THE TRANSMISSION AND ASSIMILATION OF SCIENTIFIC IDEAS TO THE GREEK SPEAKING WORLD ca. 1700-1900: THE CASE OF CHEMISTRY

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INTRODUCTION

While the social, ideological, conceptual, theological, economical and political repercussions of the new ideas developed during the Scientific Revolution have been systematically studied within the setting of the countries where that revolution originated, only few historical works have dealt with the repercussions and the actual transmission of these ideas to the countries in the periphery of Europe (that is, the countries of the Iberian Peninsula, the Balkans, the Eastern European and the Scandinavian countries). How did the ideas of the Scientific Revolution migrate to these countries? What were the particularities of their expression in each country? What were the specific, national forms of resistance to these new developments? What were the legitimising procedures for the acceptance of the new way of dealing with nature? Did the discourses developed by the scholars for writing and discussing scientific issues share the same features as the discourse used by their colleagues in the countries of Western Europe? A discussion of these questions is a necessary prerequisite for understanding not only the assimilation of the ideas of the Scientific Revolution, especially, during the Enlightenment, but also for assessing the character of the resistance to such assimilation. Studying the ways the sciences generally, and chemistry in particular, were transmitted to a region such as Greece during the eighteenth and nineteenth centuries calls for a contextual approach: it cannot be conducted independently of an overall historical assessment of what it means for ideas that originated in a particular cultural and historical setting to have been transmitted to a different cultural milieu with different intellectual traditions and different political and educational institutions.

There are many factors that have to be taken into consideration in studying the process of transmission of the scientific ideas from the centre to the periphery. The intellectual and institutional framework for the reception of these new ideas was, to a large extent, conditioned by the cultural and religious traditions of the countries in the periphery together with the role and structure of their educational institutions. The parallel processes of the spreading of the new scientific ideas and the economic and political restructuring of the regions in the periphery facilitated the birth of new ideologies and political ideas that incorporated the new ideas about

nature. Furthermore, there were the differences resulting from the overall social function of the scientists in the centre and the periphery. In the centre, the main role of the scientists was to produce scientific knowledge whereas their role in the periphery -- perhaps with the exception of the Scandinavian countries-- was entirely different. It was to disseminate this knowledge through the educational structures. Thus the predominantly productive role of the scientists in the centre has to be contrasted with the predominantly educational role of the scientists in the periphery. Especially for the Greek-speaking communities in the Balkans, the study of the introduction of the sciences will have to take into consideration additional questions. These are the ambivalence of the church concerning the possibility of shifting philosophical allegiances of the scholars who were invariably churchmen; the almost total lack of confrontation of the scholars with the church; the relations of the church with the Ottoman administration; the relations of the church with Rome and the Protestant world; the often conflicting interests of the prominent and rich Greek lay figures at Constantinople with those at other places in the Balkans.

Compared to the other physical sciences, chemical writings, discussions about chemical issues and the social role of chemistry were both minimal and insignificant during the late eighteenth and nineteenth centuries in Greece. However, the study of what little there is becomes important when combined with the introduction of the new approach to nature and the new scientific ideas. It will also help to assess the educational as well as ideological agendas of those scholars who took the initiative to introduce the new ideas, first into a nation under occupation and then, after 1821, into independent Greece.

In this paper I would like to argue the following points.

1. Most analyses of the Scientific Revolution and the establishment of the new sciences in the various countries in Europe take into consideration a host of questions related to the formation of state institutions. Issues, for example, concerning patronage, the establishment of academies and the usefulness of the new sciences for economic production are couched within the context of the formation of state institutions. The situation was different in Greece and the Balkans which were under Ottoman domination. Here, many more complicated issues enter the picture, especially since the Ottoman administration had granted to the church the responsibility for the education of the Christian population. The content, however, of what was taught was not solely determined the church. It was, rather, the confluence of largely similar but at times conflicting aims of the religious hierarchy, of the social groups with significant economic activity and of the various scholars. And in order to comprehend what appeared to be a unified educational policy of the church, it becomes necessary to articulate the relatively autonomous agendas of each of these religious and social groups.

