Summer Symposium 2013

International Society for the Philosophy of Chemistry

July 31 – August 3, 2013

Montevideo – Fray Bentos, Uruguay

BOOK OF ABSTRACTS

http://ispc2013.fq.edu.uy/

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SCIENTIFIC PROGRAM

WEDNESDAY, July 31

9:00 – 9:30	Registration
9:30 – 10:00	Opening
	Minister of Industry, Mr. Roberto Kreimerman; Vice-Chancellor of Universidad de la República and Dean of the College of Chemistry, Prof. Eduardo Manta; President of ISPC, Prof. Rom Harré; President of the Academic Committee of the Summer Symposium 2013, Prof. Lucía Lewowicz.
10:00 – 11:00	Hasok Chang (PL1)
	Is Chemistry Just Applied Physics?
11:00 – 11:30	Olimpia Lombardi (SL1)
	Chemistry and Physics: Reduction or Inter Theory Links
11:30 – 11:45	Break
11:45 – 12:15	S. Fortín; J.C. Martínez González (SL2)
	The Problem of optical isomerism: The Hund Paradox
12:15 – 12:45	Pieter Thyssen (SL3)
	Group Structural Realism: and attempt to represent the World in terms of broken symmetries
12:45 – 15:00	Lunch
15:00 – 16:00	Joachim Schummer (PL2)
	Models versus Laws of Nature in Chemistry
16:00 – 16:30	Guillermo Restrepo (SL4)
	Mathematical Chemistry
16:30 – 17:00	Julio M. Stern (SL5)
	Scientific Discovery traveling around the Moebuis Band
17:00 – 17:30	Alan Heiblum; J.C. Martínez González (SL6)
	It is time for a Chemical time
17:30 – 18:15	Break
18:15 – 18:45	R. Faccio; H. Pardo; Á.W. Mombrú (SL7)
	Structures in carbon materials
18:45 – 19:15	Jean-Pierre Llored (SL8)

Connecting ontology and the study of chemical practices: The case of nanochemistry.

THURSDAY, August 1

9:00 – 10:00 Rodolfo Gambini; Lucía Lewowicz; Jorge Pullin (PL3)

Quantum Physics, Strong Emergence and Ontological non- reducibility.

10:00 – 10:30 Rom Harré (SL9)

Affordances the Second Mereological Fallacy and Models of Molecular and Atomic Composition

10:30 – 11:00 Clevis R. Headley (SL10)

Pragmatism and Chemistry: The Role of Chemical Metaphors in shaping the philosophical imaginary of Pragmatism.

11:00 – 11:15 Break

11:15 – 11:45 W. Araujo-Neto (SL11)

Expression and Intentionality as guidelines for semiotic studies concerning structural Representations in Chemistry

11:45 – 12:15 E.L. Moreno (SL12)

Names, Symbols and Myths in Chemistry

12:15 – 15:00 Lunch

15:00 Trip to Fray Bentos

FRIDAY, August 2

9:00 – 10:00	Eric Scerri (PL4)
	John Nicholson's atomic theory of 1911 and how "wrong theories" can sometimes produce scientific progress among other philosophical questions
10:00 – 10:30	E.L. Moreno (SL13)
	The Iron man and the Archaic Tradition
10:30 – 11:00	K. Cecon (SL14)
	History of Chemistry: a useful tool to investigate guiding principles in experimental Philosophy.
11:00 – 11:15	Break
11:15 – 11:45	J.A. Chamizo (SL15)
	Instruments in Chemical Revolutions
11:45 – 12:15	M.P. Banchetti-Robino (SL16)
	19th Atomism and empirical Nature of the Chemical atom. Dalton against Lavoisier.
12:15 – 15:00	Lunch
15:00 – 15:30	L.L. Gomes (SL17)
	Values and the Chemical Revolution
15:30 – 16:00	Ronei Clécio Mocellin (SL18)
	Guyton de Marveau and the Chemical Culture of the Age of Enlightement
16:00 – 16:30	Klaus Ruthenberg (SL19)
	Paneth Propositions and Pseudo Science.
16:30 – 17:00	M.L. Martínez (SL20)
	The Institute for Industrial Chemistry in Uruguay (1912-1957)
17:00 – 17:30	Enrique Pandolfi (SL21)
	The Case of Uruguay River Pulp Mill Dispute. The political solution vs. a severe chemical monitoring.
19:30	Banquet

SATURDAY, August 3

9:00 – 11:00 Visit to the Anglo Museum

11:00 – 12:00 Celebration of the 150th anniversary of the Liebig Factory.

Participants:

Mayor of Río Negro, Mr. Omar Lafluf; Ambassador of the Federal Republic of Germany, Mr. Heinz Peters; Director of the Anglo Museum, Mauro Delgrosso; Prof. Lucía Lewowicz

12:00 – 15:00 Lunch

15:00 Trip to Montevideo

PLENARY LECTURES

IS CHEMISTRY JUST APPLIED PHYSICS?

