EPISTEMOLOGICAL ASPECTS OF THE HISTORIOGRAPHY OF SCIENCE IN GREECE

Introduction

This paper examines the epistemological aspects of the course of development of the discipline of history of science in Greece focusing on three controversial themes: i) the Continuity with the ancients, ii) the reception of modern science both in the Greek–speaking communities in the 18th–19th centuries and in the modern Greek state in the 20th century and finally iii) the issue of teaching the history of science in the science classroom.

Starting with the work of the first Professor of history of science in Greece, Michael Stefanides, this paper analyzes the transition from a discipline of history of science dominated by an attempt to establish the continuity of Greek Science from the ancients till the 20th century to a new generation of historians of science, which appeared on the scene in the late 1970’s and prevailed in the cultural life of Greece.

This new generation considered the argument for the Continuity as an ideological construction, and turned its attention in the study of the post–Byzantine era, to a period called Neo–Hellenic Enlightenment, and focused on the study of the reception and assimilation of the ideas of the 17th century scientific revolution in the Greek–speaking communities.

The last 20 years or so, a new trend in the historiography of science in Greece turns up to focus interest on the reception of modern theories in Greece at the end of 19th century and in the 20th century. In particular, factors related to the scientific, social and political milieus are examined in order to describe the reception of the theory of evolution, the theory of relativity and quantum mechanics in Greece.

Finally, this work examines the newly established relations between the historians of science and the historians of science education taking into account the fact that these two fields are closely linked to one another in the Greek context.

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1. Methodology

This paper has been written under the methodological perspective that science does not develop in a social vacuum. The development of science in the last few centuries is intimately connected to the specific socio-economic development of the European cultural region. This development has been marked by the transition from feudalism to mercantile capitalism then to industrial capitalism and, more recently, to a global transnational capitalism. This development, however, is not linear and cumulative but follows the schema of combined and uneven development leading to the notion of centre and periphery within Europe.

These transitions have been accompanied by important social and economic changes in the European cultural region, which in turn have had a serious impact on the development of science within Europe. The development of science within the European socio-economic context may be perceived at three levels at least:

a) the long-range historical level, where historical changes at the level of economic production, such as the change from feudalism to mercantile capitalism, mark their imprint on the nature and content of science.

b) the middle level of economic and political forces where more immediate social and political forces acting at a regional level have an impact on the science policy followed.

c) the micro level of the scientific community within which science develops and the main scientific debates and controversies take place.

The bibliography we refer to therefore, varies from large-scale historical analysis to detailed studies of the behavior of scientists as members of social groups.

In our paper we employ the notion of centre and periphery in order to describe how science has been received firstly in the Greek speaking communities of the Ottoman Empire during the 18th and early 19th centuries and secondly, in the Greek national state during the 19th and 20th centuries. The notion of centre and periphery has been employed widely by a significant number of scholars in the history of science in order to describe the diffusion of scientific ideas not only within Europe but also between Europe and Asia, Europe and Latin America etc. The theme of reception of science in the Greek cultural space has also been studied by local scholars. For this reason some further methodological clarifications are necessary.

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1 See E. Mandel, Late Capitalism.
3 See C. Skordoulis, G. Katsiampoura & E. Nicolaidis E., The scientific culture in 18th–19th century Greek speaking communities ...
4 See C. A. Lértora–Mendoza, E. Nicolaidis & J. Vandersmissen (eds.), The spread of the scientific revolution to the European periphery ... and K. Gavroglu, M. Patiniotis, F. Papanelopoulou, A. Simoes, A. Carneiro, M. P. Diogo, J. R. B. Sanchez, A. G. Belmar & A. Nieto Galan, Science and Technology in the European Periphery ...
We do not adhere to a historiography of science which considers the introduction of the scientific and technological ideas and practices from the centre to a periphery as a process of direct transmission. Such a historiography of transmission simply provides a rather simplistic interpretation of how the local scholars adapt to the urgent needs of the imported knowledge product. Thus our view is that of the active receiver which signifies a shift from the notion of transmission to the notion of appropriation. We underline the significance of the process of appropriation of scientific ideas, practices and techniques through the highlight of the local cultural and political processes, and through the specificities of the local scientific communities whose interventions influenced the process of appropriation¹.

Another clarification should be made regarding the area of Post–Colonial studies which has provided a significant amount of scholarly work following the publication of G. Basalla’s seminal paper on The spread of Western Science². There are, indeed, immanent differences between colonial studies and those about the European periphery.

1) In the colonies, there is a gap between the cultural affinities of the ruling class and those of the rest of the population, something which is not valid at all in the case of the European periphery. For example, in Europe, both in the centre and the periphery, there has been a unifying cultural thread i.e. Christianity in all its variations not to mention Aristotelianism in all its variations.

2) The structure of the political and educational institutions in the colonies and the role of scholars is totally different from those in the countries of the European periphery.