2. In introducing the new sciences, the Greek scholars did not attempt to introduce natural philosophy per se, but, rather, they sought a new way of philosophising. This discourse lacked the constitutive features of the discourse of natural philosophy as it was being articulated and legitimised in Western Europe and it was primarily a philosophical discourse. Though they may have been writing about the recent scientific developments, the Greek scholars of the Enlightenment thought of themselves first and foremost as philosophers. They did acknowledge the uniqueness of the developments in Western Europe concerning the new sciences. But at the same time, they did not perceive these developments as a break with the approach of the ancient

Greek philosophers. The new sciences were, on the whole, interpreted as an expected corroboration of the programmatic declarations of ancient Greek philosophers. In introducing the new scientific ideas, they were reluctant in adopting the discourse used by the natural philosophers in the academic centres of Western Europe. It is only within such an interpretative framework that one can comprehend the absence of any discussion concerning the character of the rules of the new game, the processes of legitimation of the new viewpoint and the initiation of consesual activities to consolidate the new attitude about the ways of dealing with natural phenomena. Their writings reflected three traditions, at times in conflict with each other, at times complementing each other. These were the scholastic-Aristotelian tradition, the neo-Aristotelian tradition and the tradition of European Enlightenment. The introduction and teaching of the sciences necessarily reflected a synthesis of traditions and which was subservient to the overall ideological and political contingencies of the scholars. Finally, such an interpretative framework helps us to understand why almost every one of the scholars who had played a significant role in the introduction of the new scientific ideas in Greece, wrote a book in philosophy or logic before publishing a scientific book. Chemical writings give us an additional probe into the understanding of the characteristics of this idiosyncratic discourse that Greek scholars attempted to develop for the introduction of the new scientific ideas.

3. Chemistry was part of physics books until the early years of the nineteenth century where the first translations of standard chemical books in Western Europe were published in Greek. During the nineteenth century, chemistry was taught as part of science curriculum in schools and in the University of Athens almost exclusively for the education of medical doctors and pharmacists. It was only towards the end of the century that chemistry was connected with social progress and various Ministries, Municipalities and industries sought the help of chemists at the University.

But first, I shall give some background information about social and political developments as well as of some trends among the scholars.

FROM THE FALL OF CONSTANTINOPLE TO THE EUROPEAN ENLIGHTENMENT

The long period of active involvement of the scholars of Byzantium with philosophy, mathematics, astronomy and alchemy came to a halt with the fall of Constantinople in 1453. Nearly all worthy representatives of humanism had already abandoned the region and migrated mainly to Italy. There they adopted a rather sympathetic stand towards Catholicism and found, in general, their new environments agreeable.

For reasons related to the complex relations of the Ottoman Sultan with the countries of Western Europe and the animosity between the orthodox church and Rome, the orthodox ecumenical Patriarchate was allowed to continue functioning in Constantinople. The complex strategies for survival adopted by the Patriarchate in Constantinople after the Fall of the city in 1453, especially during the early stages, meant the establishment of a symbiotic relationship with the conqueror and the decisive confrontation with the Catholic attempts to "unite" the churches. The Patriarchate eventually acquired the right to have full jurisdiction over the education of the orthodox Christian populations of the Ottoman Empire and this progressively meant the establishment of educational institutions to articulate and consolidate the ideological and political dominance of the church by the intertwining of orthodoxy and Hellenism.

A turning point in the intellectual and religious affairs of the Greek orthodox populations was the period starting with the ascension to the office of the patriarch of Kyrillos Loukaris in 1620 and the establishment of the Patriarchal Academy. Loukaris put forth a rather involved strategy for the survival of the orthodox church, which to him and many others had become almost synonymous with the survival of Hellenism. He felt that there were unmistakable signs of an impending alliance between catholic France and the Ottomans which he considered a serious threat against the orthodox church. On this background, he wrote a leaflet arguing for the common theological grounds between Calvinism and Orthodoxy. Being convinced that the Catholic propaganda was effective because of its educational institutions, he founded the Patriarchal Academy and established what came to be known as religious humanism. This was an attempt to synthesise the teaching of the ancients with the teachings of the orthodox church fathers, viewing Greek antiquity and the Christian world as a unified whole. In the prevailing conditions of intense national reorientations and regroupings, he argued that the issues related to the national identity and the national consciousness of the orthodox populations would have to be dealt within the context of orthodoxy. His initiative to establish the Patriarchal Academy, upgraded the political role of the Patriarchate by formalising the historical ties between Orthodoxy and Hellenism. The directorship of the Academy was given in 1624 to Theophilus Korydaleas who had studied in Italy and spent some years at the University of Padua as a student of Cesare Cremonini and became one of the most competent of the neo-Aristotelians. The way Korydaleas ran the Academy left clear and lasting traces in Greek intellectual life, especially in the ways philosophy and the natural sciences were taught. Korydaleas' humanistic brand of philosophy contained the sperms of a rupture with a strictly theological approach to nature and to human affairs. But at the same time, there was a conscious policy to contain and develop this new approach exclusively within the framework of neo-Aristotelianism, during a period when such a framework was being undermined elsewhere in Europe.