Hasok Chang

Cambridge University, UK

ABSTRACT

The relationship between physics and chemistry is one of the perennial foundational issues in the philosophy of chemistry. It concerns the very existence and identity of chemistry as an independent scientific discipline. Chemistry is also the most immediate territory that physics must conquer if its "imperialistic" claim to be the foundation of all science is to have any promise. I will begin by reviewing and endorsing some well-known arguments against the reduction of chemistry to physics. After that, I wish to enhance the anti-reductionist position with three additional arguments inspired by the works of some leading 20th-century chemists such as Pauling, Coulson, and Lewis. (1) The very foundation of quantum chemistry is classical, and its roots go back to organic structural chemistry originating in the 1860s. (2) What is often involved in chemical practice is chemists exploiting for their own purposes the conceptual resources provided by physics, rather than chemical theorems being deduced from physical theory. (3) Even physics itself is much more disunified than it may seem, and therefore constitutes a dubious basis for reduction as it is normally envisaged.

MODELS VERSUS LAWS OF NATURE IN CHEMISTRY

Joachim Schummer
Editor of HYLE

ABSTRACT
Although the notion of God as the legislator of nature was already known in the Jewish-Christian tradition, the modern concept of laws of nature was established only in 17th-century mechanical philosophy of nature, particularly by Descartes and Newton, and remained largely confined to that tradition before it became seriously questioned in quantum mechanics. After a brief historical survey I first discuss various examples of so-called laws of nature in chemistry and physical chemistry proposed in the 19th century to conclude that none of them really correspond to the original concept, but that they rather comprise a variety of epistemologically different statements. More recent philosophical approaches to extend the concept of laws, so as to cover chemical cases, all result in inacceptable consequences. The deeper reason of the comparatively little importance of natural laws, I finally argue, is that chemistry as the original epitome of the experimental or Baconian science has largely followed methodological pluralism in which a variety of models to be chosen from for pragmatic reasons are preferred over universal laws of nature as in mathematical physics.

QUANTUM PHYSICS STRONG EMERGENCE AND ONTOLOGICAL NON-REDUCIBILITY

R. Gambini[a], L. Lewowicz[b], and J. Pullin[c]

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[b] *Departamento de Historia y Filosofía de la Ciencia, Universidad de la República, Montevideo, Uruguay*
[c] *Department of Physics and Astronomy, Louisiana State University, Baton Rouge, LA 70803*

ABSTRACT
The discussion about the interpretation of quantum mechanics has not settled among physicists. Several realist interpretations of quantum mechanics have been proposed. Each of them would lead to philosophical consequences, which would differ in details but have points in common. To explore some of the consequences in detail we will use a particular realist interpretation: the Montevideo interpretation of quantum mechanics. Such interpretation can be viewed as a completion of the environmental decoherence program.

A realistic quantum interpretation like the one discussed eliminates the theory's conceptual dependence on classical physics and allows to reach a quantum understanding of the world. It enables to explain not only what physicists find in the lab, but also to lay the foundation for a realistic description of the world based on quantum mechanics.

We will address in this talk the issue of emergence. We shall argue that within this interpretation of quantum mechanics one can construct a purely quantum ontology of systems, states and events where strong emergence with ontological novelty and downward causation is a natural and widespread phenomenon.

Strong emergence requires that emergent properties be ontologically new properties with irreducible causal powers. The latter have effects at both the macro and micro level, and macro to micro effects are known as downward causation. Strong emergence implies that systems can have qualities not traceable to the system's components. Their new qualities are therefore ontologically irreducible. In this talk we will discuss this form of emergence and how it may appear physically in the quantum theory.

JOHN NICHOLSON'S ATOMIC THEORY OF 1911 AND HOW 'WRONG THEORIES' CAN SOMETIMES PRODUCE SCIENTIFIC PROGRESS AMONG OTHER PHILOSOPHICAL QUESTIONS

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ABSTRACT

The paper will examine the work of John Nicholson, a direct precursor of Niels Bohr and the first person to postulate the quantization of angular momentum in the context of atomic theory.

Nicholson attempted to explain the formation of the elements and the values of their atomic weights as well as well as the spectrum of nebulae and the solar corona. In the case of these spectra his theory appeared to be remarkably successful even though, as it later turned out, it was based on incorrect physical principles.

I will examine some philosophical consequences of this and similar cases. I will ask several questions such as how it is that 'wrong' scientific theories can produce scientific progress and whether it even make sense to speak of 'right' and 'wrong' in science. I will relate this case to the broader question of whether scientific progress proceeds via Kuhn-like discontinuities or whether a case can be made for incremental progress.

SESION LECTURES

CHEMISTRY AND PHYSICS: REDUCTION OR INTER-THEORY LINKS?

Olimpia Lombardi[a]

[a] *CONICET – Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires. C. Larralde 3440, 6D (1430), Ciudad de Buenos Aires, Argentina.*

ABSTRACT

In his recent book *Reducing Chemistry to Physics. Limits, Models, Consequences*, Hinne Hettema (2012) addresses the issue of the many-faced relationship between chemistry and physics from a reductive position. He devotes his work to defend this position on the basis of a "naturalized" Nagelian concept of reduction, which admits a number of modifications that significantly weaken the original schema.

