With John Dalton’s atomic theory, which gave a theoretical background to the ideas of definite proportions, and J. J. Berzelius who put atomism on a much more secure footing, using it to explain how different chemical compounds may contain the same elements in the same proportions, the research on the real nature of the acting forces responsible for the mutual combinations of the simple and indivisible atomic particles and the experimental determination of their equivalent weights, heat capacities and isomorphism in different compounds, became one of the most important part of elementary chemistry during the whole nineteenth century [1]. Although many chemists felt that an atomic theory was merely a distraction assuming that chemists ought to stick at the equivalent weights which gave accurate recipes and not bother with attempts at explanation, among the most distinguished chemists there were great debates about the status of atoms, and some of them were quite sceptical on the subject.

As a matter of fact, this has been the situation of chemistry teaching in the University of Coimbra, Portugal, in the middles of the century, where, since 1844, Chemistry was taught in the Faculty of Natural Philosophy, along four distinct disciplines, Chemical Philosophy, Inorganic Chemistry, Analytical Chemistry and Organic Chemistry. From 1844 to 1870 the most responsible Professors of these disciplines were António Sanches Goulão (1805-1857), Miguel Leite Ferreira Leitão (1815-1880) and Joaquim Augusto Simões de Carvalho (1822-1902). From the three, only Simões-Carvalho has written a Manual with the content of his twenty six lectures in Chemical Philosophy and Inorganic Chemistry. The book with the title Lessons of Chemical Philosophy, was edited in Coimbra, by the University Press, with a first edition in 1851 and a widely revised second edition in 1859 [2].

The title of the book follows a general trend for academic titles, at the time, such as some years early, J. Dalton’s
New System of Chemical Philosophy [3] and J.B.A. Dumas´ Leçons sur la Philosophie Chimique [4], or some years later, A. Wurtz´s Leçons de Philosophie Chimique[5]. Quoting among others, Wenzel, Richler, Proust, Berthollet, Gay-Lussac, Pelouze Baudrimont, Dulong, Petit, Raspail, Dumas, Laurent, Dalton and Berzelius, it is clear that Simões-Carvalho knew very well all the great debates and controversies about the status of atoms at that time. In the book he makes his own criticism of those debates and controversies. It is our purpose in this work to analyse historically that criticism.

References:

'The uses of chemistry, not only in the medicinal but in every economical art are too extensive to be enumerated, and too notorious to want illustrating.' So wrote Richard Watson, the fourth holder of the 1702 Chair of Chemistry in the University of Cambridge, in the 1780s. And so it has proved throughout the history of this venerable chair, the oldest continuously occupied chair of chemistry in Britain. From the first holder of the chair, the Veronese apothecary Giovanni Francesco Vigani, through Richard Watson, who nearly doubled the firepower of British gunpowder, Smithson Tennant, who made a fortune from the production of malleable platinum, and down to the present day, chairholders have professed the applications of their science to medicine, manufactures and industrial processes as much as they have the 'pure' subject. This paper draws on a book recently published to celebrate the tercentenary of the 1702 Chair of Chemistry at Cambridge, and explores the evolution of applied chemistry over the past three centuries through the unusual lens of the careers and avocations of the fifteen chairholders.
This paper focuses on the Art of Distillation. It analyses some aspects concerning the diffusion of this practical knowledge both in manuscripts and in early printed books, such as books of distillation, treatises on metallurgy and books of secrets, a genre very popular during the Seventeenth Century. Besides, this paper intends to study how recipes and concepts presented in different kinds of books could be interwoven by authors to compose new books, as suggested by the analysis of the Portuguese “Tratado das virtudes dos óleos de enxofre, vitriolo, Philosoforum, alicrim, Salva e agoa ardente” (1648), written by Duarte Madeira Arraes. This author acknowledged in his treatise scholars like Conrad Gesner, who wrote one of the most important books of distillation, the Thesaurus Euonymi Philiatri (1552), Mesue, an Arabic authority on the art of distillation, as well as Johan Jacob Wecker, author of the De Secretis Liber XVIII (1559), a collection of recipes. Medieval and Renaissance texts concerning manipulation of materials bring to our days vestiges of techniques employed by artisans and alchemists long time ago. Distillation is one of the most valuable, among these traditional arts. Powerful “waters”, “oils” and other “essences” could be produced by distilling vegetable, animal or even mineral materials. Books of distillation, printed in early modern Europe, reinforced the idea that distilled “waters” and “oils” were more powerful medicines than the traditional concoctions, since they kept only the purest and subtle parts of the original material. At that time, aqua vitae, produced by distillation of wine, was regarded as a celestial medicine. Authors of Sixteenth Century treatises on metallurgy also described how to prepare sharp “waters” and “oils” by...
distillation, such as the wonderful *aqua fortis*, employed to part gold from silver. Moreover, *aqua fortis* was also regarded as a very good medicine by authors of Books of distillation. During the Seventeenth Century, the powerful “waters” and “oils” produced by the art of distillation continued to be used both with medical and metallurgical purposes. Recipes published in books of secrets show it. At that time, practical knowledge concerning “waters” and “oils” prepared by the art of distillation was mainly diffused in books of secrets. These books gathered lots of recipes concerning several subjects, including medical and metallurgical recipes. However, mineral medicines became especially considered by physicians as long as Paracelsian ideas were discussed.

References:


In October 1836, James Marsh (1794-1846) communicated to the Royal Society of Arts of London his “new method of separating small quantities of arsenic”. The method was based on an already known property of arsenic: it combined with hydrogen in nascent state and yielded arsine. Arsine could be easily decomposed in hydrogen and arsenic, which formed a thin metallic film on the surface of a cold glass. The new test was soon employed in many European countries. It was favourably reported by Mohr and Liebig in the pages of the Annalen der Pharmacie. Liebig affirmed that its high sensitivity was “beyond any imagination”. Jacob Berzelius also published a positive review of Marsh’s method and suggested some improvements. Marsh’s paper was soon translated into French in the Journal de Pharmacie during November 1837 and employed during a poisoning trial in France as early as in May 1838.

In spite of these promising beginnings, the spread of Marsh test was surrounded by a great controversy. Its high sensitivity was a constant source of problems. In France, the polemic reached its apex during 1841, when special sessions were held at the Academy of Science and the Academy of Medicine. Due to the political resonance of some poisoning trials, the debate was not confined to the French scientific and medical community. Medical, scientific and popular journals dealt at length with the problem and they published detailed accounts of experimental toxicological practices and contrasted opinions concerning the use and abuse of Marsh’s test. The polemic faded away during the subsequent years and Marsh’s test became a common method in analytical chemistry during the nineteenth and twentieth-century. As a result, Marsh’s test is an excellent historical case to study how a chemical apparatus was transformed from an object of controversy to a reliable and unquestioned method for toxicological research. First, I shall analyse the old methods employed by the first experts in arsenic toxicological analysis. Then, I shall discuss how Marsh’s test was introduced in France and Germany and the advantages and drawbacks that were reported by toxicologists. Marsh’s test was largely transformed during this process and several alternative devices were suggested by different physicians.
and pharmacists. Its high sensitivity produced some puzzling and unforeseen problems, which will be analysed in the paper. I shall finally describe the scientific controversy which took place and explore the consequences of the Marsh’s test controversy in European toxicology.
The social making and dissemination of knowledge in the chemical sector has become a classical topic in the treatment of the history of that discipline. Business historians, on the other hand, have been eager to focus on the stages of integration of exogenous R&D in the chemical industry. With the emergence of the so-called “science-based industry” in the last quarter of the nineteenth century onwards, the German experience of interactions between science and industry has undoubtedly paved the way to the framing of complementary models – “industrialization of invention”, on the one hand, “scientification of industry”, on the other (Meyer-Thurow, 1982; Weingart, 1978). While such theoretical conception rationalizes our understanding of a rather complex picture, it implicitly legitimates the surfacing of a “one-best-way” model and tends to overlook the unexpected mechanisms of fruitful misunderstandings that abound in the coming together of scientific and industrial – or entrepreneurial – environments.

The question this paper seeks to address relates to the strategies deployed by the firms Solvay & Co. and Gevaert N.V. - two multinationals operating in a highly innovative sector and depending on a low national system of innovation (Devos, 1993; Schröter and Travis, 1998) - in taking advantage from the research capabilities located in the surrounding academic landscape. It will be argued that, instead of conforming themselves to any previous blueprint for innovation, both industrialists and academics sought to overcome their conflicting interests and cultural divergence by bringing out mutual opportunities that eventually led to an unexpected form of utilitarian cooperation. Paradoxically, these ups and downs proved to be decisive in the long run as they contributed to shape the patterns of increasingly coordinated and elaborated industry-university relationships in the Belgian chemical industry.
References:


Justus Liebig has been famous, very early, for his fünf Kugel Apparat (1831), for his innumerable organic analyses, for his theory of organic radicals, for his shameful quarrels and for the great activity of his laboratory, swarming with scientists coming from all over the world. He is one of the founders of the new organic chemistry, against Berzelius and in competition with Dumas and Laurent.

Among the many advances this hudge chemist performed in order to make chemistry go forward, one of them has to be taken into account, although being not a proper progress inside the realm of science. On his way back from Great Britain, in 1837, and inextricably linked to the project of writing a book on agriculture, he begun an energic rehabilitation of chemistry that aimed to diffuse all through the world another image of chemistry. An image that contemporary chemists would perhaps take as a guide an inspiror to save chemistry from its polymorphous ill fame.

Through the comparative lecture of texts, memoirs and correspondance, I shall try to detect the reasons of such a change in Liebig’s preoccupations, to evaluate the implication of such a crusade, and to determinate the reasons why such a policy did work. The review of the methods used to reach such a success, from advertising, even marketing, to personal interpretations of advances in the science of analysis, the use of his his scientific reputation to impose non-scientific assertions, but also the debates between pure and applied science, teaching and research, between science and industry, science and powers, make Liebig, once more, a very modern personage.
Chemistry in Russia and the Soviet Union experienced many changes after the 1917 Bolshevik Revolution. One of the most important of these changes was a growing interaction between academic chemists and the chemical industry. While these contacts were rather unsystematic for most of the years up to the late 1920s, this situation changed in 1928 when Stalin and the Soviet leadership moved the country toward rapid industrialization, the collectivization of agriculture, and the introduction of the First Five-Year Plan. In that year, a group of prominent chemists proposed a plan for the “chemization” of the national economy. This plan met with official approval and it became the basis for the development of chemistry and the chemical industry in the years up to the Nazi invasion of the Soviet Union in 1941. This paper will examine the plans for “chemization,” focusing on the years of the First Five-Year Plan (1928-1932). In particular, the paper will investigate the different conceptions of “chemization” as proposed by differing groups in the Soviet Union (for example, chemists and political leaders), as well as changes in the official view of “chemization” over time.
Up to the late eighteenth century Latin was the language held in common by all serious Scholars in Europe. In addition it was the language of University instruction in some subjects and countries as late as the first years of the twentieth century.