3) The political relations between countries of the centre and those of the European periphery are different from the corresponding relations between the metropolis and the colonies. These differences are even more pronounced when we refer to the types of governance and the function of the repressive apparatuses (ie police and the army) in the colonies.

Our methodological attitude is different from the one adopted for Colonial Studies when we are concerned with comparative studies. Comparative, cross–national and transnational approaches are powerful historiographical tools, which, can assist to overcome the limitations of local and national perspectives in history of science. Cross–national comparison allows historical explanation with a greater strength and validity.

One of the aims of our research is to produce studies of the historiography of science in more than one national context focusing in the countries of the Balkan peninsula, ie the national states that came out of the Ottoman empire. This has been the mission of the Network for the History of Science in Southeastern Europe and its publications³. Alike, the research group active in

¹ See K. Gavroglu, M. Patiniotis, F. Papanelopoulou, A. Simoes, A. Carneiro, M. P. Diogo, J. R. B. Sanchez, A. G. Belmar & A. Nieto Galan, Science and Technology in the European Periphery ...
² G. Basalla, The spread of Western science.
³ In the Special Issue of the Journal Almagest 1, 2/2010 we published selected papers of the Symposium Science and Technology in the Ottoman Empire and the National States held in the World Congress of History
the Department of History and Philosophy of Science of the University of Athens participating in the project STEP has produced similar studies along with colleagues from Spain and Portugal.

2. Michael Stephanides, the epigones and the issue of continuity

Michael Stephanides (1868–1957) is considered by many to be the first Greek historian of science. Stephanides studied philology and science at the Faculty of Philosophy of the University of Athens. The science chair at that time belonged to the Faculty of Philosophy. This unusual combination in this epoch ascribed to him the nickname physico–philologist by his fellow students. Being a scientist, philologist and historian, he had the ideal profile for addressing the emerging field that history of science was at that time.

From 1896 Stephanides earned his living as the director of the Ottoman Chemistry Civil Service of the Aegean Sea and at the same time he served as professor of physics and history at the Gymnasium of Mytilene (the capital of the island of Lesbos).

During his service in secondary education, he published the Mineralogy of Theophrastus, in which he compares the old and modern taxonomies of chemical elements. This is the first Greek book of professional history of science escaping the encyclopedic approach of previous works, written mostly by scholars trying to present developments in their field as scientific. Mineralogy of Theophrastus is also the first Greek book of history of science with an impact in the international community of history of science. In the following period of his life, Stephanides pursued a research career. After writing an article, in 1904, about Benjamin of Lesbos, his compatriot scholar of the 18th to 19th century, he devoted himself to the study of alchemy, publishing in 1909 his most famous scientific work: The Art of Psammurgique and Chemistry. In this book, he studied psammurgique vis–à–vis the Arab alchemy and Western χρυσοποιία (gold making) arguing that the Greek, Alexandrian and Byzantine alchemical schools were very distinct from their Arab and Western counterparts.

Stephanides was deeply influenced by the historiographical ideology of the Modern Greek State, which advocated the Continuity of Greek history and consequently the continuity of science from antiquity to the 19th century, distinguishing three historical stages: ancient Greece, Byzantium and Modern Greece (which begins in 1453). Under this scheme, Stephanides published several studies on the history of sciences in Byzantium and also at the time of Ottoman rule. Stephanides promoted a schema of continuity of the Byzantine sciences with the Hellenistic Alexandrian heritage. He was also the first to

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2 See E. Nicolaidis, L'Histoire des Sciences en Grèce ...

3 The Ottoman Empire controlled at that time several islands, including Lesbos Island, the birthplace of M. Stephanides.
claim that during the period of Greece under Ottoman rule there was continuity in science education, which reinforces his thesis of continuity of ancient Greece until the late 19th century. This thesis, which implies that the modern Greeks are heirs of Hellas, has been deeply influenced by the national state ideology and has been used extensively by state intellectuals to render the newly born modern Greek state a sense of cultural coherence.

In every article Stephanides was writing, he tried to demonstrate the contribution of Ancient Greeks and Byzantines in every area addressed. Nevertheless, his works are of value because they focus on a field largely unexplored: the sciences in Byzantium. Chronologically, Stephanides is to be placed between Paul Tannery and Joseph Mogenet, the first having studied the field of mathematics in Byzantium, the second that of astronomy, while Stephanides mostly dealt with that of alchemy.

In 1924, as assistant professor of history at the University of Athens, he succeeded in founding a chair of history of science at the Faculty of Science, which he held until his retirement in 1939. This was one of the first chairs of history of science in the world academia. Two factors proved significant in the foundation of this chair: 1) the importance of the antiquity – including Hellenic science – for the formation and the constitution of the ideological apparatuses of the Greek state and 2) the personality of Stephanides himself, who was recognized as a prominent member of the international community of history of science. Indeed, he maintained a correspondence with George Sarton who encouraged him in his research on the sciences in Byzantium. He also was a member of the International Academy of History of Science publishing widely in various international journals and was publishing participating in international conferences. It has to be noted at this point that Stephanides was present in the Second International Conference of History of Science in London in 1931. This conference acquired an importance due to the presence of the Soviet delegation under Bukharin and the subsequent initiation of the field of social history of science. This remained largely unnoticed by Stephanides who wrote in his report that the Soviet papers given in the conference were not all related to history of science and made no reference at all to the paper by Boris Hessen.