The book is a very fruitful contribution for those interested in understanding the subtleties and complexities underlying the loose and indirect links that interconnect chemistry, quantum chemistry and quantum mechanics. However, there are some considerations that deserve to be made for a balanced assessment of the work. I will critically review three kinds of issues stemming from Hettema's argumentation: scientific, philosophical and methodological.

THE PROBLEM OF OPTICAL ISOMERISM: THE HUND PARADOX

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[b]*FONCyT-Universidad de Tres de Febrero, Buenos Aires, Argentina.*

ABSTRACT

The relationship between chemistry and physics has been widely discussed in modern philosophy of chemistry (*e.g*. Scerri 2004, Lombardi & Labarca 2005). In the interdisciplinary field lying between the two disciplines, quantum chemistry appears as an interesting object to study intertheoretical relationships.

In this work we will focus on the problem of the optical isomerism under the form of the so-called Hund paradox (1927). In particular, we will describe the difficulty in explaining molecular structure in terms of quantum mechanics, as presented in detail by Woolley (1976, 1978). Then we will consider the particular case of optical isomerism and introduce in detail the Hund paradox, which is related with the problem of explaining chirality in a quantum-chemical context. This will lead us to introduce the solution provided by the decoherence program (Zurek 1991). Finally, we will discuss that solution on the basis of a precise interpretation of the concept of decoherence: we will argue that a satisfactory response to the Hund paradox necessarily requires an interpretation of quantum mechanics that provides explanatory tools to quantum chemistry.

References

Hund. F. (1927). “Zur Deutungder Molekelspektren. III”. *Zeitschrift für Physik*, **43**: 805-826.

Lombardi, O. y Labarca, M. (2005). “The ontological autonomy of the chemical world”. *Foundations of Chemistry*, **7**: 125-148.

Scerri, E. R. (2004). “Just how ab initio is ab initio quantum chemistry?”. *Foundations of Chemistry*, **6**: 93-116.

Wolley, R. G. (1976). “Quantum theory and molecular structure”. *Advances in Physics*, **25**: 27-52.

Wolley, R. G. (1978). “Must a molecule have a shape?”. *Journal of the American Chemical Society*, **100**: 1073-1078.

Zurek, W. H. (1991). “Decoherence and the transition from quantum to classical”. *Physics Today*, **44**: 36-44.

GROUP STRUCTURAL REALISM: AN ATTEMPT TO REPRESENT THE WORLD IN TERMS OF BROKEN SYMMETRIES

P. Thyssen[a]

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In the debate about scientific (anti)realism a major conflict exists between two powerful arguments: the no-miracles argument speaks in favour of scientific realism, whereas the pessimistic meta-induction calls for an antirealist position in science. In 1989, the idea of structural realism was introduced by John Worrall in an attempt to resolve the above conundrum. Structural realism represents the 'best of both worlds' by arguing that whereas the physical content of our theories (i.e. entities) might not survive theory change, the mathematical content (i.e. structure) often does.

This epistemic position was later strenghtened by Ladyman's ontic structural realism which claims that structure is all there is. It is however not always clear what is understood by the structural content of scientific theories. In this paper the mathematical content will be identified with the group-theoretical structure of theories. The principal ideas behind this group structural realism will be introduced and critically evaluated by looking at two examples from physics and chemistry: the eightfold way in elementary particle physics, and the periodic system in chemistry.

Following Kantorovich, a weak form of ontic structural realism will be argued for. According to this metaphysical thesis, the physical existence of elementary particles and chemical elements is not questioned, but they are believed to carry less ontological weight than the SU(3) and SO(4,2) groups which govern their transmutations into one another. Only by breaking these primeval symmetries during the evolutionary history of the universe did these particles and elements materialize to give rise to the current state of our world.

MATHEMATICAL CHEMISTRY

Guillermo Restrepo

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ABSTRACT

We analyse a contemporary criticism to ‘‘mathematical chemistry’’ and take it as starting point to moot what we understand by mathematizing chemistry and its implications. We then pass to ponder on some positions on the subject by considering the cases of Laszlo, Venel and Diderot, opponents to the idea of mathematization of chemistry. In contrast, we analyse some scholars' ideas on the fruitful relationship between mathematics and chemistry; here Dirac and Brown are considered. We outline that the mathematical–chemistry relationship should be considered beyond the mere aspect of whether chemistry is or not able to be mathematized. Here, Kant's and Comte's assertions are considered, the first one having two positions on chemistry based on mathematics and the latter mooting the idea of doing chemistry with mathematical spirit. We show how Comtean mathematical spirit can be framed in Weyl's mathematical way of thinking (functional thinking), i.e. setting up variables, symbolizing them, and seeking for functions relating them.

Following our definition of mathematical chemistry, we discuss several early chemical ideas and some landmarks of chemistry as instances of the mathematical way of thinking. The cases we discuss are Plato's triangles, Geoffroy's affinity table, Lavoisier's classification of substances and their relationships, Mendeleev's periodic table, Cayley's enumeration of alkanes, Sylvester's association of algebra and chemistry, and Wiener's relationship between molecular structure and boiling points. These examples show that mathematical chemistry has a long tradition and that there is a scientific community shaping it up.