The eighteenth century saw strong signs of an ideological reference to a national identity. The search for national and, of course, intellectual identity would prove decisive for the way the Greek scholars would collectively decide to promote the new scientific ideas. The introduction of the sciences served both to "enlighten" the youth as well as to help create a national consciousness through the establishment of an intriguing continuity : from the ancients through Byzantium to the present, and then to a future when glory would be re-established in Greece! The sciences in the schools were introduced as part of a modern curriculum which was also an excuse to (re)-introduce ancient Greek thought as being the precursor of all the glorious developments in Europe. From very early the teaching of the sciences was subservient to an overall political agenda which was articulated by the church and concerned the future of a nation under occupation. The purpose of establishing new schools and new curricula was to keep alive and modernise a national culture whose constitutive domains were the ancients and orthodoxy.

During the eighteenth century the Greek-speaking world enjoyed a period of educational and economic rejuvenation. The beginning of this period was characterised by the completion of the Ottoman expansion. From the end of the seventeenth century, many Greeks living in Constantinople --the Fanariots-- acquired an increasingly important role in the administration of the Ottoman state. At the outset of the eighteenth century their role was upgraded and many Fanariots became chief administrators of the Istria Peninsula hegemonies. The Fanariots would

soon take the lead among all the other Greeks dispersed in the Balkans, while at the same time as despots and as diplomats they would display what is commonly referred to as the policy of enlightened despots .
This was also the period when Greek scholars started moving all over Europe. Italy ceased to be the exclusive place for their studies and they now started travelling to the Germanic countries, to Holland, and, especially, to Paris, which gradually became their intellectual centre. In this way they became influenced by a multitude of traditions and schools. And after the middle of the eighteenth century, there appeared a strong tendency among the scholars to return home after having completed their studies abroad. There were, basically, two reasons favouring the return of the scholars. The first was the growing need for teachers as a result of the progressively better economic conditions of the Greek diaspora which entailed the need for further education and, hence, for the establishment of new schools. The second reason had to do with the gradual marginalization of the Greek scholars in Europe. Almost all of the scholars who went to Europe were churchmen having the blessings of the Patriarchate. They were among the best who had mastered the amalgamation of ancient thought together with the teachings of the church. In their travels to Europe, however, they found a different Europe than what they were led to expect from the narratives and experiences of scholars of the preceding generation. During the early part of the eighteenth century they found a Europe dominated by the ideas of the Scientific Revolution, with flourishing scientific communities concentrating on the production of original scientific work. The institutions where the Greek scholars could indulge in the all-embracing studies of philosophy and continue the kind of education they had already acquired, became progressively fewer and fewer. The problem was that to become part of the community of the natural philosophers, the Greek scholars had to abandon religious humanism. Being ideologically unwilling and intellectually unable to proceed to such a break, they immersed themselves in the study of the new sciences with a view to return home and assimilate them in the curriculum of religious humanism. A characteristic example of the application of this conception was the increasing desire to teach the new sciences in a manner that harmonised with the conceptions of the ancients. No wonder that almost all the books on the new theories written by Greek scholars in the eighteenth century reflected, and very often explicitly expressed, their "debt" to the ancient Greeks: for the modern Greek scholars it was their ancient predecessors who had invented everything and developed everything to perfection. This conception of an uninterrupted continuity and the perfection of ancient knowledge --a conception that was essentially adopted and promoted by the church--constituted one of the basic characteristics of the "neo-Hellenic scientific knowledge" in the natural sciences. Hence, the resistance to the new ideas cannot be discussed independently of the character of the break with the ancient Greek thought. Ideological and political contingencies of Christian societies under Ottoman rule during the Enlightenment, together with the dominance of Greek scholars in the Balkans, obliged an emphasis not on the break with the ancient modes of thought, but rather, on establishing the continuity with ancient Greece.