In 1938 Stephanides was elected member of the Academy of Athens. In the same year, he published his textbook *Introduction to the History of the Sciences* which is a tribute to ancient Greek Science. Indeed, 240 of the 290 pages of the book are devoted to Greek and Byzantine Science and moreover, he argues that the method of the ancients does not differ from that of the science of his time.

The personal success of Stephanides did not have any benefit for the scientific community of Greece. We do not see at this time the birth of a community of historians of science in Greece. Stephanides’ successor to the Chair of history of science, Christos Papanastassiou has left no work. Nevertheless,
during the decades that followed the retirement of Stephanides, history of science has a presence, although a weak one, in Greek publishing.

In 1940, Konstantinos Mermigas published his *History of Sciences* which insists no longer on the greatness of the antiquity but on the achievements of modern times. Namely, only 350 out of the 500 pages of his book are about classical science. He is also the first to present the relation between history and philosophy of science.

Fifteen years later, another book was published by K. Logothetis. It was a series of biographies of men of science and philosophers, in chronological order and without any connection between them. The interesting fact is that it was published by the *State Organization of School Textbooks*, which opened the door of secondary education for the distribution of the book as a valuable reading for teachers.

Neither Mermigas nor Logothetis were historians of science and their books were merely historiographical compilations. At about the same period Evangelos Stamatis edited and published works about Archimedes, Apollonius and Euclid. Stamatis was a secondary school teacher who had studied physics in Germany in the 1930’s. Very reactionary in his political beliefs, an admirer of the ancients, he published in the 1970’s excellent editions of these three scholars of Antiquity. This works enjoyed the support of the *State Organization of School Textbooks* and of the Chamber of Technology of Greece. With Stamatis a whole era came to an end. Stamatis was the last of a generation of historians of science who worked most of the time in isolation from the international community. He was also the last representative of a generation that focused its scholarly attention on Continuity.

3. The reception of scientific ideas in Greece.

In this paragraph we attempt to identify both the major epistemological obstacles that played a crucial role in the establishment of new theories in Greece and the temporal delay of the acceptance of these new theories. Our effort of analysis is situated within the framework of the theory of reception of a scientific theory in a country of scientific periphery. The theory of reception constitutes, in our view, a valuable methodological tool for studying cases of diffusion of scientific ideas from the place of scientific production to the place of reception.

The factors that determine the reception of scientific ideas in a geographical/social space on the periphery of scientific production do not necessarily coincide with the factors responsible for the propagation of ideas in social formations that produced scientific knowledge.

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1 K. Logothetis, *The Philosophy of Renaissance and the Foundations of Modern Physics*.
2 See E. Stamatis, *Euclides II. Elementa* and *Archimedis Opera Omnia*.
3 See C. Skordoulis, *The Persistence of the Theories of the Ether in Greek Science Education Literature*.
The study of the reception of a scientific theory in a country of scientific periphery is also the history of the epistemological, social, cultural obstacles that the theory faced in that country and can enlighten the factors and conditions that contributed to the scientific production in the country of origin.

In the context of reception studies in Greece, it is appropriate to mention two main groups of historians who are related to at least two regions of interest: the first region is the reception of the scientific revolution of the 17th and 18th centuries in Greece and the second is the reception of modern ideas of the late 19th and 20th century. The reception of the scientific ideas of the 17th century is what has been called Neo–Hellenic Enlightenment. Regarding modern scientific ideas, the reception of the theory of evolution, the theory of special relativity and the quantum mechanics theory in Greece are in our main concern.

3.1. The idea of Neo–Hellenic Enlightenment

In the late 1970’s after the fall of the dictatorial regime (1967–1974), an innovative spirit arose in the scientific community of Greece, with the arrival from abroad, where they were in voluntary political exile, of scholars who had pursued their careers in universities in Europe, mainly in France.

Among those, the most prominent figures were Yannis Karas, Nicolas Svoronos and Kostas Krimbas. With their arrival, we see in Greece the birth of a community of historians of science which was to grow fast in the next three decades. The common characteristic of this generation is its affiliation to the left which at that time, in response to nationalist ideas of the military junta, was keen to sever its links to the glorious past of antiquity and Byzantium and promoted the study of modern and contemporary issues.

