayr's "unidirectional" dichotomy with a "reciprocal" model of biological causation (Laland et al., 2011; 2012; 2013). I suggest that reciprocal causation conflates two distinct types of evolutionary explanation—variational and transformational (Lewontin, 1983)—which serves to explain the enduring impasse in debates surrounding the PUD, as well as suggest a number of implications for the new synthesis.

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What's Odd About Euclid's Definitions of 'Odd' and 'Even'? Aristotelian Dialectic and Ancient Arithmetic

In book VI of the Topics, Aristotle launches a major attack on the foundations of mathematics, insofar as these foundations concern definitions. For instance, Aristotle puts forward a series of dialectical arguments to refute three putative definitions of odd and even – to the extent that no other definition of these arithmetical terms seems even possible anymore:

(i) even =def a number which is divisible into halves;
(ii) odd =def that which is greater by a unit than an even; and
(iii) odd =def a number having a middle.

My paper explores the applicability of Aristotle's criticisms to the actual mathematical practice, such as Euclid's Elements. About a century after Aristotle, Euclid restates variants of the definitions of odd and even, which Aristotle expressly rejects in the Topics (see Eucl.El.VII.defs.6-7):

a) even number =def the number which is divisible into halves;
b) odd number =def the number which is not divisible into halves; and
c) odd number =def the number which differs from an even number by a unit.

In particular, Euclid deductively employs the first two of these definitions as explanatory premisses in his mathematical proofs (see Eucl.El.IX.21-34; cf. X.117). This gives rise to the question concerning the objective and outcome of overthrowing an established scientific definition. Moreover, why should a mathematician care about dialectical, i.e., non-scientific and non-mathematical, arguments against mathematical principles? Provided Aristotle's refutational arguments hit their target, what are the consequences? How seriously should we take Aristotle's tests and rules in the Topics? Should they actually make us worried about the foundations of (ancient) mathematics?

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Aristotle on the Causes and Limits of Aging

In this paper I address an important question in Aristotle's biology, What are the causal mechanisms that underlie the process of aging? There are two strands in Aristotle's answer to this question. The bulk of his discussion addresses the material-efficient cause, identified as the growth and decay of the lungs and the corresponding exhaustion of 'vital heat' in the heart. However, Aristotle also considers the formal cause of aging, identified as the nutritive soul which sets the limit for growth in the species and determines the quantity and quality of vital heat. This paper aims to provide a detailed analysis of Aristotle's account of aging and in doing so to tie these threads together, integrating the formal and material aspects of his explanation. Unlike many other areas of Aristotle's biology (teleology, embryology) that have received due

consideration in recent decades, remarkably little attention has been paid to Aristotle's theory of aging (gerontology). This neglect is unfortunate, especially since his investigations on the process of aging shed a great deal of light on other features of his natural philosophy, including the operations of the nutritive faculty, the role of the heart and vital heat in the living organism, and the relation of form to matter.

Jessey **Wright** University of Western Ontario

Interpretations of Neuroimaging Data as Explanations of Data Patterns

Neuroimaging data, which measures blood oxygenation, is indirectly related to cognitively relevant neural activity, which is the phenomena the data is used to study. Philosophers have criticized techniques neuroscientists use to analyze this data by arguing that their interpretations of are undermined by the indirect nature of the data (Hardcastle and Stewart 2002; Aktunc 2014). Responses to these skeptical arguments note that these critics often do not consider all aspects of the data interpretation process. In particular, they do not consider how multiple analysis techniques are used together to address the indirect nature of the data (Roskies 2010; Wright forthcoming). I briefly argue that progress in this debate requires accounting for the impact that data analysis has on the process of interpreting neuroimaging data. Then, I provide such an account. Drawing on Julian Reiss's distinction between supporting and warranting evidence (2015) and I.J. Good's work on exploratory data analysis (1983), I examine a case where neuroimaging data is interpreted as warranting a claim about neural representations (Kim et al 2014) - an inference that has been criticized by philosophers (Ritchie et al in press). I show that individual data analysis techniques are used in an exploratory fashion to determine if a data set can provide evidence about a given claim. The data is interpreted as warranting a claim when that claim explains the results of a variety of analysis techniques. This account captures the spirit of critiques, while remaining sensitive to the actual interpretive practice of neuroscientists.

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Hertz's Propagating Electric Waves and Selected Replication of Experiments

Heinrich Hertz's discovery of electromagnetic waves in 1887 opened a new page in the history of modern physics and technology. Hertz's major finding was that the electric effect produced by a spark-gap generator exhibited the characteristics of a propagating wave, since the effect could result in interference patterns via a proper arrangement of the experimental apparatus. Hertz's electromagnetic wave experiment comprised a variety of different trials, however. His most renowned interference experiment—creating a standing wave between the spark-gap generator and a reflecting surface—was the one his contemporaries often chose to replicate, to demonstrate the propagating wave, and to measure the wave velocity. Yet, this was actually not the trial Hertz first used to determine the speed of electromagnetic waves—that first one produced the interference between the wave in space and the wave along an extended wire connected to the spark-gap generator. Why did Hertz's followers select to replicate this reflecting-surface trial, not the trial on the interference between the direct wave and a wire wave? In this paper, we argue that the direct-wire interference experiment was trickier to replicate, since the electromagnetic waves emanating from the wire are more complex than Hertz conceived. The published papers from those who replicated Hertz's experiments did not mention such difficulties. But we can uncover and grapple more with these difficulties in our attempted replication of Hertz's direct-wire interference trial. Thus, we demonstrate the value of replicating historical experiments for unveiling the more tacit aspects of material conditions in experimental practice.