Hence, the translation of books from the language of an authors' country into Latin was a major factor in the wide dissemination of an author’s work across Europe in the seventeenth and eighteenth centuries. This factor will be illustrated by consideration of the continental editions of Boyle's individual works and collected sets in Latin and other languages. Twenty four out of the thirty of Boyle’s scientific and five out of the twelve of his religious and utopian works appeared in continental editions. Information will be given of a rare Swedish edition of "Style of the Scriptures" (1767), not noted by Fulton.

In the days before authors-copyright there was little or no protection for authors and publishers against editions printed in another country, without reference to, or indeed an author's permission. Boyle had particular problems with the Dutch bookseller/printers "pirate editions". His quite extensive correspondence with, and advice from Henry Oldenburg, the Secretary of the Royal Society and also Boyle’s literary agent, on this topic will be outlined.

References:

This Poster is about the plant named China root in connection to the cure of the Morbus gallicus/ Syphilis. AMATO LUSITANO (JOÃO RODRIGUES DE CASTELO BRANCO), one of the Portuguese physicians of the 16th century was very enthusiastic about the value of the China root, which was brought from China by the Portuguese sailor, Vicente Gil de Tristão (Vincentius Gilius a Tristanis), in 1540. In his medical writing, Curationum Medicinalium Centuriae Septem, Amato Lusitano reported to the treatment with China root to the patients, one of them a person of distinction, as we will see in Cent. II, Curatio 31 (Rome, 1551). Also the Portuguese physician GARCIA D’ORTA in Colóquios dos Simples, Colóquio 47 (Goa, 1563) mentioned the treatment of syphilis with China root. CRISTOVÃO DA COSTA (CRISTOBAL ACOSTA), based on the work of Garcia d’Orta presented a description and an image of the plant China root in Tractado de las drogas (Burgos, 1578). The Germanic anatomist VESALIUS, physician of the Emperor Charles V, dealt in the properties of this root in one of his opuscules called De Radice Cynarum (1546). Illustrations to the chapter on tuber and rhizome drugs from the Bencao gang mu (1603) in Staatsbibliothec, Berlin showed the plant China root (Smilax china L.). More recently, KEYS in Chinese Herbs: Their Botany, Chemistry and Pharmacodynamics (Tokyo, 1976) wrote that the China root can be employed as alterative and diuretic in syphilis, gout, skin disorders, rheumatism and it contains the crystalline saponin smilacin (C45 H74 O17; soluble in water and hot alcohol), tannin and resin. The plant China root seems to be an important tool to the medicine of the XVI century in Europe and in relation to the discoveries in the new world.

References:

This paper will discuss the use of corpuscular conceptions within the context of Scholastic discussion on the theory of mixtures. Corpuscularism has generally been taken as a key touchstone to distinguish between the seventeenth century nova scientia and that of the scholastic Aristotelians. Descartes’ or Gassendi’s different corpuscular matter theories are emblematic examples which are usually cited. Though closely attached to the Aristotelian setting of elements and qualities, Jesuit natural philosophers drew on the theory of corpuscles in order to explain natural phenomena as cases of mixtures of elements. In this paper, attention will be given to mid-seventeenth century Portuguese Jesuit commentaries on Aristotle’s De Generatione et Corruptione. Special emphasis will also be given to the influential Francisco Soares Lusitano (1605-1659). Two case studies will be highlighted. The first is the explanation of the origin of coldness on earth which was thought to be caused by very small, subtle particles that filled the atmosphere. These cold particles were supposed to be stimulated by Saturn by way of sympathy, thereby producing cold on Earth. The second example concerns rarefaction, and particularly the theory which stated that rarefaction was brought about by air corpuscles penetrating the porous parts of solid bodies. In doing so, this paper generally seeks to contribute to a reappraisal of early-modern Aristotelianism, and particularly that promoted in Portuguese universities and Jesuit colleges.
The optical methods, namely spectroscopy are usual techniques present in any analytical research or education laboratory, its study and its history are always associated with the Chemistry history. It isn’t possible to understand a technique’s contributes in science development without being aware of the setting and the people who interacted with it. So, we followed an evolutive path in Polytechnic School and in the Faculty of Sciences of Lisbon until 1917, in what concerns the emergence and development of spectroscopy and other optical methods and its inevitable consequences. How and when did spectroscopy arrive at Polytechnic School, namely in Chemistry area? What other methods are associated? How did it contributed to scientific research? Which are the consequents to the teaching of Chemistry?

Agostinho Vicente Lourenço, Achilles Machado, and later, in the Faculty of Sciences of the University of Lisbon, António Pereira Forjaz are landmarks in Chemistry science progress in Portugal and they are also responsible for the development and teaching of spectroscopy.

Our study permits to give the answers to the questions made and found a track through the analysis for the Chemistry chairs’ curricula, the adopted books for the Professors, the publications, the communications introduced, the catalogues and also documents archives and the pieces the instruments in existence at the Science Museum reserve.

In the evolution of an instrument, like a spectroscope, we can find the evolution of some concepts of Chemistry itself.

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In 1935, the American Chemical Association annual meeting chose as its theme the tercentenary of chemical industries in America. The theme was part of a larger effort to improve the image of chemistry (and science more generally), by portraying chemistry as an industry and study with a long, and American, history. The organizing committee selected A. Cressy Morrison to write a companion book, and in 1937, Morrison published *Man in a Chemical World*, with illustrations by Leon Soderston. Morrison’s text and Soderston’s illustrations work together as a grand apologia for chemistry aimed at the man in the street. As such, it represents a powerful attempt to transform the public image of chemistry. The illustrations were full of religious motifs, and portray the chemist as a modern-day priest, while at the same time emphasizing a new, and Americanized, image. While this was not the first instance of scientists being portrayed as “men in white lab coats,” it was one of the most overt uses of the metonym that would become the visual icon of modern science.

This paper looks at the text and images and the context of their creation, within the growing literature regarding the creation of images in science (both the scientific object and the scientists as object\(^1\)). It argues that the modern image of chemistry was a success iconographically, and but failed to truly persuade the public of the benevolence of chemists.

The more the vacant boxes in the periodic table diminished, the more scientists increased their efforts in the attempt to identify the missing elements. Although the techniques they used were more and more sophisticated, the elements seemed more elusive and difficult to find. Despite the risk of reporting false discoveries, the number of announcements increased and scientific journals received many papers that endowed many fanciful names for elements 85, 87 and 93 [1]. In the years in which physicists were successfully re-assessing the great number of new discoveries that would have led to the synthesis of artificial elements, in Paris a couple of spectroscopists was looking for the presence, in nature, of the elements of atomic number 85, 87 and 93. In 1934 Mlle. Yvette Cauchois (1908-1999) created a curved crystal focusing X-ray spectrograph. Three years later, with the aid of this highly sensitive, high-resolution instrument, the Romanian physicist Horia Hulubei (1896-1972) and his French colleague, Cauchois, reported weak lines which they assumed were a doublet of element 87. In 1939 the two physicists found evidence for the existence of eka-rhenium in the mineral betafite from Madagascar. Although they were supported by their patron, Jean Perrin (1870-1942), the “discoveries” did not receive experimental confirmation outside of France. Finally, in 1939, Hulubei and Cauchois observed unknown lines in the emission spectrum of radon, some of which could indicate the presence of eka-iodine among the disintegration products of this noble gas. They prematurely announced these discoveries and prematurely named these elements: moldavium (symbol Ml) [2], sequanium (symbol Sq) [3] and dor (symbol Do) [4]. Just a year later a new claimant for element 85, the Swiss physicist Walter Minder (1905-1992), came into the limelight. A question of priority arose between him and Hulubei, but their arguments soon became trifling and the proposed symbol, Ml, became an illegal squatter in the Periodic Table. By the end of the 1940s, solid confirmations of their existence by other workers
bestowed on them their final names: francium, neptunium and astatine.
It is possible that minute amounts of element 87 exist in nature, but definitely not in the mineral samples analysed by Cauchois and Hulubei. Naturally-occurring traces of element 93 do not exist at all. And it might be hypothesised that the discovery of moldavium, like the presumptive discovery of the first “transuranic” harmoniously named sequanium, was the consequence of incorrect interpretation of experimental data. A different conclusion is possible for dor. Since it is now known that an isotope of element 85 is found as an occasional branch product among the decay products of radon, it is quite possible that some lines of its X-ray emission spectrum may be found in the radiation from radon sources. Nevertheless, it is very doubtful if such weak radiation could be detected by Hulubei and Cauchois, even with the focusing spectrograph they used.
The paper sets out to cast new light on the relationship between mining and chemistry in Sweden during the first part of the eighteenth century. During the period, chemistry was mainly pursued by officials at the Board of Mines, the government agency for control of the mining industry. There, chemistry was to a large extent considered an auxiliary science to the industry, and was used to improve and control mining practices.

The paper studies chemistry’s dependence on the Board of Mines as a support structure, and as a nurturing matrix in which it could evolve theoretically and define itself as a cluster of theories and methods independent from alchemy. For example, it was in their capacities as employees of the Swedish Board of Mines that Georg Brandt and Axel Fredrik Cronstedt conducted the mineralogical investigations that would lead to their discoveries of cobalt (discovered by Brandt in 1730) and nickel (discovered by Cronstedt in 1751).

A central argument is that chemistry fulfilled not only scientific, but also social functions at the Board. It served to preserve the social status of the often high born officials. In order to advance at the Board, they had to learn and practice the skills of craftsmen such as assayers. While an eighteenth-century nobleman could be a learned man, he could not be a craftsman (or at least not admit that he was one). By making craft procedures a subordinated part of chemistry, an intellectual pursuit, an imagined or factual decline of social status could be avoided. Thus the hand was not elevated above the head, or rather the “heads” of the Board of Mines were not brought down to the level of the miners and other craftsmen they were meant to control.