One of the difficulties in trying to analyse the newly emerging community of scholars in the Greek-speaking regions has to do with the relative lack of consensus among the scholars as to the constitutive discourse of the community. The study of the emergence of the scientific community in the various countries of Western Europe deals with the ways a group of people managed to reach a consensus as to the discourse they were to use in discussing, disputing agreeing and communicating their results in the new field. In the Greek speaking world from the first decades

of the eighteenth century until well into the nineteenth century, the discourse that the scholars developed was substantially different from that of their colleagues in Western Europe. The (expected) social role of the scholars and their ideological prerogatives legitimated a discourse which was predominantly philosophical. Furthermore, there appear to be additional reasons for the becoming of such a discourse. Firstly, there were neither internal nor external factors to precipitate a crisis with Aristotelianism and, therefore, no need to reformulate let alone initiate a break with Aristotelianism as a result of such a crisis. Secondly, the dominant mode the scholars wished to establish was a kind of logic with had strong ethical implications related to the rules of correct arg[JM1]umentation. Thirdly, although these scholars appeared quite sympathetic to experiments, what they considered to be experiments was hardly different from demonstrations. It is quite remarkable that in all the books where there is mention of experiments the emphasis is on observation and (qualitative) results, rather than on the process of measurement and dealing with numbers. In more than one place one finds passages to the effect that "rational thought is not less effective than experimental results".

CHEMICAL WRITINGS

Chemical considerations appeared for the first time in a book written by Nikephoros Theotokis titled Stoichia Fysikis (Elements of Physics). The book, published in Leipzig in 1766-1767, was the first book in Greek presenting Newtonian physics in a coherent manner and it also mentioned that water and mercury are the only basic elements since experiments cannot reduce them to anything else. Interestingly, it was noted that the procedures for chemical experimentation are different than those for experiments in physics. In writing his book, Theotokis was deeply influenced by the writings of Peter van Musschenbroek and Abbe Nollet.
After Theotokis' book, chemistry was discussed in two books whose aims and agendas were much more general than to instruct Greeks in the new sciences. In 1780 Iossipos Moissiodax published his Apologia pros tina Ieromenon (Apology to a Clergyman) and in 1790 Rigas Feraios published his Physikis Apanthisma (Anthology of Physics). Both works were published in Vienna by the two persons who were among the very few faithful representatives of European Enlightenment in the Greek-speaking world. Moissiodax was the most radical defender of the new ideas about nature and in his writings he continually stressed the difference between science and metaphysics that, as he also mentioned, was so successfully delineated by Newton. He discussed the relation of chemistry to metallurgy and, especially, to medicine and gave information about the different salts. Rigas Feraios was among the first revolutionaries in the war of independence and was imprisoned and executed in the very early stages of the uprising. He seems not to have been particularly well informed about the latest developments, but his aim was to present bits and pieces of natural philosophy and natural history as an attempt to educate and convince the Greeks that natural phenomena are explainable and that there is no reason to believe and be frightened of presumed mystical forces behind the natural phenomena. He preferred the alchemical terminology with the metals being related to the planets, considered that the number of metals was exactly six and mentioned that a metal becomes a calx after heating.
Chemistry was also part of other books whose main purpose was to present the new developments in physics. Almost invariably, in all these books there was reference to the usefulness of chemistry and, more specifically, to its special role for medical doctors and pharmacists. From the very beginning it was considered as an experimental science --much unlike physics which for a long time was considered as an alternative to philosophy -- and a