SCIENTIFIC DISCOVERY: TRAVELING AROUND THE MOEBIUS BAND

Julio Michael Stern[a]

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The Institute of Mathematics and Statistics of the University of São Paulo.

ABSTRACT

The main goal of this article is to use the Cog-Con+FBST framework, that is, the Cognitive Constructivism epistemological framework equipped with the Full Bayesian Significance Test for accessing the epistemic value of sharp statistical hypotheses, to address Piaget's central problem of knowledge construction, namely, the re-equilibration of cognitive structures.

The Cog-Con+FBST perspective is illustrated using some episodes in the history of chemistry concerning the definition or identification of chemical elements. Some of Heinz von Foerter's epistemological imperatives provide general guidelines of development and argumentation.

The episodes in history of chemistry used in this article involve: (1) Lavoisier's definition of chemical elements as invariants in stoichiometric equations; (2) Morveau's affinity intervals defined by replacement reactions; (3) Kirchhoff's equilibrium law for radiation and its role in the spectroscopy revolution.

A slide presentation for this talk is available at
http://www.ime.usp.br/~jstern/miscellanea/jmsslide/moebs.pdf

IT IS TIME FOR A CHEMICAL TIME

Alan Heiblum Robles[a] and Juan Camilo Martínez González[b]

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[b]*FONCyT – Universidad Tres de Febrero, Buenos Aires, Argentina*

ABSTRACT

The aim of the present text is to discuss the idea of time in chemistry. We will distance ourselves from the usual position (Benfey, 1963), which examines the temporal terms of the physical laws applied to chemical systems. On the contrary, the target of our inquiry will be the experimental core of chemistry. The problem is that the experimental core is *prima facie* timeless. Nevertheless, a second examination allows us to suggest that it is possible to postulate a purely chemical time. According to a common conception of time and stuff, new substances arise without the disappearance of others. This intuition corresponds to the image of a standard periodic table as a cumulative list, as well as to the continuing synthesis of new substances in the practice of the experimental core. In order to develop this intuition, one could summon a demon, a direct relative of Laplace's demon, with an infinite capacity to list the existing substances. It is possible to show that for this demon the universe has a temporal arrow pointing on the direction of the increasing number of substances and mixtures. However, such a demon seems to present serious difficulties worth to be discussed, among others: what exactly are the items of the list (particles, elements, "substances")? How does the demon distinguish between pure substances and mixtures? What role does the purification process play in his temporal view?

STRUCTURES IN CARBON MATERIALS

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ABSTRACT

Since 1985, carbon materials have shown unexpected structures. The initial step was the discovery of fullerenes, but after this, the production of carbon nanotubes have triggered the dawn of a new area, plenty of technological promises:nanotechnology.

In the recent years, research in graphite and graphene, has been hot topic for the materials science and the condensed matter communities, due to the novelty of the properties that have been found and the potential applications for high-tech devices.

In particular, very interesting properties have been found when carbon atom vacancies are created in these pure materials.

The evolution of the studies in carbon materials will be shown.

CONNECTING ONTOLOGY AND THE STUDY OF CHEMICAL PRACTICES: THE CASE OF NANOCHEMISTRY

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ABSTRACT

How do chemists make chemical bodies become intelligible? The answer of this question depends, among other factors, on the practices involved at a particular time. Lavoisier both institutionalized and enhanced a kind of chemical reasoning which connects a chemical 'whole', the parts produced by a chemical analysis, the ingredients contained within the individual under study and their respective quantities. A major epistemological shift occurred during the Nineteenth Century as soon as chemists also included chemical structure in order to account for chemical transformations. The way chemical individuals were conceptualized thus changed because composition, quantities and structure became co-defined and thus co-dependent from within chemical practices.

Bearing this historical reminder in mind, my talk then examines how the notion of structure is still at stake from 'soft chemistry' to 'integrative chemistry'. In a nutshell, I shall scrutinize how the different specialties which are currently subsumed under the label 'nanochemistry' broaden and reshape the conceptual framework within which the word 'structure' is understood. To do so, I first identify the characteristics of those new forms of chemistry by studying different up-to-date practices (sol-gel synthesis, one-pot synthesis, the design of interactive materials, biomineralization, the modeling of chemical interactions). In this respect, I shall point out that chemists must think about chemical composition, structure, size, shape, function and process, at the very same time. This new kind of relatedness is a major feature of recent chemistry. If one modifies the chemical process, one thus alters the size of a chemical body. By changing the size, one turns out to transform the structure of this individual even if its composition and the quantities of its ingredients remain the same! From the light of those new 'nanochemical' practices, one can renew the question on how the ontological status of chemical individuals can be defined. Ontology and practices can thus co-operate in a novel way.

The individuality of a chemical body does not only depend on its composition and its structure but also dwells upon its size. Furthermore, it is process or context-dependent: instrumental modes of access constitutively take part in the definition of the body. Chemical individuals are afforded by experiments to refer to Harré's terminology. Affordances are certainly products of the interaction of equipment and the world, but in many cases they are not constituents of that which affords them, neither as properties such as 'colour' nor as entities such as 'parts', nor as processes such as 'walking'. Our practical enquiry allows us to develop these ontological and mereological perspectives from the standpoint of practices!