Yannis Karas initiated the aforementioned field as he studied the development of science in Greece during the time of the Ottoman domination. He was appointed in the Centre of Neo–Hellenic Research of the National Hellenic Research Foundation (NHRF) where he established the Research Program Influences of the European Scientific Thought in the Wider Greek and Balkan Region. Karas turned his attention to what has been called Neo–Hellenic Enlightenment, i.e. the reception and assimilation of the ideas of the 17th century scientific revolution in the Hellenic communities. His work incorporates research on primary sources, connections between the history of sciences and the political, economic and ecclesiastical history, connections with the philosophical currents and the international political developments.

Indeed, mathematics, physics, biology, geology, geography, astronomy and medicine were studied by the Greek scholars of the 18th century, at a level that cannot be played down as elementary. Recent research has shown that the Greek scholars of the 18th century worked on an ideological project in order to enlighten the Greek–speaking communities of the Balkan region and to guide them to a national revival, which comprehended also a scientific, social and political dimension.

\[^1\] See G. Brush, *Why was relativity accepted?*

\[^2\] See E. Nicolaidis, *L’Histoire des Sciences en Grèce* ...
Greek scholars of the Enlightenment considered that the Greek communities of the Ottoman Empire – belonging to the scientific periphery of Europe – should prove that they were a part of Western civilization. These scholars tried to disseminate in these communities the knowledge they acquired during their studies in European universities\(^1\).

When we examine issues of reception it is necessary to discuss the ways in which ideas that originate in a specific cultural and historical context are introduced into a different milieu together with its own intellectual traditions and its own political and educational institutions.

The issue of reception of Western science in the Greek–speaking communities of the Ottoman Empire is part of a discourse that has developed internationally during the last decades, especially concerning the ways of diffusion of the dominant Western science and technology. There is also a growing interest in comparative studies of the different scientific and technological traditions of the peoples of the world. The study of such topic is not only limited in recognizing to the cultural specificities, but it moves further on to examine and reveal the relations of power and dependence, as well as the uses of science by dominant social classes\(^2\).

Whether the above project will be successful or not remains to be seen given the controversial nature of the factors involved: institutional, political, ideological and/or scientific. Undoubtedly, however, the researchers involved are determined to carry out the project whose importance transcends national borders and can be considered as a model case for other countries of the European scientific periphery.

Karas and his research associates in NHRF have organized a series of conferences in the 1990’s focusing on the reception of the ideas of scientific revolution in Greece. When Karas retired, Efthymios Nicolaidis picked up to continue his work as the Head of the Program of History and Philosophy of Science in NHRF.

In the early 1990’s, the development of Greek universities allowed members of the community to create new institutions, in addition to the existing National Hellenic Research Foundation and the National Technical University of Athens. The culmination of these developments was the foundation of the Department of History and Philosophy of Science in 1992 at the University of Athens and of the journal *Neusis*.

During the 1990’s also, the Department of History and Philosophy of Science at the University of Athens, initiated the project *Hellinomnimon* under the supervision of Prof. C. Gavroglu. This project, which assisted strongly research on the reception of scientific theories in Greece, consists of a collection, in digital form, of all the writings of the Greek scholars of the 16th to 18th centuries and has been constantly enriched. The same group also participates in Science and Technology in the European Periphery (STEP), an international research group focused on the study of processes and models of

\(^1\) See C. Skordoulis, G. Katsiampoura & E. Nicolaidis E., *The scientific culture in 18th–19th century Greek speaking communities* ...

circulation of scientific and technological knowledge between European centers and peripheries from the 16th to 20th century.  

3.2. Reception of scientific ideas of the 19th to 20th centuries in Greece

If knowledge is seen as a cultural product, the emergence of new knowledge scientific, historical, philosophical and so on, must be seen as more than merely the accumulation of the empirical facts. It should be considered the result of the historical, social and cultural conditions of the period of its appearance. In the same vein, the reception of a theory or practice by an intellectual milieu other than that from which they originated depends not only on the scientific value of the theory or practices themselves but also on the social, historical and cultural context at the receiving end. In fact, the stronger the relation between the communities at the respective places of origin and reception the smoother is the appropriation of the new knowledge in the receiving environment. In any case, however, the assimilation and acceptance of the new ideas are rarely unproblematic, let alone permanent.  

Concerning the epistemological aspects of the reception of modern science in Greece, the reception of Darwinism and Haeckel’s ideas, the reception of quantum mechanics and the reception of special relativity are integral parts of modern historiography. Books and popular scientific publications written in the first half of the 20th century mainly by Greek Academics, who were educated in Europe, seem to be the vehicles for the diffusion of the new currents of Western scientific thought. In these books, the conflict of paradigms is demonstrated in all the above fields.  

In the late 19th and early 20th centuries, Greece underwent several constitutional changes and got involved in the Balkan wars (1912, 1913) and the two world wars (1914, 1939) managing in the meantime to double its territory. It also faced the neighboring Turkish state three times in armed conflict (1897, 1912 and 1922). After the Second World War, Greece was caught in a civil war between the Right Wing government and the Democratic Army, led by the clandestine Communist Party. The Greek civil war was officially terminated in 1949, but its ramifications extended through to 1974, where, following a seven – year rule by a military junta, the Communist party became legal again. One of the consequences of this conflict was a heated ideological war, which occasionally resulted in the demonisation of everything even vaguely leftist or materialistic.  