science that had links with other sciences. There was also another reason for the introduction of chemical thought. The ambivalence of the Greek scholars towards the new discourse of natural philosophy, or rather, their continuous attempts to modernise Aristotelian philosophy, found fertile ground in the problematique of a discipline whose core were issues concerning change, mutability and immutability and the finding of "building blocks".
A change in this climate was marked by the translation into Greek of Benjamin Martin's Grammar of the Philosophical Sciences, translated by Anthimos Gazis and published in Vienna in 1799. Gazis was one of the more influential figures of the Greek Enlightenment and had written extensively about physics. The book was written in the form of a dialogue between a teacher and his student. Gazis inserted a number of additional data which totalled about 50 pages to make up for the shortcomings of the book. He insisted that almost all of the new material made up what had been possible to discover "with the chymical laboratory". Among the additions of Gazis were the following:
* A discussion of the mechanism through which simple bodies stick together based on a Newtonian model.
*It was mentioned, for the first time in a Greek work, that water consists of oxygen and hydrogen "as proven by Lavoisier" and that the atmospheric air is also made up of mainly two gases, oxygen and nitrogen.
*In his description of combustion, Gazis noted that the remaining calx "cannot be explained by Stahl's chymical theory". *The translator emphasised the significance of a standard nomenclature for chemistry.
*For those interested to learn more, a bibliography was given of works which had not been translated (mainly French). These were Lavoisier's Traite Elementaire de Chymie; Fourcroy's Elements d'Histoire Naturelle et de Chymie; and Brisson's Traite Elementaire au Principes de Physique sones sur le Connaissances le plus certains tant Anciennes que Modernes et Confirmes par l'Experience.

The first "proper" books in chemistry were two translations, namely Fourcroy's Philosophie Chimique (Paris 1792) translated by Th. Iliadis in 1802 and Pierre August Adet's Lecons Elementaires de Chimie a l'Usage de Lycees (Paris 1804) translated by K.Koumas in 1808. Adet's book had been approved by the French Government as a book to be used for schools and this gave it additional prestige as a textbook also for Greek schools. Koumas included a long introduction and many notes, omitting though the original dedication of the book to Prince Joseph Bonaparte! In the introduction, Koumas praised Lavoisier for his ability to combine so "masterfully the method of experiment with that of rational thought". For those Greeks who "have not seen a chemical laboratory or an experiment" he added a chapter titled A short report on a chemical laboratory. By 1821, the start of the Greek Revolution, there were other translations of standard chemical works (e.g. of L.I.Thenard and I.M.Branthome) and many books of physics continued to include chapters discussing the developments in chemistry.
Even though chemistry was considered as part of physics, it was slowly realised that chemistry is an autonomous science dealing with the study of the mutual interaction of bodies as well as their composition and decomposition. In Koumas' Synopsis Physikis and Konstantine Vardalahos' Peiramatiki Fysiki (Experimental Physics), both published in Vienna in 1812, there were extensive discussions of what constitutes the elements of the more complex substances, and the notion of chemical affinity was introduced for the first time. In the latter book it was stated that modern chemistry provided proof that the caloric substance does not exist.

The published material on chemistry was primarily for use in schools and for the benefit of those who wanted to enrich their knowledge of the developments in the sciences. The introduction of chemistry did not lead to any ideological disputes which was so often the case with physics and, of course, astronomy. Chemistry was presented to the Greek audience in a manner following more faithfully the recent developments than was the case with Physics and, on the whole, it appears that the people who commented on the translations had a better command of chemistry than was the case with the analogous situation in physics. Furthermore, many articles and much information about books published in Europe appeared in the pages of the Journal Hermes the Scholar which was founded in 1811 and was in circulation until 1821. In this Journal one reads a debate about the nature of the caloric and in many articles the usefulness of chemistry to pharmacy and agriculture was mentioned without further details.
Despite the fact that the teaching of the sciences was generally welcome, not everyone was happy with the introduction of the sciences. I.Oikonomou criticised his friend K.Vlissaris for "having sold the Collected Works of Xenofon to buy a chemical book". Yet, at the same time, in 1816 V.Lesvios, demanded that he be given "modern books in Physics and chemistry, published after 1805 or 1806" in order to accept a teaching post in Athens.

