Medicine, Science, and Religion
in Historical Context

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SCIENCE
and
EASTERN ORTHODOXY

*From the Greek Fathers
to the Age of Globalization*

EFTHYMIOS NICOLAIDIS

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ity of European astronomy, his exploits in mechanics, the drawings of measuring instruments and surveying methods—everything fascinated Chrysanthos. In fact, it was his first contact with the world of the new European science, which until then had been despised by the Orthodox world. And, again, these were not the most recent discoveries or ideas. In cosmology, Verbiest, like his Jesuit brothers, remained a Tychonian, for this system could explain the phases of Venus (as it turns around the sun) as well the existence of satellites of Jupiter (as all heavenly bodies do not circulate around the Earth). On instruments, Verbiest was behind by several decades in comparison to Europe, for he constructed huge instruments, hence subject to distortion, and did not employ the eyepiece as an aiming device. Nevertheless, what he did show seemed a marvel to Chrysanthos. The Ottoman Empire did not possess an observatory, and the only attempt at one, made by Muslim astronomers in 1577, had not lasted very long, because of religious reactions.[18] Byzantine scientific tradition did not include an instrumental culture, either, and the only texts concerning instruments were on the theory behind the astrolabe, so the only scientific instruments that Chrysanthos had previously seen or read descriptions of were small astrolabes. It is not surprising that he immediately commissioned a copy of Verbiest's Latin manuscript. It was undertaken by a student at the Slavo-Greco-Latin Academy and finished in January 1693.

Chrysanthos kept his copy in the library of the annex (*metochion*) of the Patriarchate of Jerusalem in Constantinople. In effect, this was an extremely indirect breakthrough by the new science into the Orthodox East, because it was accessible only to a narrow circle of readers at the library who knew Latin. However, this library was being enriched by a great number of manuscripts dealing with science, thanks to the special interest and collecting spirit of Chrysanthos, who would become patriarch of Jerusalem at the death of his uncle in 1707.

After the end of the seventeenth century, the Patriarchate of Jerusalem—as well as the rest of the Greek world—continued to maintain close relations with Russia, which long dreamed of reconquering Constantinople. But the tsars, having acquired control of the church in Russia, now depended much less on the help of the Greek patriarchates. As for the sciences, after the reforms of Peter the Great the influence of the Eastern Orthodox Church on science education in Russia would continue to decline. Science would henceforth be taught either by Europeans or by Russians who had studied at European universities. In the eighteenth century, the spread of science in Russia would become an affair of state.[19]

CHAPTER TWELVE

Who Were the Heirs of the Hellenes?

Science and the Greek Enlightenment

In 1697, some years after his mission to Moscow, Chrysanthos Notaras, a monk, was sent by his uncle Dositheos, patriarch of Jerusalem, to Padua in order to complete his education. The curriculum of the University of Padua included theology courses that were attended not only by Catholics but also by Orthodox students such as Chrysanthos. This might appear to contradict the hatred of Catholics felt by a majority of the Orthodox clergy, but the clerical aristocracy needed men who well understood the dogmas of the "Latins." Following a Byzantine tradition, a certain portion of the clerical aristocracy maintained good relations with the Catholic Church. Chrysanthos's professor at Padua was the Greek Catholic Nicolas Komninos. His attachment to Catholicism did not prevent him from considering Italy as a sinful land, and he maintained friendly relations with Dositheos, to whom he wrote that his nephew was leaving Padua more knowledgeable—and without having been perverted by Italian morals.[1] The faculty of arts in Padua was Aristotelian, but Chrysanthos was not content with Aristotelian study; he had a curious mind and knew that a new science had been developing for a long time, if only from the manuscript of Verbiest that he had had copied (chapter 11).[2] In 1700, at the end of his study in Padua, he went to France, "the land of the Celts," according to Komninos.