During this period the Greek educational system placed heavy emphasis on the history of literature and grammar, which ultimately weakened physical
sciences. In these circumstances science was unable to find a place either in the general public or in the school and university curriculum. So the only scientific activity was seen to come from professors of university and students of physical sciences. It should be mentioned that the University of Athens was founded in 1837 only and was the only University of Greece up to 1922. So few people got opportunities to get acquainted with modern theories. The Physics and Mathematics Department operated under the aegis of the School of Philosophy until 1904, when it attained the status of an administratively autonomous School. While a Chair of physics existed from 1837, a second Chair of Physics was instituted only in 1904 and for reasons more political than scientific. The curriculum in the newly founded Physics and Mathematics School emphasized the practical applications of science, while the professors appointed in the newly founded Physics Department rarely engaged in innovative scientific research of international significance. In the field of Biology, the Greek educational system seems to have been badly behind. Although Biology courses were offered in several Departments of the University, yet the first autonomous Biology Department was founded in 1967, in the University of Athens.

3.2.1. The Reception of the Theory of Evolution in the Modern Greek State

Given the above educational context, let us start our discussion of the reception of modern theories in Greece, with the almost simultaneous reception of Darwin’s theory of evolution and Haeckel’s ideas. At the end of the 19th century, the two theories, almost simultaneously, came up in Greek popular science publications. The first reactions to Darwinism in Greece, after 1871 when Darwin’s *Descent of Man* was published were hostile. However, there were supporters of Darwin’s theory in Greece at that time, mainly writers under the influence of German and French literature. Most critics of Darwinism were affiliated to the Church. In their texts they usually referred to supporters of evolution as seekers of pleasures, hedonists, atheists, materialists, worshippers of carnal delights, etc. Attacks on these people by the clergy and their followers were relentless. Around 1890, words such as *materialist* were employed as insults, and perhaps that is why most Darwinists recanted and confirmed their faith (in religion). Approximately at the same time, Ernst Haeckel gained recognition as a scientist and a philosopher whose entire work revolved around Darwin’s theory. Haeckel first presented his views in his two volume work in 1866,

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1 See Th. Kritikos, *The Reception of Scientific Thought in Greece.*
2 See Th. Kritikos, *Physics in Greece (1900–1930).*
5 See K. Krimbas, *Broken Mirror.*
7 See E. Haeckel, *Generelle Morphologie der Organismen.*
seven years after the appearance of Charles Darwin’s work *On the Origin of Species* (1859), where he formulated the biogenetic law *ontogeny recapitulates phylogeny*. He contributed to the dissemination of Darwinian theory in the German lands and in France, but also in other countries, like early modern Greece, which was under the cultural influence of the French and the Germans. The Darwinian theory Haeckel promoted was a patchwork of both Darwin’s ideas and his own. Moreover, Haeckel put forward a philosophical system he called monism, which aimed to replace all religions. Haeckel’s ideas were introduced in Greece during the second half of the 19th century, along with Darwin’s theory, and because the two were introduced together, often Haeckelian ideas were mistakenly attributed to Darwin. Haeckel’s ideas were promoted mainly by the faculty and students of the University of Athens (the only Greek university at the time), who championed a mechanistic view of the world. On the other hand, their adversaries were not only theologians but also secular scholars. Haeckel’s ideas reemerged in Greece in the second decade of the 20th century, and paved the way for the introduction of dialectical materialism.

Regarding the relation between the two theories, Haeckel’s views were not identical with Darwin’s. Haeckel regarded the evolution as a developmental process driven by the laws of physics and chemistry. Instead, Darwin argues the competition between organisms is not subject to any law–dictated direction. Moreover, Haeckel argues that evolutionary theory can be applied not only to explain the diversity of living beings but also to explain the operation of the entire universe and society.

One of the first publications presenting the Darwinian Theory in Greece was an article appearing in the magazine *Ηλισσός (Ilissos)* in 1871 and titled *Theory of Darwin* and subtitled *On the appearance of the organic world and the change of species*. In it we encounter Haeckelian views of spontaneous generation, the appearance of the first man, biogenetic law etc. Haeckel’s ideas were not generally disputed. It also deserves notice that the name of Haeckel is tagged no description (e.g. zoologist, natural philosopher, professor), which shows that Haeckel was probably already known to the target public. Moreover, Haeckel appeared to enjoy respect, since his opinions are used to ratify various other opinions and conclusions.