THE SCIENCES AFTER INDEPENDENCE

The Greek independent state was founded after the Revolution of 1821. Its first king, Otto, was a Bavarian. Otto, and especially his doctors and pharmacists, were instrumental in the founding of the University of Athens in 1837 originally equipped with Schools of Medicine, Philosophy, Law and Theology. Most of the first professors were German and the courses in mathematics and the physical sciences were part of the curriculum of the School of Philosophy. Chemistry was, almost exclusively, taught as part of the curriculum of the Medical School.
Disagreements and misgivings of the Fanariots and other Greeks residing outside the mainland concerning the course of the revolution, were couched within a context characterised by a political agenda for the liberation of the Greek nation, by the insistence of the indigenous population to liberate their lands and by the resurgent nationalist movements in the Balkans. The first liberated parts of the country were the Peloponese and the northern parts of Athens. The country was poor and the dominant economic activity was farming for the sustenance of the farming families themselves. Although there were many and quite famous schools of the Greek diaspora, the exact opposite was the case in the regions which were the first to become independent. The politically unstable situation did not favour the development of a local industrial bourgeoisie and until the first decades of the twentieth century agricultural and, generally, economic production could be sustained without the participation of scientifically trained personnel. The relatively large-scale industries were owned by foreign firms and the various needs were met by scientists and technicians the firms brought from their respective countries.
In the educational sector the main emphasis was the establishment of primary and, in certain cases, secondary schools. The University of Athens catered for the training of doctors, lawyers and pharmacists. The School of Arts and Techniques --also founded in 1837 and which eventually became the National Technical University-- trained technicians mainly in civil, mechanical and electrical engineering. The major activity in chemistry took place at the University, at the Laboratory for Pharmaceutical Chemistry formally founded in 1869 and which was part of the Medical School. The first person to have taught Pharmaceutical Chemistry was

the professor of experimental chemistry Xavier Landerer who was also the royal pharmacist. He was appointed in 1837, left the University in 1843, was reappointed professor of pharmacology in 1844 and retired in 1869. Initially he taught at the royal pharmacy where he performed some chemical demonstrations and, then, the teaching was done at the University with demonstrations during the lectures.

The lack of teaching means for chemistry, the backwardness of the students concerning their understanding of the physical sciences, the difficulties with students taking notes in class and the low level of the existing books led Landerer to the decision to write Chemistry in 1840-1842. He started writing the book by consulting journals and the works of Vogel from the University of Munich and Berzelius, whom he considered as the hero of chemistry. He had difficulty in finding or devising the correct Greek terms for chemistry. In 1847 Landerer also wrote a booklet titled The Handbook of Pharmaceutical Chemistry.

Georgios Zavitsanos was appointed professor of pharmaceutical chemistry in 1869 and he insisted that students of pharmacy should perform practical exercises. In the new large building completed in 1870, the students were trained in qualitative analysis. The students in their first year could prepare inorganic chemical medicines, in their second organic chemical medicines and in their third they prepared, what was termed, galenic medicines and tested various pharmaceutical products.

In 1892 Anastasios Damvergis, a student of Bunsen and Hofmann, was appointed professor of pharmaceutical chemistry. Since 1882 he was professor of chemistry at the military schools. The main scientific activities of his Chair and the Pharmaceutical Laboratory were along three directions. The first direction was to "develop science through research" by the analysis of the quality of drinking water, of the springs at the various health spas in Greece, by the analysis of tobacco and by the analysis of honey and wax. The second activity was to ensure the practical education of students. Thirdly, the Laboratory had to be in a position to respond to the various questions asked by the State and industry. Damvergis in 1899 published a handbook where one could find prescriptions on how to prepare over 3000 medicines. Furthermore, the Laboratory provided yearly reports about the water reserves of Athens after directives by the Ministry of the Interior to the University to provide such information. Damvergis had also responded to many tasks required by the Ministry of Economics, the Ministry of Health as well as from many industries. Some of the tasks undertaken by the Laboratory were the following: To establish and test standards of food, drinks (especially alcohol content) and clothing; description of colouring agents; description of explosives; sanitising the ships of the royal navy; health problems related to the washing of the streets of Athens with sea-water; comparative examination of petroleum products; corrosion of the marbles of Acropolis; analysis of coins to combat counterfeiting; testing the quality of natural gas; establishing norms for the quality of ceramics. Quite a few of these reports were published in German journals and the thorough analyses of Greek tobacco were reported to the international meeting of applied chemistry in Brussels in 1894. Until the early 1930s, there were no other laboratories connected to the State institutions and whatever technical need and advice was sought from the University. Thus, the University of Athens since its founding was also the "technical advisor" to the State and to many industries. There were no chemists and, generally, scientists of the physical sciences to be found employed in administration or industry and those who had acquired some knowledge of chemistry were either the pharmacists or the medical doctors.