It is furthermore argued that chemistry became surprisingly “modern” in this context, and that important concepts that were later to be taken up by such chemists as Torbern Bergman and Antoine Laurent Lavoisier were originally developed in this setting.
By the end of the 19th Century and the early 20th Century, France lived one of its richest periods of chemical industrialization. This paper focuses on one of the less known branches of chemical industry, the rare earths industry. Normally, readers are more acquainted with the work developed by chemists such as Georges Urbain (1872-1938), Auer von Welsbach (1858-1929), Lecoq de Boisbaudran (1838-1912) in this field, than with the process and the reasons underlying the emergence of this industry. Considered in generally as chemical curiosities, only Auer von Welsbach, an Austrian chemist was employing a mixture of Thorium and rare earths in order to produce incandescent mantles, improving gas lighting. At the turn of the century, Auer von Welsbach came to France and established a rare earths' elements factory whose production was interrupted by the First World War, upon request from the French Army. After the war, Georges Urbain, a French chemistry professor whose reputation derived from his contributions to this field, founded in 1919 the Société des Terres Rares. A factory was established and its direction was given to the Société by the Army. By establishing close links between research and industry, Georges Urbain gathered around him a group of researchers and created in this way the French research school of rare earths. His research programme focussed on the isolation of these elements was directly influenced by the French academic culture in a similar way to that of Marie Curie regarding radium industry. The foundation of factories in France increased the production of rare earths, and gave France industrial autonomy in rare earth related alloys. Rhodia, one of the biggest chemical groups in France, can be considered today as a product of Urbain’s school know-how of purifying mixtures of several rare earths elements. Ferro-cerium’s production, for instance, allowed for the formation of a large monopoly in lighter flints for nearly 80 years, which closed down in 1998 due to environmental problems caused by rare earths production, notably soil and water contamination by radioactivity. This situation was even worsened by China’s low cost production and better technology for purging radiation from rare earths mixtures.
Georges Urbain is also known to have been one of the staunch supporters of fundamental chemistry playing a role in French chemical theory. His research programme focussed on pure chemistry, and his chemistry courses at La Sorbonne advocated the beauty of the scientific discoveries to the detriment of applied chemistry. That was why a controversy opposing Urbain and Le Châtelier occurred because of their contradictory views concerning the teaching of pure and applied chemistry in their courses. Contrary to Curie’s works on radioactive substances whose social utility was perceived as being of paramount importance, rare earths’ elements seemed not be as interesting to the needs of mankind, despite the tests made to evaluate their medical applications. Urbain’s positions regarding pure and applied chemistry seem contradictory: if on the one hand Urbain joined his friend Jean Perrin during the 30s in a campaign for the promotion of “pure” science, and created la Caisse nationale de la Recherche scientifique and the Laboratoire des gros traitements chimiques, on the other, he established the Société des terres rares, a company devoted to the production and trade of rare earths salts. By then chemists realized that they needed industry to pursue their research programmes in fundamental chemistry; in turn, industrialists were aiming to earn money from their research. Changing boundaries between pure and applied chemistry or becoming an adept of one field or the other was more concerned with getting funds to use in the industrialization efforts than with rational or moral practice of science.
The practice of post-1980s science differs greatly from that in the 1950s and 1960s. Back then, the emphasis was on basic science; scientists had almost complete freedom to pursue any line of research they felt was promising. This contrasts strongly with the present situation, where scientists are forced to focus their studies on topics that are considered relevant to society. The time horizon for this research is short- to mid-term at best.

To emphasize the qualitative rift between these periods, new terminology has been introduced: basic science is now contrasted with ‘Mode 2 science’. Authors like Michael Gibbons argue that Mode 2 science is not just applied or strategic science, because societal influences are intrinsically interwoven with the practice of science. It is obvious that these developments imply a seriously reduced autonomy for the individual scientist. The present paper seeks to analyse the prior history of these developments, recounting how in the 1970s, the Dutch government succeeded in limiting academic freedom so that chemical research at universities was directed at societal problems in general and innovation in particular.

The case study to be analysed here is the debate over the safety of recombinant-DNA technology in the context of an emerging innovation-oriented science policy. The Dutch government felt that the promotion of public understanding of science was necessary to educate the public at large about the risks as well as promises of rec-DNA techniques. To this end, an agency called Science Information Services (Dienst Wetenschapsvoorlichting, or DWV) was founded by government, which was housed at the offices of the Royal Netherlands Academy of Arts and Sciences (Koninklijke Nederlandse Akademie van Wetenschappen, or KNAW) without being an official branch of this institution. However, it was not long before a controversy developed between DWV and KNAW on the former’s activities to promote the ‘public understanding of science’. A heated conflict arose about the objectivity of science.

In the early 1980s, DWV was dissolved and the government sought other instruments to educate the public about
science. In line with international developments, Dutch safety regulations on recombinant-DNA technology were relaxed. Eventually, however, this meant that the government started to constrain academic freedom as it continued to develop its policy on science. This resulted in plans for strategic research in the domains of biotechnology, materials sciences, catalysis and pharmacology. The paper ends with a discussion of academic freedom in Mode 2 science.
TABUN, the first known nerve agent, was discovered accidentally in 12/23/1936 by the Bayer division of the IG-Farben researcher Gerhard Schrader (1903-1990). Officially called an insecticide this agent was patented (No. 15/399) in March 1937. Because of the law of 4/24/1934 which required all inventions of possible military significance to be reported to the Ministry of War, Schrader has informed the Army Ordnance Office (“Heereswaffenamt”) (HWA) about the military implication of this stuff. The code name of this agent was called Präparat 9/91, later called Le100, Gelan, Stoff83 lastly known as TABUN. From 1937 to 1939 the semi-technical production of TA-BUN were proofed and tested, so that a pilot plant was implemented in Munsterlager under the commando of the HWA. In this peace time period the I.G.-Farben didn’t want to have any military implication in directly related war material production. In January 1940 however, the Germans began construction of the full scale plant, code named Hochwerk, at Dyhernfurth. An I.G.-Farben sub-sidiary, Anorgana headed by the I.G. board member Otto Ambros, operated the TABUN plant [1].

The May 1943 meeting of Ambros with Hitler is often mentioned in literature, but lastly the content -Ambros didn’t recommend the beginning of chemical warfare (CW) - are based on affidavit of Ambros in the Nurnberg trial (1947) which is historically spoken should take with care [1-5]. Nevertheless, the Germans have had their weapon of mass distinction: In this time the German TABUN stock was about 1858 tons in shells and bombs. This means the German war machine have had the power to destroy all higher animals within 4000 km² area within in few minutes [1, 6]!

On 1 March 1944 Ambros (1901-1984) gave a lecture on the situation of the German CW pro-gram in the “Führerhauptquartier” together with Hitler and others. He explained that the decided amounts of 1000 ton per month (moto) TABUN of the meeting of 15 May 1943 were fulfilled to 70%. In the next month it was indented to fulfil the production target to 100 %. After this lecture Hitler enhanced the production quota to 2000 moto without considering that the amount of Phosphor did not exist in Germany [1, 7]. Almost 40 % of phosphor stock (50000 t/a
P₂O₅ year production) was already used by the TABUN production [8]! In this lecture mentioned, Ambros referred to Hitler “about the demoralise impact, which were occurred by application of these types TABUN and SARIN, and the use of these stuffs was characterized as a means of very last decision. It was referred to the possibility [italics author], that the opponent [=allies] had drifted the development in a similar [italics author] direction. In literature is has been known, that - especially in America [=USA] - scientific investigations were carried out with matter related constitution [“Kör-per verwandter Konstitution”] [1, 8]! What did Hitler understand presumably with the formulation “matter related constitution”? Or otherwise asked, what kind of rhetoric effect of this chemical expert (Ambros made his PhD. by the Nobel prize winner Richard Willstätter) will be happened by such a chemical layman like Hitler as a listener? To my opinion, there might be only one answer: Hitler might or more probably have to get the impression that the opponent have had the same quality of chemical weapons with nearly the same amount, but the allies did not have nerve agents as well known historical matter of fact and the allies noticed lately it, despite of ENIGMA, not until since May 1943 [3]! So Hitler might be deterred and this is the reason for not starting the chemical war machine with nerve agents. What a kind of big difference on the degree of enthusiasm of Ambros compared with Fritz Haber’s exertion of influence in starting the CW in the World War I [1].

References:

Liebig’s chemical theories played important roles as generators of new research not only in organic chemistry, but also in fields of applied chemistry such as agricultural chemistry and nutrition science. Biochemistry (physiological chemistry) gained (much) impetus by the publication in 1842 of Liebig’s *Die Thier-Chemie* (in English *Animal Chemistry*, published the same year), in spite of (or because of) the fact that many of Liebig’s ideas were repudiated in the following decades. As Larry Holmes has pointed out in his introduction to the 1964 reprint of Liebig’s book “[s]eldom has a book written with so little regard to scientific standards of objectivity and caution wielded such demonstrably important scientific influences”.\(^1\) The impact of Liebig’s theories took place on a scientific level as inspiration for new physiological research, but also at a common level in so far as the concepts were used as theoretical background in the composition of popular dietary and nutritional guides.

This paper explores the development of a science of nutrition in Denmark in the nineteenth century and and the way scientific theories were presented in scientific and popular publications. Particular focus is given to the interplay between medical and chemical approaches to solving the new science’s main problems. The paper will review the reception of Liebig’s ideas in Denmark and will attempt to evaluate the impact of the ideas on the practical dietary advices given to the ordinary Dane.

The paper results form ongoing research that is a part of a larger research project (located at the Department of History at the University of Copenhagen) on cultures of and discourses on food, drinks, and tobacco in Denmark in the nineteenth century.

Few historians would dispute that chemistry provided the prototype for modern laboratory sciences. Nevertheless, the formation of chemistry itself as a ‘science’ has been something of a mystery since many argue that chemistry was no more than a cookery until the Chemical Revolution: it had to acquire physical instruments, methods, and theories to become a ‘science.’ This characterization of ‘chemistry as a branch of physics’ severely undermines our ability to understand the historical development of chemistry and to conceptualize that of empirical sciences in general. Recent efforts to anchor such development in ‘practice’ have not successfully addressed the issue of how various material practices become organized into genres of disciplined knowledge.

In this paper, I would like to model the historical evolution of pre-Lavoisian chemistry around the two concepts of ‘experimental system’ and ‘theory domain.’ The concept of ‘experimental system,’ originally devised to describe the dynamic complex of materials and techniques that sustained the investigative activity in modern biology, can be exploited fruitfully to describe that of chemistry in the early modern era. What organized chemists’ ongoing practice in the seventeenth century was the model system — the distillation of plants — that yielded five categories of substances. Chemists stabilized these substances and matched them to the philosophically prescribed ‘principles’ to organize their didactic discourse. This move constituted the ‘theory domain’ of composition that became a backbone of the chemical tradition. The introduction of a new analytic method — dissolution in acids and alkalis — established the new model system of salts, however, and undermined the validity of the principalist approach to chemical composition. The selective actions of salts led to a new ‘theory domain’ of affinity and the affinity approach to composition, which were embodied in the affinity tables. In other words, stabilized experimental systems and theory domains defined the contour of theoretical chemistry that was neither dominated by idle philosophical questions nor hampered by aimless trial and error.
1. **Axis, regional cartels and local capitalism: the situation of the French chemical industry before WWI**

Before the 1st World War, the French chemical industry is strongly linked to territories. This industry is located in only a few valleys (Oise Valley, Rhône Valley, Alpine Valleys) and dominated by cartels and regional bourgeoisies. Only a few factories are located in peripheral areas in order to provide superphosphates for agricultural needs. The link of the chemical industry to the territory is very strong and is doesn’t only appear in their names (Compagnie de Saint Gobain, Société Anonyme des Matières Colorantes de Saint-Denis, Manufacture d’Auby, etc…) but combine capitalism to territories by two means: the division of the national territory in regional cartels is due to the high cost of transportations of this raw materials. Moreover, most of the French companies are based on regional capitalism (Kuhlmann, d’Auby…). Only two exceptions tends to minor this point of view: the power of Saint-Gobain which is the only company to deserve the title of « national scale company » and the dyestuffs compagnies (Saint-Denis) which depend not mainly on the cost of raw materials but on the proximity of markets (Paris, Lyon). The price to pay for this cartellisation of the chemical markets is a creation of an oligopolistic position and a cut throat competition imposed by major companies to smaller ones who didn’t agree to sign cartels agreements.