Darwinian Theory in Greece, as in all Europe, was identified with materialism by various Christian circles but also by the Faculty of Theology of the University of Athens. Consequently their polemic against materialism was directed against Darwinism and Haeckel’s ideas. Their opposition was motivated, first, by Darwin’s rejection of teleology in nature, secondly, by Haeckel’s and later Darwin’s theory of the common origin of man and ape, and, finally, by Haeckel’s explicit rejection of the existence of a supernatural creator God, of an immaterial soul and of freedom of will.

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1. See K. Kyriakou & C. Skordoulis, *The Reception of Ernst Haeckel’s Ideas in Greece*.
2. See K. Kyriakou & C. Skordoulis, *The Reception of Ernst Haeckel’s Ideas in Greece*.
In the same period, Darwinian Theory progressively appears in university lectures, but not without protests, first by medicine professor Ioannis Zochios and later, by reader in Physiology Rigas Nicolaides. Both men did not limit their teaching to Darwin’s ideas but included some ideas of Haeckel. Thus, Zochios started his teaching with single cell human genesis and completed by demonstrating the automatic operation of human conscience\(^1\). Nicolaides rejected the existence of a Creator and adopted the Haeckelian mechanical creation of the being, as well as the lack of individual free will, despite believing that the problems of the Prime Mover or the eternal existence of matter will never be solved\(^2\). Nevertheless, the teaching of Darwinian Theory in the University, which as we saw was laden with Haeckelian ideas, was greeted with cheers and applause by students. The majority of students of Medicine and Natural Sciences adopted the opinions of Haeckel about the origin of man and thought that only the most illiterate of scholars could believe in the supernatural and outward creation of life. For those students, science was the answer of all the mysteries of the universe, while religion was for the uneducated\(^3\).

The delay of reception of Darwin’s theory and Haeckel’s ideas in Greece was inevitably related to the fact that although Biology was taught as a university course, until 1967 there was no university department from which students could graduate with degrees in biology. The first autonomous Biology Department in Greece was founded in that year. As a result biology was late in entering the Greek school curricula as a separate subject\(^4\). Conditions were created for a fuller presentation of evolutionary theory only after the fall of dictatorship. But the fact that human evolution was included only in the first two editions of the 12\(^{th}\) grade Biology textbook and then it was removed (Krimbas – letter to the Greek newspaper To Vima, 1985) can be attributed to the attitudes and practices of the same circles that were the legacy of the past and which continued to dictate what should and should not be taught on that issue\(^5\). Even after the year 2000 the theory of evolution can be taught only in junior high school, although even this is not absolutely certain, as it is up to the judgment of each teacher and the time he or she has available for teaching this subject. At the same time, the sketchy treatment of biological concepts in primary school textbooks and the general absence of any evolutionary approach to the study of organisms, leads to the worrying conclusion that evolutionary theory has not yet been used as a useful tool systematically in explaining biological concepts and issues\(^6\).

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1 See A. Sotiriadou, *The emergence of the theory of evolution, data from the Greek area.*
2 See K. Krimbas, *Broken Mirror.*
3 See K. Kyriakou & C. Skordoulis, *The Reception of Ernst Haeckel’s Ideas in Greece.*
3.2.2. Reception of Modern Physics Theories

The above shown political and social milieu has also influenced the reception of both the quantum mechanics and the theory of special relativity in Greece. A delay of about 50 years between the final formulation of the quantum mechanics theory and its systematic appearance in the Greek educational system has happened\(^1\). To be more specific, in the first 25 years of the 20\(^{th}\) century, quantum mechanics is mentioned only briefly and often misleadingly in Greece, while the authors never mention any contemporary research and provide very scarce details on the subject. The first appearance of Planck in Greek scientific literature will finally be made in a lecture of 1924 which asserts that science has concluded that matter as a concept is obsolete and only energy remains. In a textbook, quantum theory for the first time appears in 1925 (physics in two volumes – Vasileios Aiginitis). This book was written for use by students in various courses, both first–year and final–year courses in physics, chemistry and medicine, within the University of Athens. The \textit{Rutherford–Bohr} atom is mentioned, without any further analysis, while the Planck hypothesis and the constant \(h\) are mentioned but briefly. Finally, Einstein and the photoelectric effect are discussed in a cursory manner. At the same time, nuclear physics is given much more extensive treatment, with Stark, Zeeman and Brondy all being mentioned.

Three sets of factors for the delayed reception of quantum mechanics in Greece are distinguished\(^2\): scientific, social and political. Regarding the scientific factors, although Greece had no significant contribution to international scientific research during the period, a survey of the Athens University library reveals the existence there of magazines in the forefront of physical research, in German, English and French; among them \textit{Annalen Der Physik und Chemie}, \textit{Zeitschrift für Physik}, and \textit{Proceedings of the Royal Society}\(^3\). The literature reveals that the considered delay was not a matter of lack of communication, nor a matter of inadequacy of Greek professors. Some of them have graduated from very prominent European universities. Obviously the reason of the delay of quantum mechanics in Greece should be found in social and political factors\(^4\).