The appointment of Anastasios Hristomanos to the chair of experimental chemistry in 1866 upgraded the work at the Pharmaceutical Laboratory. In 1871 Hristomanos had written the Book

of chemistry according to the most recent developments in science. This was a book for university students and it was the first book where many chemical phenomena were treated mathematically. It was a standard text-book with an interesting passage at the preface where he attempted to taxonomize the sciences. He divided the physical sciences into those which describe the characteristics of "creations" (astronomy, geography, geology, natural history, anatomy, physiology) and those which describe and explain the observable phenomena (physics, chemistry). And he made a comment (without any further explanations) that this taxonomy was "dictated" by historical and philosophical considerations. In 1878 Hristomanos translated H.E.Roscoe's Chemistry. It was the first such book written for high schools. In the preface the translator noted the significance of a series written by Roscoe, Balfour Stewart (Physics), Norman Lockyer (Astronomy), and Foster (physiology), for training youngsters in the physical sciences. He insisted that the emphasis of the teachers should not be on the volume of information, but rather on whether students are able to understand the principles involved in chemistry which should be realised through experiments as well. And he concluded the preface by commenting that the existing science books for high school students "will steer away anyone wishing to learn the principles of the physical sciences."

One of the most interesting documents we have from this period is the address of Anastasios Hristomanos, on the day of his investiture as Rector of the University of Athens in 1896. His address was titled The Physical Sciences and Progress. The Greeks, he stated, were too preoccupied with the problems of liberation which required all their attention. But Greece had now been liberated and modern Greeks, as the only lawful heirs of the ancients, should have two aims: to preserve the ancient heritage and to compete with other Nations which "today are in the forefront of civilisation". Although the Greeks had made many steps in the building of the new country, there was still a long way to go if they wanted to reach the aims articulated by their predecessors. And this, Hristomanos continued, cannot be achieved if the main preoccupation of the population continued to be farming, fishing, housework and trade. There were now new conditions and the Greeks were obliged to use new methods. The knowledge inherited from the ancients was no longer sufficient for progress because of the changed conditions. "It is not the case that we reject the ancients, since they gave us the theory that contemporary scientists corroborate". Progress, according to Hristomanos, was the dominance of nature through science, the application of the scientific novelties upon the arts and life, and the application of all these by the nation in the largest possible scale, "which in our days is represented by industry. This is the notion of progress." In this address Hristomanos presented the various developments in physics, chemistry, biology and technology during the nineteenth century, stressing that the verification of the atomic theory was one of the great triumphs of the sciences during this period. Interestingly, Darwin is not mentioned anywhere. And the development of the molecular view of matter (in addition to the atomic) was considered as an appreciation of Aristotle's views twenty-three centuries later. He concluded with a plea for more practical high schools and for increasing the number of students to major in physics so that they can teach sciences. In no other document is the rhetoric of progress and development through science, as pronounced as in this address. Delivered at the end of the nineteenth century, it is a document vocalising the concern of certain intellectuals for the future. Though it was ideologically expedient to keep on hammering on the glory of the past, it was equally significant and perhaps politically necessary to emphasise that Greece need modernisation, and that the latter cannot be achieved unless Greek society adopted and implemented the extensive use of science in its attempt to modernise itself.