AFFORDANCES, THE SECOND MEREOLOGICAL FALLACY AND MODELS OF MOLECULAR AND ATOMIC COMPOSITIONS.

Rom Harré

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ABSTRACT

The recent introduction of the concept of `affordance' into the philosophy of chemistry (c.f. Llored amd Harré (2011)) has made possible a more sophisticated analysis of the conditions under which theories of the internal structures and composition' of chemical objects are heuristic or candidates for consideration as verisimilitudinous depictions. There are two mereological fallacies, the first ascribing attributes to parts of wholes that have meaning only as ascribed to wholes; the second, more apposite for chemistry, is the ascribing to wholes as their parts some affordances of certain analytical or seeming analytical procedures, but not others. Is there a principled way of deciding that, for example, Mullikan's move from orbits to orbitals, treating electrons minimally as model objects is acceptable whereas Bohr's treatment of electrons as constituents is not. Is there any analogy between this historical cases with Bohr's outdated concepts and energeticist models, potential energy wells etc., of the internal structure of atomic objects?

Ref. Llored, J.-P. & Harré, R. 2011 .

PRAGMATISM AND CHEMISTRY: THE ROLE OF CHEMICAL METAPHORS IN SHAPING THE PHILOSOPHICAL IMAGINARY OF PRAGMATISM

Clevis R. Headley

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ABSTRACT

Pragmatism has not received the serious philosophical attention that it rightfully deserves. This philosophical neglect has been sustained by the stereotype of pragmatism as America's contribution to philosophy, a contribution that is said to be reflective of the tendency of American culture to exalt the material and the practical at the expense of principle and sober intellectualism. The thesis to be defended here is that the leading architects of pragmatism were astute students of chemistry and employed their intimate understanding of chemical practice to craft a nontraditional philosophy infused with the norms of experimental science. The philosophical imaginary of pragmatism is highly dependent upon the basic root metaphors of chemistry. Peirce and James, in particular, utilized chemical metaphors to frame original perspectives on certain philosophical topics, frequently substituting chemical metaphors for traditional visual metaphors. To be blunt, pragmatism is an outgrowth of the mindset of practicing chemists and not, as commonly claimed, the expression of a hardcore materialistic mindset. It will be established that pragmatism is a form of naturalized philosophy that is modeled on chemistry rather than on physics. Since pragmatism takes it inspiration from chemistry, pragmatist naturalism is not reductive as is the case with those forms of naturalism inspired by physics. Although I will be focusing on Peirce and James, and to some extent Dewey, Peirce represents the most obvious case of having been influenced in his thinking by the practice of chemistry. This evidence is to be found in his Pragmatic Maxim, a core principle of pragmatism, and elements of his conception of the scientific method. James, the more linguistically creative of the pragmatists, vigorously employed chemical metaphors to capture his fluid ontology of Being and radical empiricism. The dynamic nature of chemical processes provided inspiration for his articulation of a style of thinking resistant to the stagnant and static mindset of traditional philosophy.

EXPRESSION AND INTENTIONALITY AS GUIDELINES FOR SEMIOTIC STUDIES CONCERNING STRUCTURAL REPRESENTATION IN CHEMISTRY

W. Araujo-Neto[a]

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ABSTRACT

The article deals with a unique aspect of structural representation in chemistry, known as stereoformulas, according to IUPAC, a formal two-dimensional representation of a three-dimensional molecular structure obtained by projection of bonds (symbolized as lines) onto a plane with the designation of the positions of relevant atoms by their chemical symbols. The study takes two arguments, respectively: (i) from Cassirer´s Philosophy of Symbolic Forms[(1)] – the notion of *Expression*, and from Husserl´s Phenomenology[(2)] – the notion of *Intentionality*, composing a semiotic study on the use of stereoformulas towards working as "representations of representations".

Considering any simple exercise with a representative form, for example, a Newman projection, gathers only a part of the whole set of knowledge that is available about a particular chemical entity. However, despite being incomplete under the criteria of possible relations with his representative, the Newman Projection is a powerful semiotic tool in solving problems concerning the chemical structure. This refers to the understanding that the graphical tool to use in a given situation of structural representation is the result of an intentional process. Intention and incompleteness are somewhat intertwined, because the choice of using a particular tool stems from the recognition of the different features that can be supplied by it, or from those not available, in the sense of an evaluation of the extent of incompleteness. By way of a conclusion, it appears that the recognition of the intentional character of representative activity is a certificate of humanity of this process, which is bound to the necessary recognition of its expressive function, in the sense proposed by Cassirer.

(1) Cassirer, E. (1996) **The Philosophy of Symbolic Forms**. v. 4. New York: Yale University Press.

(2) Husserl, E. (2000) **Logical Investigations**. New York: Humanity Books.