The lack of a cohesive scientific community, the politically directed appointment of new chairs in the university and the lack of lasting scientific organizations, societies and groups are some of the social factors that have not facilitated the reception of quantum mechanics in Greece. The political developments over the same period, as already mentioned, were characterized by Greece’s endeavours to incorporate to European culture, the two world wars, the rise of a strong communist movement and its political conflict with the right–wing political formations. Of special interest to our study is how materialism in Greece came to be identified with communism. Several intellectuals

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\(^1\) See C. Tampakis & C. Skordoulis, \textit{The History of Teaching Quantum Mechanics in Greece}.

\(^2\) See C. Tampakis & C. Skordoulis, \textit{The History of Teaching Quantum Mechanics in Greece}.

\(^3\) See G. Lefkaditis, \textit{An Index of Foreign Magazines of Physics & Chemistry in Athens}.

\(^4\) See C. Tampakis & C. Skordoulis, \textit{The History of Teaching Quantum Mechanics in Greece}. 


and pro–church groups like the editors of the magazine *Rays* contested Darwinism, materialism and Freudism. Nor did they hesitate to attack any scientist that in their opinion showed a materialistic disposition. As a result, we find many physicists taking antimaterialistic positions in their lectures. This, in our opinion led to misrepresentations of several scientific theories, among them quantum mechanics, which, in conjunction with the general emphasis on humanities that characterized Greek intelligentsia, did not allow for a tradition in theoretical physics to form and did not facilitate the introduction of new theories.

Brush has proposed a general schema for the reception of relativity by different scientists in different countries. It would be interesting to examine if the Greek example fits in it. Regarding the reception of the theory of relativity in Greece, which has not yet been discussed in an all–embracing study, two studies so far have concluded that, in Greek cultural and intellectual atmosphere, very few scientists tried to get acquainted, teach or popularize the new theory. However, that gap was soon filled with publications from authors with no scientific background, many of whom tried to streamline relativity with their personal ideological agenda. This comes across as another example of the interaction between ideology and scientific practice that, in our opinion, characterized and inhibited intellectual and scientific activities in Greece at the time.

### 4. The issue of teaching

After 2000, a new research group appears on the Greek academic scene called *History, Philosophy and Didactics of Science and Technology* (HPDST). HPDST originates from two complementary groups, the History and Philosophy of Science and Technology group of the National Hellenic Research Foundation and the group for the Didactics of Science of the Department of Education of the University of Athens. Their merger came about as a result of the recognition that there is a strong need for science to be reestablished in society and for its stakeholders to engage in the process. This goal is to be accomplished through state of the art research using an interdisciplinary approach. Since 2000, HPDST has developed into one of the most promising research teams in Southeastern Europe. The epistemological issue arising is whether these two disciplines, i.e., history of science and didactics of science can complement each other. The main question to ask is whether it is legitimate to teach history of science in the science classroom.

The first attempt to fuse these two research traditions following developments in greek science education was made by Andreas Kassetas, a secondary

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2. See G. Brush, *Why was relativity accepted?*
4. See G. Vlahakis, *The Reception of Einstein’s Ideas in Greece*.
A first event was undertaken, in the autumn of 1980, during the 2nd National Conference of the Hellenic Physical Society, when Andreas Kassetas first pointed to the need to incorporate elements of the history of physics in physics teaching in Greece. Which were the theoretical milestones of this proposal? According to A. Kassetas’ own writings his theoretical sources included: the antipositivism of T. S. Kuhn’s *Structure of Scientific Revolutions*, Arthur Koetsler’s *Sleepwalkers*, Yannis Karas’ *History of Greek Science*, John Bernal’s *Science in History*, René Taton’s *Histoire Général des Sciences* and above all the *Harvard Project Physics Course*.

A few years later, the Hellenic Physical Society appointed A. Kassetas and his team (his teacher in Athens University S. Mourikis and his friend and colleague N. Dapontes) to write a physics textbook for 10th and 11th grade students (1st and 2nd grade of the Greek Lyceum). The textbook was written following the general line of the Harvard Project with certain variations and differences though, which reflect the originality of the authors’ contribution in physics teaching. The textbook was endorsed by the Ministry of Education and was printed and distributed to polykladika Lyceum. In the Greek educational system of those days there were two types of lyceum: the polykladikon and the general. In the polykladikon lyceum a student could follow specialized and more intense physics courses while the general lyceum was oriented to the provision of general education. There were fourteen Polykladika Lyceum in Greece with nearly 10,000 students. Kassetas’ textbook was taught for 12 years (1984–1996) while the revised edition of the book was taught for another 4 years (1996–2000) in all the Lyceum of the country.

Unfortunately, there was no official state committee to evaluate the outcome of this attempt. We have in our hands only one evaluation report from 6 Lyceum in the Athens region based on a questionnaire distributed among the physics teachers of the corresponding schools. The structure of the questionnaire is fragmentary, reflects only the personal opinion of the teachers and there are no any quantitative data to support reliable conclusions. However, the general feeling is that the majority of Greek physics teachers were not adequately prepared to teach the historical material contained in the book, since they did not have any formal education in the history of science, or even any training in the logic of the Harvard Project before the official introduction of the book. Their usual tactic was to omit the historical information or the paragraphs dealing with epistemological matters.