2. **The 1st World War and the birth of a national chemical policy.**

The invasion of the northern part of France by the Germans led the French State to develop powder and chlorine plants in the Alps and Pyrénées upper valleys and the Rhône valley. The south/west of the country and the mediterranean shores where developed as well. At the same moment, a reflexion is led by the State on the renewal of a branch dominated by the Germans. Some compagnies, such as Kuhlmann are subsidized in order to create a Compagnie Nationale des Matières Colorantes (National Dyestuffs Company). The opportunity to develop new plants in remote parts of the
Country is also the occasion for many company to extend their scale and to conquer new territories in order to build superphospahtes plants: Kuhlmann transform itself from a regional to a national company. The war drew a new map of the french chemical industry based and strategic interests and low-cost energy.

3. The Post-war years: the birth of national chemical capitalism.

The post-war years were marked by a nationalisation of the chemical industry and a new occupation of the territory:

- The return to peace means the sales of the german factories based in France (mainly of dyestuffs) to french companies. The return of Alsace to France brought huge potash mines to the State.

- The French state developped a politics in favor of the chemical sector: many powder plants erected during the War were sold to private companies whereas those were protected by a new tariff and refused internationals cartel agreements (franco-german) until 1927/28. Moreover, the French state created a national company in order to develop the Haber process in Toulouse (ONIA) far from the frontier. This policy led to a self-sufficient mineral and organic chemistry, mainly in the fields of dyestuffs and fertilizers.

- The private companies entered from 1919 in a fierce commercial war: regional cartels exploded whereas many mergers occurred (CNMC and Kuhlmann in 1924, SCUR and Poulenc in 1928). The regional bourgeoisies based company were replaced by national companies which were nevertheless far from being as powerful as ICI in England or IG Farben in Germany.

The speech will be completed by many maps presenting the location of different companies, maps of different scales (studies of valleys) at different moments of the period studied.

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To anthropologists, a material systems approach concerns itself with full contextualization of an item. Their studies center on the context of use of an object by focusing on the context of its exchange. I shall follow their precepts about how information should be gleaned from the material culture of a people with an example from our own tribal practice.

Many a student of chemistry has performed the sucrose inversion experiment, as part of laboratory training throughout the period from the 1860s to the present. In this talk I report on the multiple meanings of a practice that amounts to an exchange in which the elders share their experience with the novices. It can be seen as an initiation into adulthood, as part of the certification as a professional chemist.

In part a ritual, putting organic chemistry under the seal of chirality, such a monitoring of a chemical reaction in real time is also a celebration of sweetness in foods, an allusion to the continuity from field work (beet cultivation) to industry (sugar manufacturing), and to the close link between chemistry as a science and chemistry as an industry. That the inversion is catalyzed either by an enzyme or by Bronsted acids is also an essential element of the background of this particular experiment. Such a bridging of the chemical and the biological perpetuates the ideas of Louis Pasteur, who was so instrumental in setting it up.
In a previous study, I emphasize that links between university and industries were old and regular in the French chemistry. Even though today the French government supports those connections, from the thirties until today, it’s uncommon to meet scientists really able to admit that the academic research has many contracts with industries for a long time.

It’s why the Institute for Natural Substances Chemistry (hereafter ICNS) history is so interesting. The ICNS researchers have always worked with several firms. The ICNS is one of the main National Centre For Scientific Research (hereafter CNRS) laboratory. The ICNS was founded in the late 50s, because France couldn’t compete with Great Britain, Switzerland and USA to carry out research on natural products.

The ICNS is famous because Pierre Potier’s team has patented two major molecules and has dealt with two firms to turn them into drugs named Navelbine and Taxotère. In one way, Pierre Potier’s team has won the competition against the American scientists despite the National Cancer Institute program. The French drugs are very used everywhere around the world for the cancer therapy.

The Pierre Potier’s ability to manage the contracts with Pierre Fabre Pharmaceutical firm for the Nabelbine and Aventis for the Taxotère is noteworthy. Whereas oncology drugs were not seen as the most desirable area in which firms might compete.

What I would like to do with this presentation is to explain how was-it possible? The CNRS (public sector) doesn’t fund cancer research in the strict sense of the term. However, many researchers are working on this point. One aspect of this story is the degree of autonomy and freedom of action that the French researchers enjoyed.

The rich collection of archival material is required here. Pierre Potier (the inventor) has thrown nothing away and I have access to notes about all the steps of a research project and direction to take when not pursued and
preliminary drafts of publications since corrected as well as officials letters, personals letters, memo, minutes and laboratory notebooks. Pierre Potier has given me more than 30 hours of interviews. So I am able to explain how P. Potier has managed his team, his laboratory and then the Institute firstly to discover the two news molecules, secondly to turn them into drugs. Furthermore, I will present his personal strategy to preserve the public science interest, the researchers’ interest and how has he kept under control the intellectual and industrial properties of their discoveries even today as he is retired. The licences fees pay by the two firms are huge and are still now the major patents income for the CNRS.

I would argue that the relationship between individual and collective is the key of the success whatever the role of the state, of structures and of organisation and I would present one path to make chemistry in France since the 60s until today.

References:

LESTEL, Laurence:  Fertilizer producers in France in the 19th century: their links with chemists (1830-1870)

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The importance—and shortage—of fertilizers, and especially nitrogen, in agriculture in the nineteenth century France led to an intense activity for the identification of nitrogen sources and flows in the city, the use of urban and industrial wastes as nitrogen fertilizers for agriculture, and the development of the organic and mineral fertilizer industry in Paris.
We would like to show how the fertilizer producers used the knowledge of chemists to produce new fertilizers or fertilizers of controlled quality, through the example of factories such as Lainé, or Houzeau-Muiron. This paper also deals with the arguments used to promote urban and industrial fertilizers, i.e. the transformation of all kinds of urban refuse into low-cost fertilizers, the recovery of until then useless industrial waste, and the transformation of a dangerous and unhealthy nitrogen containing excremental material, when discharged into rivers, into a valuable and useful product for plant nutrition and the human diet. This could be illustrated by the increase of the number of new fertilizer factories around Paris in the 1870s.
Enlightenment philosophy posited that nature and laws governing it embrace the totality of knowledge about the world and should thus constitute the fundamental sphere of scientific research. With analysis believed to be the most important tool of cognition, the issue of composition of bodies became more relevant than ever before. The perception of nature as a reservoir of goods available to benefit man was consistent with Paracelsus’s earlier view that nature is also an immense pharmacy. The only problem was how to find one’s way about that pharmacy. From time immemorial, plants had served as the most abundant source of medications. Many species of medicinal plants were known and effectively utilised. At the turn of the 19th century, efforts to find new medicines led pharmacists to look at the dangerous realms of poisonous and narcotic plants. Chemical studies of their composition yielded increasingly substantial results as analytical methods and techniques were more and more sophisticated.

The new approach to the examination of plants involved dismissing distillation in favour of the analysis of plant juices, extracts and other liquid material obtained from plants. As plant juices tended to be more or less acidic, the discovery of an alkaline substance in the concentrated juice from immature opium poppies *Papaver somniferum* was a remarkable surprise. The compound was morphine and that discovery channeled scientists’ efforts towards finding alkaline substances in other plants. The analytical method they used was simple. It involved alkalising concentrated juices or extracts to detect any organic bases, called alkaloids by W. Meissner, in the resulting solution. The findings were almost invariably positive if the material came from poisonous plants. There would be a fine sediment of nitrogen-containing substances possessing strong pharmacological effects.

The appeal of this line of research and its apparent simplicity made it popular not only across university laboratories but also in pharmacies. European scientific journals were soon brimming with reports on the discovery of various natural substances exerting potent effects on the human body. The newly-discovered substances were put to medicinal use very quickly. However, another problem arose: the discoveries, so numerous reported by the press, would often turn out to be illusory as the substances were
actually mixtures of a number of chemical compounds, a fact of which their discoverers were usually not aware. Arguments over attribution of discoveries ensued inevitably, and many of them have persisted until today.
The process of making paper can, since its origin, be described as a mechanical treatment of raw products, mostly linen, in order to free the cellulose. During the 19th century the need for more paper drastically increased, and the classical sources, especially linen, could not satisfy the demand. Other sources were actively searched for and wood was a natural choice. When first using wood it was treated mechanically the same way as other raw products had been treated, but such a paper became a rather weak paper, and mechanical methods were gradually replaced by chemical ones. This paper is about how such new chemical methods were introduced into the pulp and paper industry. I will focus on the meeting between the new technology and the existing mechanical methods, and the questions will be asked on what points the two methods differed, and not the least what united them. I will make an attempt to answer such questions by following the careers of some of the leading persons in the pulp industry during this time, but also by using the concepts locality, continuity and mobility. Finally some general conclusions will be drawn.
In August 2004 a project on the collection and preservation of scientific instruments, chemicals and glassware from the previous Department of Organic Chemistry at the Norwegian Institute of Technology (NTH, now NTNU) was initiated. The original aim of the project was to preserve and register objects from the organic chemistry laboratory, and has now been extended to other sections of the previous Faculty of Chemistry. The work has also included archive studies of outgoing letters from the organic chemistry laboratory, which shed light on what it was like to establish a laboratory of organic chemistry at Norway’s first Institute of Technology.

The role of instruments and experiments in the history of science has been given increasing attention from the 1970s and onwards, and as a consequence the Scientific Instrument Commission (of the International Union of the History and Philosophy of Science) was founded in 1977. Of the many papers presented and published the last 30 years, few are devoted to the role of objects in chemistry. Especially chemicals are important in chemistry, along with instruments and glassware. In the ongoing project at NTNU all three types of objects are well represented. In this presentation it is our aim to illustrate the role of chemicals, glassware and instruments in the establishment of a research and teaching laboratory and show how such objects can be exploited in the writing of a history of an institution or field.
The conceptions concerning the weight increase during calcination of substances from antiquity till the end of the 18th c. are discussed. A special attention is given to the Essay of Jean Rey (1630). The analysis of this Essay shows that Rey suggested that air became denser and increased in weight when heated, and this denser air had to be attached to the particles of tin-calx. No explanation, how the tin-calx is formed, is proposed. Nevertheless W. H. Brock in his The Fontana History of Chemistry suggests that this author explained the calcination by addition of air particles to the metal. A similar idea as that of Rey is found in Lomonosov's Latin paper (1752) erroneously translated by N. E. Zernov into Russian in 1828. Lomonosov writes: “nothing else can be the reason for the weight increase except that the acid of sulphur which having been liberated from phlogiston and gathered under a globe and having a tendency to remain at the top, then penetrates into the pores of copper and silver and there thickened, increases the weight”. The words “there thickened” (in Latin original: “illisque concretum”) were replaced by Zernov (probably under influence of Lavoisier’s ideas) by: “uniting with them”, (in Russian: “соединяясь с ними”). This was repeated by a Russian chemist, N. B. Menshutkin in 1905 in German. This incorrect Russian text was the basis of errors in Ganzenmüller’s reference to Lomonosov’s conception in Gmelin Handbuch der anorganischen Chemie. The ideas of Rey and Lomonosov are fundamentally different from those of Lavoisier, but these two authors are mentioned in some handbooks as the first authors, who explained the weight increase as a result of combustion during calcinations. It was, however, only Lavoisier, who accurately formulated the theory of combustion having considered simultaneously the increase in the weight of metal, and the decrease in the volume and weight of the air during calcinations in closed vessels.
References:


5. R. Ganzenmüller, in Gmelins Hanbuch der anorganischen Chemie, Syst. Nr 3, Lieferung 1, Leipzig 1943, p. 44.
Recent studies in the history of molecular biology have stressed the importance that must be attributed to the instruments in the development of the discipline. This communication presents the case study of a research group which emerged in Barcelona, Spain, in the mid sixties, within a general process which also took place in other European countries: the Macromolecular Chemistry Department. The distinctive feature of this research group lies in their physical location within an Engineer’s School and in the academic training as chemists of their founders. Their postdoctoral training in The United States, United Kingdom and Israel, sets their research towards structural molecular biology, towards the adoption of the X-Ray techniques and to the development of their own instruments to be applied in the structural analysis of biological macromolecules (DNA and histones). The engineer’s School workshop made possible the design, construction and modification of some X-Ray diffraction cameras. This communication deals with the so-called Catalan structuralist school, led by Joan Antoni Subirana and Jaume Palau.
Chemistry occupied a large segment of the Science Museum’s exhibition space between the rehousing of the collections in the East Block in 1925 and the closure of the main chemistry galleries in 1999. For most of this period, chemistry was the basis of one of the museum’s departments headed by a Keeper. While none of the Keepers of Chemistry ever became Director, the famous historian of chemistry (and editor of Ambix) Frank Sherwood Taylor was Director between 1950 and his premature death in 1956. Many children first became aware of the excitement of chemistry through the chemistry displays at the Science Museum, most notably Oliver Sacks (Uncle Tungsten) and John Stock. Thus the portrayal of chemistry at the Science Museum was a major element of the popularisation of chemistry in Britain in the twentieth century.

How chemistry has been presented in this time and the rationale of this presentation will be the focus of my paper. What was displayed was also largely what was collected – whether it was collected to be displayed or displayed because it had been acquired – and hence any discussion of the presentation of chemistry also shed light on the museum’s acquisition policy. Throughout the period under discussion, chemistry was divided into applied (industrial) chemistry and pure (experimental) chemistry. Latterly biochemistry became a separate subject (both in terms of collections and displays). I will examine the background of the chemistry staff, their outlook on chemistry and the external influences on their views, and how they sought to communicate with their audience through their presentation of chemistry. Moving from the history to current practice, I will trace the movement away from a strict disciplinary division between galleries and curators during the 1990s towards a new way of presenting chemistry as part of science as a whole. The culmination of this process will be the opening of a major science gallery around 2009.
Atomic weight has been a matter of fundamental importance in chemistry and other science for well over a century. Available knowledge about atomic weights gets more precise and more extensive as time goes on. During the first half of the twentieth century the development of new instrumentalities led to realization that atomic weight is a different sort of property than had previously been thought. Atomic weight had been understood as a constant, a direct characteristic of each element’s atoms, and much successful chemistry and physics was done on that basis. From the 1910s through 1920s however, it was recognized that this was the case only for mono-isotopic substances. For elements with multiple isotopes, atomic weight was still a distinct characteristic but it was seen to be an average based on the abundances of the isotopes and the masses of each. From the 1930s on it was established that the abundances of the isotopes of some elements vary not only in particular samples but over time and space in the world at large. Atomic weight in such cases is thus a variable, not a constant. Atomic weight now is known to be a different sort of thing for different materials. These discoveries depended on the introduction, improvement, and spread of new capabilities, especially that of separating and manipulating atomic and isotopic ions with mass spectrometers. The development of mass spectrometry also led to two distinct, discipline-centered measurement systems, and ultimately to a third scale reached through international negotiations and votes. The development of the laboratory instruments and techniques directly linked to the issue of atomic weights also produced extremely important breakthroughs in the other fields in chemistry as well as in other areas of science and technology. This story of the transformation of atomic weight can illuminate the inadequacies of many widespread views of the nature of science, while recognizing the crucial role of the development of laboratory instruments and techniques helps point the way to a far clearer and more comprehensive account of how scientific knowledge grows in chemistry and beyond.
There are not many industrial branches that influenced society in the European countries in such a complex manner as sugar industry did in the 19\textsuperscript{th} and at the beginning of the 20\textsuperscript{th} centuries. Pronounced influence of this industrial branch can be tracked especially in the Czech Lands, where the prosperous beet sugar manufacture was immediately followed by increase in agricultural production, growing manufacture of fertilisers, development of specialized farm and industrial machinery and, last but not least, changes in laboratory practices.

Many local sugar manufacture specialists, both Czechs and Germans, were excellent professional chemists and their inventions and technology improvements influenced technology of sugar production throughout the world. Sugar industry contrary to "classical" food industries like brewing was not constrained by rigid traditions and its technological progress represented an impetus of this industrial branch. Beet juice purification – carbonatation, and an entirely new diffusion process invented in the Czech Lands have been used all over the world up to these days.

The unprecedented development of sugar industry in the Czech Lands associated with technology improvement and sugar yield increase was conditioned by careful and exact control of the manufacture process. Sugar concentration in the main production flow, as well in different by-products and wastes, was the basic parameter of this control that required fast and adequately exact analytical methods. Both these aspects – speed and accuracy – were eminently important owing to the continuous character of manufacture and necessity of permanent monitoring of sugar yield. Polarimetry, a sensitive, non-destructive technique for measuring optical activity exhibited by inorganic and organic compounds, has played such important role in this field that it can be without exaggeration considered pillar of sugar industry development. Before introduction of polarimetry to control laboratories of sugar factories, no simple analytical method or physico-chemical equipment for such purpose had existed since sucrose is rather difficult to determine, especially in complex mixtures of sugar manufacture intermediates. We also should take into account
that in the 19th century possibilities of analytical methods were very limited comparing to the present state. For all these reasons, considerable attention was paid to polarimeters by chemists as well as manufacturers of polarimeters so that during decades of their use in the laboratories of sugar industry many modifications of these apparatuses were developed. Among polarimeters of well-known European manufacturers (Soleil, Duboscq, Haensch and Schmidt, Pfister and Streit, etc.) also the device of a Czech firm Frič Brothers achieved international recognition. A Bates-type polarimeter, improved by Fričs, was adopted as a standard device by the American Bureau of Standards in Washington. The paper will compare the utilisation and principles of different types of polarimeters employed in sugar industry of that time.
In 1926, based on two federal reports suggesting that existing stocks of oil in the US would be exhausted within six to ten years, Standard Oil of New Jersey, the largest oil company in the world, feared that its business was about to implode. In consequence SONJ was willing to countenance a commercial relationship with IG Farben the European chemical giant. Farben, created in December 1925 by a merger of Germany’s six leading coal tar dye firms, was interested in an alliance with the American company because it alone could provide the financial resources that Farben needed to develop new chemical processes that would give it market dominance for the next two decades. Chief among these new products was synthetic oil.

In 1925 Frank Howard, head of development at Standard Oil visited BASF’s laboratories in Germany. What he saw there astonished him. Farben's hydrogenation technology, developed to make synthetic nitrate during world War One, was also being use to make, acetylene, synthetic rubber and oil-from-coal. American research was infantile compared to the well equipped labs on the Rhine. Howard was quick to see that hydrogenation technology could provide an answer to the terrifying prospect of rapidly dwindling US oil reserves and he lost no time in getting Walter Teagle, President of Standard Oil, over to Germany to begin negotiations with Farben for access to their hydrogenation technology. Synthetic oil was only part of SONJ’s interest, more importantly Farben’s hydrogenation technology, which used iron catalysts and high pressure, could be used to improve oil refining, doubling the level of product recovered from a barrel of crude oil.

The result was a limited agreement in 1927 whereby SONJ would be able to use Farben's hydrogenation technology. However both sides saw this as inadequate and Farben proposed a more complete arrangement with SONJ buying the full international rights for a cash sum. SONJ was less happy but seeing that Farben needed the resources to continue to fund its own development of synthetic oil agreed. In 1929 a four party agreement was signed that gave Farben 2% of SONJ’s common stock, some to $35, 000, 000.
The German company had, in exchange for a protected home market, a large injection of cash at a vital time when the depression was causing its sales to tumble dramatically. At the same time, new oil reserves were discovered in the American Southwest, however SONJ still saw the purchase of Farben’s hydrogenation process as the most significant deal of its career, since it enabled SONJ to compete effectively with the new Houdray cracking processes. What had been a straightforward commercial relationship between two industrial giants was complicated by the rise of the Nazis and Hitler’s plans for war. In 1938 SONJ helped Farben obtain vital stocks of tetraethyl lead, necessary to make 100 Octane aviation spirit, for the Luftwaffe. Moreover, it became embroiled in the synthetic rubber controversy, something that proved highly embarrassing to SONJ. Furthermore, in the 1960s the method Farben had used to transfer the proceeds of the hydrogenation sale to Switzerland through its affiliate IG Chemie became the subject of a US tax investigation, which would eventually cost $24,000,000.
At the end of XVIIIth century, chemistry achieves a special status as an instrument useful for understanding the mysterious processes concerning life. Within a new academic institution in Barcelona: the Royal College of Surgery, chemical knowledge was applied to, and shaped the world of medicine with one specific purpose: improving the art of surgery, not least, putting into practice the healing art.

The new perspectives opened by modern chemistry as applied to medicine were showed, discussed and spread out thanks to a new academic network raised by specific rules established by the colleges of surgery themselves. These rules gave birth to the setting up of a special kind of periodical scientific sessions: the ones known as “Juntas Literarias”. These public sessions were mainly addressed to scholars as well to other audiences. Once a week, a professor of the college gave a lecture which, later, according to the rules of the college had to be censured by one peer in front of the “Junta”. The “Junta” was composed by the director and other colleagues all of them professors of the Royal College of Surgery. Most lectures and discussions were written down and had been preserved.