NAMES, SYMBOLS AND MYTHS IN CHEMISTRY

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ABSTRACT

According to the IUPAC recommendations, chemical elements must be named as: a mythological concept (including astronomical objects); a mineral or similar substance; a place or geographic area; a property of the own element; or a scientist. The long strophes that captivate the nominations of the periodic table date back to ancient and modern values that, together, form in their small fragments a kind of kaleidoscope of history of human beings. Different types of perceptions were grown in its reflexes, but their angles can be summarized in two main ways of thinking: the phenomenological and the mythical. The first relates to the willingness to present the names of the elements in logical bases, in a strict sense of science - as the positivist position. The second, the mythical mode, corresponds to our psychic reality, interspersed with symbols and relationships that resemble plots and stories.

The modern notion of chemical elements was inaugurated in the 18th century, and even then most of the substances received names derived from Alchemy and ancient metallurgy, permeated of several mythical and theological views. Since the beginning of the current century, the new paradigm of chemistry, at the expense of Alchemy and marginal Sciences, left little room for symbolic names, a trend which remains to this day.

Nevertheless, among the 69 new chemical elements discovered from the 18th century to the 19th, there would still be space left for 19 names with mythical relations. About 30% of 114 elements currently recognized by the IUPAC have some roots in legends and myths, whether in their intrinsic values or their nomination. Furthermore, all language is symbolic, what is little explored by the educational structure, still addicted by content that favors the positivist heritage.

THE IRON MAN AND THE ARCHAIC TRADITIONS

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ABSTRACT

In the history of the technological revolution of the metals, there is a period marked by the development of the metallurgy of copper and bronze. The iron supplanted bronze technologically, both in its use and on the techniques of production, and, after, it was perfected to the steel. Those who apply the iron metallurgy, the blacksmith, are, according to the philosopher and historian Mircea Eliade, "the main agent of diffusion of mythologies, rites and metallurgical mysteries", remodeling and expanding significantly the previous beliefs. The same author also states that "the iron age victorious, whose mythology, largely submerged, still survives in traditions, taboos and mostly unsuspected superstitions".

Indeed, the most prestigious god in the alchemical art in the middle ages, as well as Hermes, was the crippled and smith god Hephaestus. The tools also participated of sacredness. Some of the major gods, who inhabited the Pantheon of diverse cultures that have developed metallurgy, were blacksmiths or dominated iron instruments, almost always weapons. In addition to its technological importance, the iron had a long era of sacredness and an appreciation that sometimes overtake the gold.

In the 20th century, mankind apparently needed a new blacksmith myth. At the same time, the industrialized world entered an ambivalence era. As technology has affected more aspects of our daily lives, distrust on their side-effects and unintended consequences fueled the loss of confidence in the understanding of technological progress, and iron is until today one of his greatest symbols. The Iron Man, created by Stan Lee in 1963, is among the many modern myths that best represent this current ambivalence and the legacy of archaic traditions.

HISTORY OF CHEMISTRY: A USEFUL TOOL TO INVESTIGATE GUIDING PRINCIPLES IN EXPERIMENTAL PHILOSOPHY

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ABSTRACT

The main goal of this communication is to make use of historical examples from a well succeeded chemical experimental programme in order to investigate guiding parameters in experimental philosophy. An experimental programme could be defined as the method or procedure by which an experimental agent establishes his agenda, organizes data and plans future activities. The parameters used by this agent in order to design new experiments can be exposed if careful attention is paid to details inside his experimental work, which can be studied by reading his published works, workdiaries and letters. This very particular situation establishes an interesting bridge between history of chemistry and experimental philosophy.

This communication is focused on the chemical works of Robert Boyle, which is known for his exemplary experimental programme, especially in relation to chemical experiments. Since his experimental programme was a successful and fruitful enterprise, it is justifiable by our goals to try to understand how it operated. In order to analyze and exemplify how Boyle's experimental programme worked, some chemical experiments have been selected. The primary source material used here was mainly collected from his published works, with a few examples from his workdiaries. This collection considers (at least in the cases that will be presented) a few experiments that exemplify how Boyle developed new experiments from old results and, in doing so, expanded his experimental agenda.

INSTRUMENTS IN CHEMICAL REVOLUTIONS

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ABSTRACT

In the Postscript of his 1970' *The Structure of Scientific Revolutions*, Kuhn, indicated that he had conflated two conceptually distinct connotations of paradigms- 'exemplars' and 'disciplinary matrices'.

Thus the term 'exemplar' represents a specific historical community's collection of solved problems and is generally located in the professional literature, like textbooks. It is narrower than paradigm and avoids some of the ambiguities that the latter shows (Kindi, 2012). Making explicit the role of instruments (Baird, 2004) in normal science reduces the gap between normal and revolutionary. This has an important consequence, because exemplars, being more flexible and also more accurate than paradigms, not only recognize the conceptual or theoretical changes within a discipline, but also indicate that they are accompanied by the design, construction and use of certain instruments[1]. Here I restructured, from the consideration of the chemical instruments, the three chemical revolutions recognized, long ago by Jensen (1998).

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[1] Here is important to recognize the words of Gutting, one of Kuhn's critics: *One instance is technological practices that exist independent of theoretical science (arts and crafts). In contrast to the common view that such practices are entirely unscientific, being at best instances of knowing how rather than knowing what, an analysis in terms of exemplars suggest that both the skilled artisan or craftsman and the pure scientist are in essence people how know how to adapt and extend previously exemplary achievements to new cases* (Gutting 1984, p.56).