SUMMARY

The introduction of the new scientific ideas in the Greek speaking world was a process almost exclusively related to their appropriation for educational purposes[1]. The apparent aim was to modernise the school curricula, but this did not mean a neutral attitude as to the possible ideological uses of these new ideas --especially the need to make contact with the heritage of ancient Greece. The problem under consideration here was the introduction of the new scientific ideas to a national community which was under occupation and which did not have their own national state institutions. This is a very unusual situation where the lack of national state institutions did not provide any of the conditions where the effectiveness of the educational system and of the training of students in these sciences could be socially gauged. Lacking such a corroborative framework where the utilitarian character of these sciences would be under continuous vigilance, ideological and, in fact, philosophical considerations became the dominant preoccupation of the scholars. Hence, the embedding of all these new ideas within a philosophical context which was so strongly at variance with that of the European scholars became an aim in itself since it was the only way these new ideas could be legitimised. It should be stressed, that the development of the sciences in the Greek speaking world in the 18th century accentuates the significance of state institutions in comprehending the role of the sciences. Chemical notions and procedures were first introduced as part of books dealing with physics and it was only at the beginning of the nineteenth century that books whose content was exclusively chemical were published. The first such books were translations and only after the founding of the University of Athens in 1837 there was a number of books published for the use of the students of the Medical School. Most of the books were either translations of foreign books or anthologies of translations of chapters from various foreign books. Any laboratory work associated with chemistry was performed in the course of the training of pharmacists and medical doctors, especially since the University did not confer a degree in chemistry until 1911. The economic activity mainly in agriculture and the small scale enterprises in the cities combined with protracted political instability throughout the nineteenth century did not create conditions which necessitated the production of scientific personnel and engineering technicians to be employed in the state bureaucracy, in agriculture or in industry. The initiatives for establishing those institutions which have been traditionally associated with attempts to modernise a society were not taken before the end of the 1920s and the University of Athens catered to what little was required by the state institutions and industry. As a result we find no activity of chemists in industry nor many books in applied, agricultural or industrial chemistry[2]. There were both politicians as well as intellectuals who articulated and propagandised an agenda of modernisation through the dynamic use of science and technology, but these were isolated and, sadly, ineffective voices. In Hristomanos we see for the first time an attempt to propose an agenda where progress rather than the heritage of the ancients became the ideology of a much respected academic and intellectual. Although he thought that such a heritage was highly important for ideological reasons, he strongly stated as his belief that the future of the nation would depend on its ability to compete with the other nations that had progressed because of their adoption of the recent scientific developments. Though it was a message which was not immediately and enthusiastically accepted by the dominant political forces, it was also the case that it was a message that no one could totally ignore.

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were very helpful.

ENDNOTES

1 Lest there be any misunderstanding -- especially during these difficult times in the Balkans -- let me emphasise that I do not imply that the history of ideas in the Balkans during any period of the Ottoman rule was exclusively the history of ideas associated with the Greeks. Because of the way the Ottoman Empire was administered and as a result of the significant Greek minority in Constantinople, Greeks were given the administration of large hegemonies (as for example of Vlahia and Moldavia). Rumanian, Bulgarian and, to a lesser degree, Serbian scholars, churchmen and merchants, on the whole, were fluent in greek. The extended merchant class with connections throughout Europe had, with the consensus of the church, founded academies in Iasio and Bucharest as well as Sofia. There were also many Greeks in Dubrovnik and, of course, there were all kinds of schools in Constantinople. This is what I mean by the greater area of Greek cultural and intellectual influence which transcended the boundaries of the geographical part we consider as Greece. The comprehensive study of the introduction of the sciences to the Balkans necessitates, of course, the study of the transmission of the sciences in each country separately and, of course, a very thorough study of the situation at the Ottoman Empire.

2 Two other books written during the last third of the century present an additional interest. The first was Elementary Lessons in Technological chemistry by L.Dosios, 1871. It was a book popularizing some aspects of applied chemistry for those who wish to use it "in everyday life and industry." The author apologises for possible inaccuracies, but he stresses that his purpose was not to write a strictly scientific book. After the chapters where he describes the properties of common elements (carbon, oxygen, hydrogen, sulphur, phosphorus etc.), he has chapters on glass, the nutrition of plants, metals, dyes etc. The other book was the translation of Studies of nature or letters to Sophia about physics, chemistry and natural history by Martine Aime first published in Paris in 1810; translated by K.Varvatis, 1862. Among other things, the letters to Sophia include the description of Newton's laws and the developments in chemistry due to Lavoisier. The eternity of the soul is stated and it is argued that the aim of the sciences is the happiness of man. The following chapters are included: The general laws of nature; relations of air with physics and chemistry; knowledge concerning light, sun rays and colors; relations of water with physics, chemistry and natural history. Varvatis translated the book because he believes that "it is preferable for parents and youngsters to read books of this sort rather than immoral novels".