By analyzing information contained in these extremely rich set of sources, and taking the Royal College of Surgery of Barcelona as a case study, this communication aims to do a first approach to the ways through which chemistry contributed to the improving of biomedical knowledge regarding anatomy, physiology, pathology and therapeutics at the end of the XVIIth century.
In the present work it is intended to analyse and put in context an article on the exam of the air of Rio de Janeiro that was published in 1790 in *Jornal Encyclopedico*, a periodical whose main objective was the spreading of general knowledge, namely the principal scientific achievements. The author was the physician José Pinto de Azeredo (1763/6?-1810) whose experimental works made him an author of particular interest among historians of science in Portugal and Brazil. There are few references to his life and work, although he is the author of several other memoirs on medicine in Brazil, Angola and Portugal that should give him a more prominent place in the Luso-Brazilian-Angolan and Portuguese medical history. Azeredo was born in Rio de Janeiro and there he made secondary studies. For some unknown reasons, he went to study medicine in Edinburgh with his brother, in 1786/87 and 1787/88. In 1787, he wrote a dissertation about *An experimental enquiry concerning the chemical and medical properties of those substances called Lithiontriptics, and particularly their effects on the human calculus* (Wemyss, 1933). Andrew Duncan, president of the Harveian Society, made a 3-pages summary on it that was published in the *Medical Commentaries* of December 2, 1788 and ends saying: "Upon the whole, all his experiments, to a number of 106, are conducted with great judgement; and the inferences which he draws from them, are highly important, both in a chemical and medical view" (Duncan, 1788, 398). In the same year he presented a memoir about the effects of “fixed air” on the nervous system and got the medical degree in the cosmopolite university of Leiden (May) after having defended a thesis on Podagra. In the second half of 18th century five Portuguese and five Brazilian born students took their graduation there (Rieu, 1875). He returned to Lisbon and stayed there for one year after being recognised as a physician by the Crown. That gave him permission to work in Portugal and all other colonial dominions. In April
1789, the Queen nominated Azeredo as “fisico-Mor” (Chief of Medicine) in Luanda (Angola) and among his duties he should open there a “School of Medicine”. In June 1789, he arrived in Rio de Janeiro and stayed for one and a half year (he sailed to Angola in Sept. 1790). There he began his medical practice. He presented some experiments on air composition before the Literary Society of Rio de Janeiro. His experimental measurements led to the publication of the above-mentioned article in 1790. This publication begins with an introductory part where he explains its aim and historical context as well as the knowledge of the works of Black, Priestley and Lavoisier. In the following, he refers to his experiments on “pure air” and “fixed air”. In the last part, “mophete” is mentioned but without experiments. In each section, Azeredo refers several physical, chemical and biological properties and takes some conclusions.

References:

Between 1900 and 1940 Austrian chemists made leading contributions to microchemistry. This branch of chemistry is not clearly defined, but is mainly used for analytical methods. In this paper the name is used for methods adapted from classical chemistry for very small amounts of substances (about a few milligrams).

There are several advantages of the micro-approach compared to the macro-approach:

1. it can be done even when very small amounts of a substance are available.
2. the time for manipulating small amounts is much shorter compared with that necessary for larger amounts.
3. the micro-approach is cheaper concerning reagents and less detrimental to the environment.
4. the apparatus is usually cheaper compared to apparatus for macro-amounts.

Microchemistry began very early and was mainly used for the analysis of minerals. The systematic description of microchemical methods began around 1895 with the book by T.H. Behrens. It was extended by Friedrich Emich around 1900, who was the founder of quantitative inorganic microanalysis. He established a school of microchemistry in Graz. The most famous representative of this school was Fritz Pregl who received the Nobel Prize of Chemistry in 1923 for his quantitative elemental analysis of organic compounds.

Emich and Pregl were followed by a number of capable microchemists, among them Hans Lieb and Julius Donau in Graz, Hans Molisch, Robert Strebinger and Fritz Feigl in Vienna and Ludwig Kofler in Innsbruck. These are only the bestknown of a larger number of microchemists working in Austria between the two world wars.

Why became Austria leading in the field of microchemistry and not other countries which were famous for their chemists and large chemical industries? There may be the following reasons to explain this fact:

1. Austrian chemists had a long tradition of isolating and characterising natural substances from plants and other organisms, even when they were present only in minute amounts.
2. Austrian universities were more involved in very delicate experimental work (and less theory)

3. The lack of expensive physical apparatus in these years forced the researchers to concentrate on extending classical chemical methods.

The microchemical school of Austria continued after World War II, but continually lost its importance because physical methods of analysis exceeded by far the sensitivity of the microchemical methods. Today microchemical methods get back some importance in medical analysis, forensic methods and in the new field of combinatorial chemistry.
It is quite well known that the 1980 Spink's Report helped to launch the British biotech industry. However, what is not so well known, is that Alfred Spink's, a chemist and the author of the report, had spent all of his career at ICI, during which he saw the group become fully committed to pharmaceutical R&D, and then expand into biotechnology, one of the first companies in Britain to do so.

This paper charts this progress by looking at the changing material culture and organisation of ICI's Pharmaceutical Division, from one that was dominated by the research tools and practices of synthetic organic chemistry, to another, in which a greater balance between the physical and biological sciences was achieved, leading to the creation of hybrid departments - such as the Biological Chemistry or Physical Chemistry departments. It argues that these transformations placed ICI, and Spink's, who had witnessed them at first hand, in a privileged position when it came to advising the British government, which had become concerned about Britain lagging behind the USA in another high-tech industry, this time the emerging field of biotechnology.
This paper aims to analyse the transmission of scientific knowledge in the domain of Chemistry, performed at the College of Natural Philosophy of the University of Coimbra, under the rule of a liberal power. The Portuguese university, at that time, was based in Coimbra, and the College of Natural Philosophy lectured exact and natural science, within which chemistry was included. The political and social instability which characterised the liberal period that mediated the transition from a monarchical regime to a republican regime reflected itself in the education system in Portugal, particularly in the higher education, thus influencing an intellectual elite which began a set of reforms necessary for the progress of the country.

As a methodology, we will analyse the data respecting the teachers who have lectured the subjects of Chemistry, from the degree of Natural Philosophy, and the data relating to the choices they have made concerning the curriculum they have taught and the course-books they have adopted. This information will be counter-crossed with the objectives preconised by each of the reforms performed in the teaching of Chemistry in Portugal during the period we are studying. This way we intend to know whether the College of Natural Philosophy was, or not, an institution innovative and modern enough, able to replace the bookish study for an experimental teaching, more directed at its practical application in science, propitiating the development of Chemistry applied to industry, the same way it happened in the rest of Europe in the XIX century.
In the late 1940s and early 1950s, chemists, physicists, and electronic engineers developed Nuclear Magnetic Resonance Spectroscopy (NMR) from a high-precision physical method to a routine chemical technique. Important contributions to this development came from the research group of the physical chemist Herbert S. Gutowsky at the University of Illinois in Urbana-Champaign, USA. In Gutowsky's laboratory, students of chemistry and engineering worked together to unravel effects that became the basis for the uses of NMR in structural analysis. In doing so, they designed and constructed several NMR spectrometers on their own. The talk will present a detailed analysis of the design and construction process of their first spectrometer, and will focus on its teamwork character. It will be argued that Gutowsky and his group needed the understanding of electronic, physical, and chemical phenomena in order to obtain control of the spectrometer. This multi-faceted control was the decisive step in the recognition, characterization, and subsequent standardization of fundamental effects in the chemical applications of NMR.
In the first two decades of the nineteenth century, various Portuguese periodicals were published in Paris and London, and sent to both mainland Portugal and overseas. They were published by Portuguese émigrés, the majority of which fled the country either to escape political persecution, or simply to foster their scientific education. These periodicals had an encyclopaedic matrix and scope. They aimed at bringing science to a wide audience and contributing in this way to the transformation of a country, which their editors perceived as being remote and far from the centres of production of scientific and technical knowledge.

From 1808 to 1822, these periodicals drew the attention of Portuguese readers to the importance of being in touch with the most recent developments in science and technology. They published abridged versions of articles and texts taken from books, dictionaries and other European periodicals, which were translated into Portuguese. Among the sciences they disseminated, chemistry was considered of paramount importance, due to its applications, notably to agriculture and industry.

Between the late eighteenth century and the early nineteenth century, Portuguese editors and writers of periodicals followed closely the changes and major developments in chemistry and tried to bring them to the knowledge of a diverse, though restrict group of readers of scientific periodicals in Portugal. This paper focuses on the role of these disseminators of science and their views on chemistry, as well as on the participation of editors and readers in this process.
In 1830, Justus Liebig invented an improved apparatus for the easy and accurate determination of the carbon content of organic compounds. Liebig’s timing was superb, for the science of organic chemistry was just then beginning to explode both in volume and importance. A recently published historical/chemical investigation in which some of Liebig’s early analyses were repeated with a replicated apparatus has provided evidence that suggests that Liebig’s technique was indeed as simple and reliable as he claimed. But what may have been some of the wider effects of this innovation? It is well known that the half-century from 1830 to 1880 saw a great movement toward professionalization of European science. In this paper we explore the role that Liebig’s new laboratory practice may have played in that process.
After the Second World War, the practise of industrial research entered a boom period with very generous spending and an emphasis on science and long-term research. The 1950s and '60s were an unique period of spectacular growth, seemingly unlimited technological opportunities and some major technological breakthroughs. Histories of industrial research, however, have shown the isolated position of many research departments in the 1950s and '60s. Science and a long-term orientation combined to technology push research, which became a problem when growth started to slow down and technological opportunity seemed to decline. From the late 1960s onward companies tried to turn form technology- to market-driven R&D: companies emphasised that research should have a commercial payoff and directed their research to care more for business interests.

This paper will re-evaluate this turn from technology- to market-driven industrial research with the example of DSM, and specifically with caprolactam, an intermediate for nylon. As a medium-sized Dutch chemical company, DSM is of a category that has not received much attention from historians of R&D, who typically focus on large German and American companies. I will focus on an important process improvement, the so-called HPO-process, to show that research did not have an isolated but an independent position. This position enabled research to develop its own view of the interest of the company and start research projects regardless of the opinion of the production and marketing functions. The example of the HPO-process shows the problems attached to such a position, DSM’s production function showed no interest in the process at first and it was commercialised in Japan, but also the potency of this position as DSM later did build an HPO-plant and as the process strengthened the company’s market position.
This paper explores combustion research in the ‘Third Reich’: a field of science located in the borderland of chemistry, physics and engineering. It focuses on a transdisciplinary ‘twilight zone’, in which ‘peers of science’, acting as science managers or intermediaries, strove to yoke domains of ‘basic science’—analytical chemistry, chemical kinetics, fluid mechanics, instrumentation—into research projects dealing with technological problems as the ‘knock’. As pivotal scenery of the story, I consider the ‘Institute for Motor Science’ at the Center for Aviation Research near Braunschweig, which was built in the 1930s in the course of German rearmament policy.

For convenience, the figure of the director of this institute, a professor named Ernst Schmidt, serves as crossing point in outlining three spheres of description, which may constitute a narrative of German combustion research. From a micro-perspective, the account sheds light on the experimental setting and the generation of knowledge at Braunschweig. By taking up a meso-perspective, it is reasonable to call attention on research communities (‘Arbeitsgemein-schaften’), who were established to ensure the circulation of knowledge across institutional barriers and between different power blocs, and special emissaries (‘Bevollmächtigte’) like Schmidt, who were nominated to bundle research activities at different sites and to allocate resources with regards to technological ends. And the view from a macro-perspective suggests to ask, how events and actions on the micro- and meso-level correspond with short- and long-term transformations of involved disciplines and with general trends in science, technology and policy.

Such a multi-level approach is a starting point to unfold a landscape of combustion research as heterogeneous field of discourses and practices and to trace patterns of interaction against a background of sociocultural configurations. In addition, the paper echoes some suspense-creating factors or ‘oppositions’ arising from historiographic reflections of that kind: short-term
programmes versus ‘longue durée’, the ‘fluidity’ of careers versus the ‘inertia’ of institutional settings, a horizontal of ‘claims’ and demarcations versus a vertical of ‘collective expectations’ and decomposing/composing activities from engines to test tubes.
This is an account of two remarkable Portuguese men, father and son, who played an important part in the popularisation of chemistry in 19th century Britain. It reveals little known facts about the dissemination of chemistry in Victorian England and also offers an insight into scientific relations between Portugal and Britain.