19TH CENTURY ATOMISM AND THE EMPIRICAL NATURE OF THE CHEMICAL ATOM: DALTON AGAINST LAVOISIER

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ABSTRACT

This paper addresses the fundamental disagreement between the views of Lavoisier and Dalton on the scientific and epistemic value of positing indivisible chemical atoms as the most simple and fundamental particles of matter. Lavoisier rejects the epistemic value of positing chemical atoms and considers such positing to be mere metaphysical speculation. Lavoisier's emphasis on quantitative analysis greatly influences his position on this issue. Since chemical atoms cannot be measured or weighted, they contribute nothing to actual experimental laboratory work nor to the chemist's understanding of chemical elements. For Lavoisier, the term 'element' should not be applied to chemical atoms, which he considers as suspect metaphysical entities. Instead, by 'element', Lavoisier means those substances that remain as the last product of chemical analysis. John Dalton, on the other hand, seeks to eliminate the distinction drawn by Lavoisier between 'elements' and 'chemical atoms'. The challenge for Dalton, however, is to support the existence of chemical atoms by using the experimental and quantitative method advanced by Lavoisier. Dalton purports to achieve this task by claiming that chemical atoms have *empirical* features that can be quantitatively ascertained in the laboratory. For Dalton, the relevant empirical feature of chemical atoms is their weight. According to him, different elements consist of different chemical atoms, and what accounts for the differences between elements are the different weights of the atoms of which these elements are constituted. Dalton's chemical atomic theory seeks, among other things, to establish how the weights of chemical atoms affect the different properties of elements. This theory of atomic weights is also fundamental for Dalton's development of the law of multiple proportions. The paper will assess the role of Dalton's revision of atomism in the context of modern empirical and quantitative chemical analysis.

VALUES AND THE CHEMICAL REVOLUTION

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ABSTRACT

We intend to discuss the role of values in scientific activity, based on Hugh Lacey's theory, which proposes that non-cognitive values play an important role in the process of choosing strategies for the development of the scientific activity. These strategies determine, for example, what kind of data should the scientist look for, which methods should be used, what kind of questions might be asked (and what kind shouldn't). On the other hand, Lacey also points that non-cognitive values should not play any important role when it comes to appraising and choosing theories, i.e., given two different theories produced under the same kind of strategies and about the same phenomena, scientists should choose between them based only on cognitive values such as comprehensiveness, empirical and theoretical adequacy, etc.

Grounded on this philosophical framework, we discuss the relations between Chemical Revolution and the French Revolution, both being forged throughout the XVIIIth century and taking place in the last years of that century. We suggest that the cultural and social conditions of life in XVIIIth century France provided a common set of values which provided the conditions of possibility for both the Chemical and the French Revolution. This set of values, however, does not reduce one revolution to the other, neither has any deterministic implications of cultural or social life over science and vice-versa. The richness of Lacey's theory is that it offers an explanation of the ways science is socially determined and the ways it is not (or should not be), and offers an interesting approach to our intent of apprehend the complexity of the Chemical Revolution.

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GUYTON DE MORVEAU AND THE CHEMICAL CULTURE OF THE AGE OF ENLIGHTENMENT

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ABSTRACT

I propose to show the main contributions of L-B. Guyton de Morveau (1737-1816) to the chemical culture of the second half of the 18th century. I call *chemical culture* of the Enlightenment the system of practical attitudes, gestures, theories, artifacts, instruments, manuals and methods of teaching, translations, correspondences, symbolical forms and their meanings, shared by a group of *individuals* who had in the *chemical laboratory* the production center of a theoretical-experimental knowledge of *materials*. Besides an own *reasoning style*, this culture scattered itself through society begetting from material results up to thorny philosophical debates. Heir of the first generation of French *philosophes*, Guyton de Morveau was between the 1770s and 1790s the great organizer of a *république des chimistes* and active actor of the second French *encyclopedic project*, which would have great influence on the *classification* of the knowledge into specific *subjects* in 19th century. He made the Academy of Dijon an advanced center of investigation and teaching of chemistry concretely contributing to *revolutionize* this science. After the sociopolitical revolution of 1789, he would occupy important functions in the administrative reorganization of the French republican State, in the reform of the science learning institutions and in the building of a new political system of scientific researches. Ultimately, these characteristics lead us to suggest that the activities of Guyton de Morveau help in the comprehension of the *material culture* of eighteenth-century chemistry and the *genealogy* of the concept of *techno-science*.

PANETH, PROPOSITIONS, AND PSEUDO-SCIENCE

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ABSTRACT

The Austrian born and later British chemist Friedrich Paneth (1887-1958) is well-known for his contributions to radiochemistry, radical chemistry, and cosmochemistry, among others. He is also an eminent figure in the history and philosophy of chemistry.[1] As a philosophically interested chemist he is framed by his father Joseph, who was a philosophically interested biologist, and his son Heinz, who was trained as a physicist and who later became a professional philosopher of science.