Kassetas estimates that only about 30–40% of teachers felt comfortable with the book and embraced it wholeheartedly in its first phase. The growing opposition to the book led to its revision in 1996 when a lot of the historical
material was left out and finally to its replacement in 2000 by another textbook.

It is interesting to note though that the main argument against Kassetas’ book was based on a naive empiricism advocating the introduction of experiment as the solution to any problem that Greek physics teaching faced. In this context, it is not surprising that the introduction of a History of Science and Technology course, on a compulsory basis, in the Greek Lyceum in 1999, supported by a textbook written by Th. Arabatzis and C. Gavroglu, Associate Professor and Professor respectively of the Department of History and Philosophy of Science, was not well received from both teachers and students and it was made facultative the following year.

Following these events, it became a common belief among scholars in the Departments of Education of the Universities of Thessaloniki and Athens that only a process of systematic teacher education and training on both undergraduate and postgraduate level in history, epistemology and didactics of science linked with research work on the conditions that have shaped the educational environment from the 19th century onwards and in constant dialogue with the international community holding similar views can create fertile ground for the success of HPST in Greece.

Regarding the Greek curriculum, it includes goals for students such as to develop critical thinking, to recognize the unity and the continuity of scientific knowledge, to recognize the relation between physical sciences, to be familiar with the scientific way of thinking and to adopt a critical stance towards science and technology (Cross–Thematic Curriculum Framework for Physics and Chemistry). The related literature reveals that regardless of whether or not history of science improves students ideas about several scientific concepts, it is helpful in abolishing the Two Cultures dichotomy, showing to students that science is part of the human culture and that science is a human activity, improves the image of scientists in society, changes students’ attitude towards science and also attracts highly qualified students to science courses. Research in the relevant fields has proven that teaching history of science improves critical thinking and problem solving skills and students acquire a better understanding of the nature of science (NoS).

The objections of colleagues criticizing the teaching of history of science in the science classroom are based on the ideas developed by Thomas Kuhn. Kuhn’s main argument is that teaching history of science in the science classroom undermines the dedication of students to normal science, to the dominant Paradigm, and that history of science in science textbooks is a pseudo–history, i.e., a history of science that has undergone a Didactic Transposition. Didactic Transposition was first introduced by the French sociologist Verret in 1975 and was used extensively in the field of Mathe-

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2 See C. Skordoulis, Hellenic Studies in History, Philosophy of Science and Science Teaching ... .
3 See T. Kuhn, The Essential Tension.
4 See M. Verret, Le temps des études.
matics Education by Chevallard\textsuperscript{1}. According to this classical approach, scientific knowledge is transformed to school science after specific educational system (institutional) actors have functioned upon it. Some years later, in 1986, Martinand\textsuperscript{2} showed that it is not only the formal (institutional) educational system but also the social practices that play a crucial role in the didactic transposition of a scientific concept. More recently, in 1998, Clément\textsuperscript{3} added the value system as a determining factor in the didactic transposition.

**Epilogue**

In this paper we have studied and analyzed the three major epistemological issues that the Greek community of the historians of science is concerned. While the issue of *Continuity* has been resolved by contemporary research the other two issues, the reception of modern ideas in the Modern Greek state and the introduction of history of science in science classroom, still prevail in history of science research in Greece. This is well presented in a special issue of *Archives Internationales d'Histoire des Sciences*\textsuperscript{4}, dedicated to contemporary research in history of science in Greece.

It is a fact that after having gone through its phases of infancy, i.e. the admiration of ancient science, history of science in Greece has now reached a mature period where current research trends are integrated with those of the international community of historians of science and also of science educators. The HPDST group has established partnerships with European research groups and built a network of historians of science and technology in South-eastern Europe. To support these goals, the group publishes a bilingual journal (*Kritiki: Critical Science and Education*), an international journal (*Almagest, International Journal for The History of Scientific Ideas*) and the *Newsletter for the History of Science in Southeastern Europe*. The role of this group in Southeastern Europe has been further strengthened by support from the European Union for its future development (program Hephaestus, REGPOT 1–2008). These developments along with the successes of colleagues in the Department of History and Philosophy of Science at the University of Athens open a new era for history of science research in Greece.

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\textsuperscript{1} See Y. Chevallard, *La transposition didactique: Du savoir savant au savoir enseigné*.

\textsuperscript{2} See J. Martinand, *Connaître et transformer la matière*.

\textsuperscript{3} See P. Clément, *La biologie et sa didactique. Dix ans de recherches*.

\textsuperscript{4} See *Archives Internationales d’Histoire des Sciences* 60, 2010.


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