The older man was Antonio Freire Marreco who in his youth had been involved in the struggle for Brazilian independence, and came to England in the 1820s as a wine importer. He soon helped to set up the world’s first association for chemistry: the London Chemical Society. Although short-lived this society published a journal, in which chemistry and politics are intertwined. Later he moved north and became associated with the Stephensons in development of railways in Durham. He married the daughter of a local entrepreneur but after some years moved with his family to his native Portugal, advising industry on railway and mining technology.

A son of this marriage, Algernon, received some early education in Portugal but on his father’s death returned to northeast Britain. Here he too became fascinated by chemistry, and eventually became the first professor of chemistry at what is now the University of Newcastle-upon-Tyne. However he chiefly to be remembered, not for the research he carried out, but for his part in another chemical institution. He was deeply involved in the foundation and subsequent fortunes of the Newcastle Chemical Society. His was another “first”, being the earliest example of a provincial chemical society anywhere. The significance of this society, very different from the London Chemical Society, will be explored in detail.
From early Latin alchemy to modern day “biomimetic” chemistry and nanotechnology, “learning from nature” has been a popular concept to place chemical research into a metaphysical context that provides both orientation for chemists and a convenient public image of chemistry. Underlying this concept is a teleological notion of nature that, in popular contexts, equips nature with all kinds of anthropomorphic capacities, including agency and intention. Since medieval times this anthropomorphism has unleashed a series of metaphors of quasi-personal relationships between Nature and Chemistry, such as “Chemistry learns from Nature”, “Chemistry rivals Nature”, “Chemistry surpasses Nature”, and “Chemistry masters Nature”.

Following-up earlier work (Schummer 2003), this paper analyses the uses of such metaphors in the popular historiography of chemistry with emphasis on Paul Walden’s history of organic chemistry from 1941. By arranging the metaphors in a historical order – from “learning from Nature” to “mastering Nature” – Walden created a notion of progress that provided metaphysical sense and orientation to the work of ordinary chemists. Not only could they embed their work in the universal relationship between Man and Nature; Walden’s notion of progress also provided metaphysical direction and goals for chemists and allowed them to locate their particular work in the universal history.

Such popular history, although embraced by many chemists for obvious reasons, has a prize, however. As with all ideas of progress, it smuggles in normative implications which one need not share. This paper will finish by arguing that the prize for metaphysical orientation has been public hostility towards chemistry.

References:

The roasting of pyrites started, in Barreiro (Portugal) chemical complex, with the first plants for the production of sulfuric acid (by the lead chambers process) that the chemical corporation CUF- Companhia União Fabril, S.A.R.L. established there, in the first years of the 20th century. The specificity of the mechanical multiple-earth furnaces (initially of the type Herreshoff - Stinville) allowed, as also happens in the rotary furnaces, to an quite satisfactory elimination of the arsenic contained in the Portuguese pyrites that, as common to all the pyrites of the “Iberian pyrite belt”, present it in an amount such that, if fixed in the cinders, would be unacceptable for the requisites set forth by the iron & steel industry for the purified leached cinders (“purple ore”). Cumulatively, in this period previous to the II World War, the sizing of the industrial units, the low requirements in relation to the quality of the acid, almost totally dedicated to the production of phosphate fertilizers, and some important modifications in the equipment of the lead-chamber (“box-chambers”), had not only helped to keep the technological status in the sulfuric acid production of that company as exclusively dependent of the mentioned process, but extended their useful life far beyond what would be expected under the rhythm of modernity.

However, since the end of the World War II, the domestic demand for an acid with low contents in arsenic and iron, moved the company to choose the technological alternative required to give a suitable response to this new growing market. It was in this context that appeared first (simultaneously in the company and the country) sulfuric acid plant by the contact process. However this first move was not enough to bring the production of the “contact acid” above the amount of the “chamber acid” still being produced in the CUF industrial premises at Barreiro. Only the production of nitrogen fertilizers, that CUF initiated in 1952, would bring a truly important application for this “new acid”. Successively, the bigger economic size of the new industrial plants has been reflected in the necessity
use of successively bigger furnaces, with greater problems for maintenance of the suitable thermal profile, guaranteeing the same effect of the removal of the arsenic and implying an increasing attention for the recovery of the roasting heat.

This paper analyzes how the technical staff of the company has faced, in an innovative mood, the technological limitations to the date: “flop” of the then modern foreign technologies for the roasting of arsenic-containing pyrites in turbulent beds with keeping the requirements of iron & steel industry for the leached cinders coming out, the successively increasing size of the units of contact acid production of CUF and of their roasting furnaces and the introduction of heat recovery equipment. Using to advantage the domestic know-how when the process intensification was recognized as the solution to increase the “contact acid” production required by the new nitrogenated fertilizers line, and keeping the quality of leached pyrite cinders with at sight its ironmaking application, these technicians have conceived original solutions in the field of the roasting of arsenic-containing pyrites, keeping in Barreiro, at least for plus one decade, the exclusiveness of the use of mechanical furnaces for the roasting of Portuguese pyrites. On the other hand, the acquired knowledge about the mechanism of arsenic removal during the roasting of pyrites allowed them to approach, successfully, the longed for introduction of turbulent bed furnaces – what would come to have place in 1972, with selection and use in a new bigger unit of the two-stage roasting BASF process.
Chemistry was always at the centre of the activities of the City of London Livery Company the Society of Apothecaries. It was a specific skill that distinguished apothecaries from other members of the Grocers’ Company, thus contributing to their claims for separation in 1617. Furthermore when a laboratory for manufacturing chemical medicines was constructed at Apothecaries’ Hall in 1672, this was the key event in delineating a role for chemistry in the apothecaries’ activities.

Despite its long history of chemical activity, the Society is most familiar for its role in medical licensing in the nineteenth century. This emphasis has led to the importance of chemistry for the institution being overlooked. Chemistry was essential to the operation of the pharmaceutical trade at Apothecaries’ Hall. This had developed out of the 1672 laboratory and at the beginning of the nineteenth century the Society was one of the largest drug manufacturers in Britain, holding valuable monopolies with the Navy and the East India Company. However in addition to chemistry’s practical importance in drug manufacturing, through the research and consulting activities of the Hall chemists the subject helped to shape the Society’s institutional profile.

Chemistry was also important for the Society’s status in medical licensing. In a complex world of medical occupations, it was the Society’s objective to make chemical training a criterion of the particular expertise of the apothecary. This was demonstrated when the Apothecaries’ Act of 1815 required candidates to take classes in chemistry and from 1835 in practical chemistry. The practice of chemistry also had a rhetorical function for the Society. When faced with criticisms that “a contemptible gang of retail druggists” had the power to license medical practitioners, the Society sought to raise its status as a learned institution by organising lecture courses on chemistry and materia medica, developing a library, arranging scientific conversaziones and using its manufacturing laboratories as a learning resource. In using
media compatible with the culture of public science that was prevalent at the time, the Society demonstrated the wide-ranging applications of chemistry to various audiences of its members, medical students and the larger London medical and scientific community. Chemistry was thus crucial to the Society’s institutional identity as it sought to raise its status as a learned organization and by understanding the subject’s place in the Society’s activities a new perspective on the organisation is obtained.

5 The Lancet, 1 Nov. 1828, p. 148.
Chemistry has been presented as an essentially experimental science within the community of chemical practitioners as well as to outsiders. What were the implications of theoretical (quantum) chemistry in reshaping this image, especially in what concerns the ways chemists introduced their science to non-expert audiences? In this talk, the contributions of C.A. Coulson are used as a probe to answer this question. Coulson played a key role in the emergence of theoretical (quantum) chemistry in the UK, in the development and popularization of the molecular-orbital approach, and in the internationalization of theoretical (quantum) chemistry. He allied research and teaching with activities as a textbook writer, popular science lecturer and lay preacher of the Methodist Church, whose sermons often dealt with science. Especially through the delivery of popular science lectures, Coulson pushed forward the view that theoretical chemistry was an integral component of chemistry. The analysis of his popular lectures enables one to look at the ways in which Coulson articulated his views about the role and status of theoretical (quantum) chemistry, and specifically the character of theory, in its relationship to chemical notions, experimental results, numerical data, and the role of visualization. I also characterize audiences and settings used to reach ever wider audiences and, finally, rhetorical strategies deployed to build an effective discourse.
The family firm founded in Prague by Wenzel Batka in 1759, traded mainly in chemicals and chemical glass. Stepwise, pharmaceutical products, chemical apparatuses, laboratory and pharmacy furnishings and agricultural products enriched the assortment of the merchandise, especially in the next generation when Wenzel’s sons Paul and Wenzel Jr. became the owners. After 1820, when Wenzel Batka’s grandson Johann Baptist Batka directed the company, it became renowned all over Europe; it supplied many important chemical laboratories, not only in the Czech Lands, but also other countries. Among the customers were, among others, J. J. Berzelius, J. von Liebig, J. E. Purkinje, most probably also F. Wöhler and D. I. Mendeelev, and even the Greek Queen. The Batkas had demonstrable contacts with J. B. Trommsdorff, J. A. Buchner, J.-L. Gay-Lussac, and many other prominent European chemists.