Presumably not so well-known in philosophical circles is the fact that Friedrich Paneth was a pioneer of what is now called *cold-fusion* research. In a paper titled "On the transmutation of hydrogen to helium" from 1926 Paneth and his assistant Peters suggested the catalytically steered production of traces of helium from hydrogen in palladium at room temperature.[2]

In the present contribution it will be shown that what is sometimes called pseudo-science is, as far as Paneth was concerned, a prototype of classical scientific experimentation which can (and will here) be described with the tools of logical empirism. It only has to be criticized, however, that Paneth drew his conclusions too early: Only a few months later he withdrew his earlier interpretation.[3]

Another main point addressed here is the following. We will try to strengthen the hypothesis that Paneth´s whole "helium-project" was driven by an attempt to conquer "physical" territory by chemical means that is to describe what might be considered "physical" matter by "chemical" operations.

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[1] For a short philosophically oriented biographical account see Ruthenberg K. (1997) Friedrich Adolf Paneth (1887-1958). *Hyle* 3, 103-106. See also Ruthenberg K. (2010) Das Kant´sche Echo in Paneths Philosophie der Chemie, *Kant-Studien* 101, 465–479. An intriguing look at Paneth´s thinking from the point of view of continental philosophy is offered by Babich B. (2010) Early Continental Philosophy of Science. *Articles and Chapters in Academic Book Collections*, Paper 31, 273-276. http://fordham.bepress.com/phil_babich/31.
[2] Paneth F. and Peters K. (1926) Über die Verwandlung von Wasserstoff in Helium. *Die Naturwissenschaften* 43, 956-962.
[3] Paneth F. (1927) Neuere Versuche über die Verwandlung von Wasserstoff in Helium. *Die Naturwissenschaften* 15, 379. Further experiments were presented in Paneth F. and Günther P.L. (1933) Der chemische Nachweis künstlicher Elementverwandlungen. *Die Naturwissenschaften* 21, 367-368.

The Institute for Industrial Chemistry in Uruguay (1912:1957)

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ABSTRACT

During the second term as President of José Batlle y Ordóñez (1911-1915) and with Eduardo Acevedo as Minister of Industry, the Uruguayan government developed policies aimed at achieving an autonomous scientific-technical education in the country, creating technical-scientific institutions for this purpose. These policies were carried out in the context of other measures aimed at a greater autonomy from British imperialist policies, in terms of economy, science and technology, and energy.

In this attempt to promote the agricultural development of the country and the transformation of raw materials incorporating new technologies and practices, Batlle's government decided to import technology, within the framework of development policies in which the incorporation of knowledge played a central role. To this end, he resorted mainly to attracting European and North American experts whose function was to apply their knowledge to the study of the natural conditions of the country and communicate their skills and experiences to Uruguayan students and researchers.

In this context it was of key importance the creation, between 1911 and 1913, of four institutions: the Agronomic Stations, the Institute of Fisheries, the Institute of Geology and Mining and the Institute of Industrial Chemistry.

In this paper I analyse the creation of the latter in 1912 and its development until it was annexed to the National Administration of Fuel, Alcohol and Portland (ANCAP) in 1957. To this end I study in the first place the conditions that surround its creation, its original objectives and its organization, modelled on the German laboratories proposed by Justus von Liebig. Secondly, I study its evolution in terms of its three main functions: the promotion of research, productive development and technical and educational training during this period.

THE CASE OF URUGUAY RIVER PULP MILL DISPUTE.
THE POLITICAL SOLUTION *vs* A SEVERE CHEMICAL MONITORING.

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ABSTRACT

Uruguay, a typical grassland in the southeastern part of South America, began to change his landscape after the landing of Botnia´s pulp mill, nowadays UPM, in Fray Bentos (Río Negro Department). This fact forced our society to assume new challenges, not only related to industrialization, such as ecological and environmental aspects and workforce issues (uncontrolled demand plus syndical conflicts) but especially bi-national political relationships (which nobody *a-priori* was expected as a trouble). In 2006, while the uruguayan government gave green light to the first pulp mill at Fray Bentos (which forms the natural border between Uruguay and Argentina), Argentina filed suit at the International Court of Justice (ICJ), claiming against river pollution (in a case formally named Pulp Mill on the River Uruguay, Argentina vs. Uruguay). The dispute officially ended after the ICJ decision in 2010 and the presidents agreed to create a binational scientific committee in order to monitor the river pollution which officially ended the dispute. But, by contrast, Argentinean people from different locations did not accept the resolution, creating serious difficult in the communications between both countries; involving also goods and human transit in the region. Why foreign governments, and a group of "self-called ambientalist", block the technological progress in our country? Are the pulp mills appropriate for our own tourism policy: "URUGUAY NATURAL"? Does chemical monitoring warrant "zero" pollution in the Uruguay River? As scientists we may preserve the sustainable development through a rational approach that the politicians and the rest of the society not always share. When the governments don´t arrive to a political solution, should "the voice of the Science" talk? But could the Science itself resolve the dispute? or how could it contribute to a political controversy?

Answering these questions, scientists could contribute not only to resolve controversial issue but most of all, take a compromise with their social environment.