The owners of the firm were not ordinary merchants. Wenzel Batka Jr. and his son Johann Baptist Batka published a number of scholarly publications. J. B. Batka regularly visited the Congresses of the German Naturalists and Physicians, not only to advertise there his commodities, but also read papers. Some of the traded equipment had been improved by J. B. Batka’s own practical innovations; he also invented new recipes for making chemicals; this way he personally contributed to the progress of laboratory techniques and facilities. In 1835, J. B. Batka founded in the outskirts of Prague a well-equipped chemical laboratory where he and his collaborators prepared chemicals including various very pure elements that served in European laboratories as standards. In this lab he also trained young chemists some of whom became recognized scientists. J.B. Batka was also known for his activities in several scientific and professional societies and his political involvement in the revolutionary year 1848, when he stood up on the side of the Czech intellectuals demanding more autonomy for the Czech nation within the Habsburg monarchy. The Batka case may demonstrate that studies into the history of laboratory practices and instruments should also include dealers who used to supply laboratories with
glassware, apparatuses, chemicals and other necessary equipment, and whose role has often been neglected in historical studies. This paper attempts to show that deeper insight into the activities of some businesses may unearth their unexpectedly versatile and active role in the scientific enterprise and society in general.
Before the mid-18th century Sweden made its scientific contributions mainly due to its mining tradition and the variety of minerals. Swedish chemistry lost its leading position when Torbern Bergman (1735-1784) and Carl Wilhelm Scheele (1742-1786) died in the 1780s. However, Jacob Berzelius (1779-1848) was soon to take their place in the world of chemical science and continued the Swedish tradition. There was in fact an important link between these periods: Johan Gottlieb Gahn (1745-1818) – discoverer of manganese, inventor and chemist – a forgotten celebrity. The fundamental interests of Berzelius encompassed the whole of chemistry, although his professional life can be divided into different periods. The grand creative genius of Berzelius and the joy he had in his work are not only apparent in his experimental research, but are evident also in his activity as a teacher and in his writing. The style of his writing exhibits great freedom, force and beauty. Berzelius was very careful when planning and performing his experiments. He formed his opinions on the basis of his own experience. In analysis he tried to select or develop methods that depended as little as possible on the manipulative skill of the chemist. The laboratory was the central place in Berzelius’ life, a place where he passed a considerable portion of his time. It is therefore natural that its arrangement and furniture claimed much of his attention when he was setting it up. Historians have had a pronounced tendency to ignore the details of the practical work of the chemists, not least the small pieces of equipment. In the early 19th century no given rules existed for how a chemical laboratory should be constructed or equipped. If the time in the laboratory was to be as pleasant and profitable as possible, a number of technical problems had to be solved e.g. moisture, water supply, ventilation, light and heating. The work surface was usually a large central table. We have only small fragments of how Berzelius laboratory was furnished, although the remaining 3000 items including chemicals will provide us with a sense of how it could be at the time. The knowledge has recently increased since a chemical laboratory of the time has been found in the southern part of Sweden. This laboratory has not been in
use since 1866 and belonged to the count H.G. Trolle Wachtmeister – a very close friend of Berzelius. The enormous correspondence of more than 700 letters written from 1818 to 1848 has recently been published and gives us tremendous information on scientific matters as well as social, political and personal matters in an open-hearted atmosphere. After a few months in the Berzelius laboratory in Stockholm, Trolle-Wachtmeister moved to his home Årups, where he built a well-equipped chemical laboratory where he performed his mineralogical analysis under the guidance of Berzelius. Later on, analysis of agricultural products was to be on his schedule. In the laboratory journals found, together with the original equipment used in each of the described experiments, we are able to see how chemists of the time performed their chemical experiments, what equipment they used and all the problems that occurred during their work. Let us visit this remarkable laboratory!
The professionalisation of science in the nineteenth century is usually described as the emergence of a distinct social group with a particular professional profile and a corresponding university education, regulating entrance into that profession. But equally, professionalisation may also be seen to depend on the public recognition and appreciation of scientific competence. In addressing public audiences, scientists claim an area of expertise by promoting a public image of their discipline, emphasizing e.g. its utilitarian aspects, its philosophical implications or its relevance for wider social issues. These public strategies not only complement the process of academic professionalisation, but are in their own right to be regarded as dominant factors in shaping the intellectual and cultural authority of the discipline in compliance with local imperatives.

During the nineteenth century, chemistry was a rapidly expanding discipline in Belgian university life. Chemists found academic employment in science, engineering, pharmaceutical and agricultural departments. Yet, throughout the century, chemistry was (compared to mathematics or physics) not an important part of secondary education, distancing the chemical profession from what was generally regarded as basic science. Professional chemists often had to face fierce competition from other professional groups; industrialists were not very interested in the theoretical foundations of the art, while physicians reacted forcefully against the scientific claims of pharmacists. The promotion of chemical fertilizers by chemical companies was criticised by agriculturists favouring organic manure, and the hazards of the chemical industry (and chemical research) put the discipline in a rather unattractive position. A professional society, representing the discipline, was only founded at the end of the nineteenth century.¹

In the face of all this, Belgian chemists developed several strategies to claim scientific competence with the public. Some chemists engaged in philosophical debates on the nature of atoms and forces; others gave public lectures or
wrote more or less ‘popular’ textbooks. One chemist, Henri Bergé, attempted to found his own popular journal, Le Chimiste, which, however, lasted only a few years. These divergent strategies were probably not very successful. The lack of professional cohesion between Belgian chemists was illustrated by some bitter and widely publicised controversies.\(^2\)

This lecture will focus on the popularisation of chemistry in Belgium, evaluating the resulting public image of the discipline and the audiences reached.

References:


2 The lack of cohesion and the subsequent construction of a united academic profile has been studied by Geert Vanpamel and Brigitte Van Tiggelen “The profession of chemistry in nineteenth-century Belgium”, in Knight, David en Kragh, Helge (eds.) The making of the chemist: the social history of chemistry in Europe 1789-1914, Cambridge University Press: Cambridge, 1998, 191-206.
The Greco-roman world is acquiring purple from the waters of the Mediterranean, and in a lesser extent from the Atlantic depths. Huge loads of molluscs offer evidence of substantial manufacturing in early second millennium Crete. Later on, production will flourish in Cypriot Larnaca, and nowadays Lebanon and Israel; while in the seventh century innovative conservation techniques will permit the imperial Byzantine palace to establish a rigorous monopoly. Careful observers of a society familiar with the multiple meanings of this most glorified dye of all ages, Pliny the Elder and Vitruve are meticulously describing the way of collecting the yellowish precursor of the colouring principles. The actual dyes – dibromo indigo, dibromo indirubin, indigo and indirubin – are the result of a complicated reaction chain, based on their equilibrium with the leuco monomers. Rare, valuable and exquisite, purple was consciously imitated – or desperately adulterated – by extremely elaborate procedures, including a sequence of dark red and violet baths. Rather dull and fading, the outcomes are due to a large series of colorants, while minerals are documenting on an ingenious technical knowledge or are attempting to influence the hue, along with various flower extracts. By far more widespread are recipes proposing the use of kermes, madder or orcanet. Addition of indigo dyes or treatment with oak gall and mineral mordants is creating a violet shift. Primary purple substitute is however dyer’s bugloss, carefully combined or ingeniously complexed. Even as late as about the turn of the first millennium a.D., the relative success of the fraud is causing serious penalties. Indigenous in the Mediterranean area, woad provides Europe with a conventional organic blue, bearing its rare and precious Oriental counterpart in the extract of Indigofera tinctoria L., highly valued by antique and medieval open sea traders. In both cases the actual colouring principles are indigo and indirubin. Hellenistic and Roman technical manuals are meticulously describing the procedure yielding a highly standardized woad pulp. Mastering the laborious process since earliest times, European cultures are using this versatile violet blue for both dyeing and painting; while Pliny the Elder and Dioscurides are correlating
indigo paste – a mysterious powder of almost mineral origin – to several volatile by-products of purple.

Woad acts as an alternate to indigo, and both are well known for contributing in many recipes concerning purple imitations, instinctively relying on the chemical correlation of the colouring principles. Although inexpensive and widespread, woad is still at times replaced by metal oxides. By far more precious, indigo will be substituted by its Mediterranean relative, or even by unstable flower extracts and weight increasing material. Cautious empirical approaches – including sublimation – allow a series of proposals yielding unsteady, but nonetheless aesthetically acceptable results.

References:

E.A. Varella, Experimental Techniques And Laboratory Apparatus In Ancient Greece, Medicina Nei Secoli 8 (1996) 191
E.A. Varella, Natural Colouring Lakes In Europe, Thessaloniki 2001 [CD ROM]
The reactivity-selectivity principle (RSP) holds that “highly reactive species are unselective in their choice of reactants compared to stable and therefore unreactive species”, a hypothesis that “has long been part of the chemist’s intuition”. For almost a half century the RSP has been used to predict relative reaction rates, gain insight into reaction mechanisms, and provide guidance to the perplexed undergraduate. Yet it is founded on the premise that necessary connections could be established between the thermodynamic and kinetic parameters of a reaction, which classical thermodynamics denies. This talk explores the role of theoretical aspirations, empirical practices and anthropomorphic “intuitions” in establishing the RSP and in making it vulnerable to criticism.

By the 1930s a combination of thermodynamic and kinetic studies was found indispensable for understanding reaction mechanisms, which physical organic chemists were using to refashion organic chemistry “as a science rather than an art”. They began to examine the possibility that thermodynamic and kinetic characteristics of series of related reactions could actually be connected, using the many practical and theoretical studies of aromatic substitution. The Hammett equation, dating from the late 1930s, was the first so-called extrathermodynamic relationship between reaction thermodynamics and kinetics. In the 1950s J. E. Leffler and G. S. Hammond established a theoretical rationale for these relationships, while H. Brown arrived at an empirical measure of reactant selectivity. The stage was set for the institution of the RSP as a major generalization about chemical reactions. Although there had been caveats from the beginning about the RSP’s scope of applicability most initial investigations supported its validity. However, further extensions began uncovering an increasing number of exceptions. In 1977 one reviewer concluded that “in spite of many apparent failures the reactivity-selectivity principle is fundamentally valid”, while a later pair of reviewers asserted that “it is time [the RSP] was dropped
from textbooks as a tool for prediction or interpretation of reactions in solution in spite of its theoretical appeal”. 6 The argument has continued to the present; its persistence tells us much about both chemical practice and chemical culture, especially with regard to the discovery of general “principles”.

References:

5. Ref. 1, p. 126.
In history of science there exist names of scientists at the mention of which in our memory appear associations with the development of entire areas of knowledge. Prominent organic chemist academician A.E. Chichibabin is one of such scientists. His creative evolution is inseparably linked with the history of chemistry of heterocyclic compounds, pyridine, in particular. His way in science is an example of entwinement of theory and practice.

In the work, basing on new archive materials (Russian and French) there is shown contribution of scientist in the elaboration of a number of known technological processes and his important managerial role in the establishment and development of certain industrial productions in Russia.

Reaction of cyclocondensation of aldehyde with ammonia, discovered by Chichibabin (Chichibabin’s name reaction) in 1906 became the basis of contemporary industrial synthesis of alkylpyridines. It is also used for synthesis of raw feedstock for production of artificial rubber. Amination of pyridines, discovered by him (1914) led to creation of new ways of producing azodyes.

Being a professor of Moscow university, over 20 years heading chemical faculty of Moscow High Technical School (MVTU), Chichibabin made a lot for preparation of qualified personnel of chemists for chemical and defense industry, who made direct contribution in creation of potential of Soviet industry. In MVTU he founded military-chemical department with chairs of explosives, toxic gases etc.

In 1914-1918 being the chairman of chemical departments of Moscow Military-industrial Committee and Zemgor, the scientist participated in solving pressing problems of extending capacities of chemical productions, of improving their technology because of a necessity to change over to new sources of raw materials in war-time conditions (organization of production of sulfuric acid in village Rastiapino, Nizhegorodskii region etc.).

A.E. Chichibabin is also an organizer of Russian chemical-pharmaceutical industry. During World War I years he established Moscow Committee Assisting to the Development
of Chemical Pharmaceutical Industry. In MVTU together with scholars he organized medical supplies workshop and also, for the first time in Russia, chair of chemistry and chemical technology of pharmaceutical industry. Together with scholars (V.M.Rodionov, N.G.Patsukov etc.) Chichibabin developed industrial methods of preparing a number of alkaloids. In 1917 he organized construction and startup of first alkaloid plant in Russia. Due to the scientist’s research there were also created methods of producing salicylic acid and its salts, aspirin, phenacetin etc.

In Soviet Russia (1920-s) Chichibabin worked as a chairman of Board of State Chemical-Pharmaceutical Plants of VSNKh (Supreme Council of the National Economy), that controlled all chemical-pharmaceutical industry of the USSR.

A.E.Chichibabin continued his research in this direction in emigration, in 1930-s, cooperating with largest pharmaceutical companies of the world (e.g., "Établissements Kuhlmann", "Schering", "Roosevelt & C°").