In Paris, Chrysanthos made the acquaintance of liberal theologians such as Louis Ellies Du Pin, Alexandre Noël, and Michel Le Quien. Still more important for him was his contact with men of science. As he was the nephew of the patriarch of Jerusalem and had traveled throughout eastern Europe, Chrysanthos was well received by French scientists. After asking to visit the Paris Observatory, he was welcomed and lodged there for a week by John Dominique Cassini, first director of this modern establishment. As he himself wrote, "There we observed with him [Cassini] with the aid of the largest telescopes the Moon, Jupiter and its so-called satellite-stars, the galaxy, and other things. He then told us that by using several methods and observations, he discovered that one minute of the Earth's circumference—that is to say, an Italian Mile—is five thousand, seven hundred six feet from Paris, or five thousand eight hundred eighteen geometric feet."[3] Apart from astronomy, Chrysanthos expressed interest in methods of measuring the earth, that is, in surveying and determining coordinates; he also learned about the work of Jean Picard (1620–82), which was the most up-to-date science on these subjects. He even constructed a sort of astrolabe according to Cassini's instructions and had engraved on it the following inscription: "This instrument has been fabricated by the monk Chrysanthos according to instructions from Cassini for his brothers in Jerusalem, so that they may adore God through his works."[4]

Adoring God through his Creation meant studying science. This was not a new idea for the Orthodox; we encountered it several times during the Byzantine period. What was new is that Chrysanthos, who on the death of his uncle Dositheos (1707) became patriarch of Jerusalem, departed from the scientific tradition of Orthodox humanism, which accepted only Hellenic science as valid. As a precursor of the Greek Enlightenment, he was able to present to the Orthodox world, with his immense moral authority, modern European science—*neōterai epistēmai*, or "new sciences," as it was called by the Greek scholars of the time.[5]

After his Parisian experience, Chrysanthos wrote a book, *Introduction to Geography and to the Sphere*, that reflected what he had seen and learned in the capital of scientific learning.[6] This was the first printed book to present the new science to the Greek world. Because of his position as patriarch, the prudent Chrysanthos presented this new science in such a way as not to raise theological problems. In the astronomical part, he presented the Copernican system but also explained that for practical astronomy (determination of the positions of heavenly bodies) both systems—heliocentric and geocentric—were valid. Why then, he asked, not lean to the latter as closer to scripture? Just as cautiously, he publicized the heliocentric system through the engravings in his book—but not in the text. Out of nine engravings presenting the subject, only one offers the "system of the world according to Ptolemy" and one according to Tycho Brahe; seven others depict the heliocentric system in detail, of which two are the "system of the world according to René Descartes," which includes the Cartesian whirlpools to explain the functioning of the world.

Chrysanthos's presentation of the heliocentric system was totally symbolic. Although an able mathematician himself, he did not present any mathematical aspect of the Copernican system but remained at the level of qualitative description. Nor did he mention Johannes Kepler's revolutionary solution of ellipses

for the orbits of the planets. Instead, Chrysanthos focused on geodesy rather than astronomy, the former being less sensitive from a theological viewpoint and more concerned with method and scientific rigor. Chrysanthos, familiar with Picard's work, presented the rigorous surveying methods used in geodesy, as well as the instruments of triangulation and the details of their fabrication. In addition, he gave his own measurements, including his efforts to redetermine the coordinates of various cities in the Balkan Peninsula.

This book was not Chrysanthos's only involvement in the teaching of the new science in the Greek Orthodox world. Before coming to the patriarchal throne, he had taught science at the Patriarchal School of Constantinople and served as tutor to the children of the prince of Walachia, the Romanian region of the Ottoman Empire, which enjoyed a special status and at this time was governed by Greek princes. He also helped in the construction and purchase of scientific instruments, notably telescopes for the entertainment of the princes of Walachia. As a result, he became known as a great scholar in the Orthodox world. The envoys of the king of France to Constantinople in 1729, the abbots Sevin and Fourmont, described him as the most scholarly man of this part of the world, one who knew the value of books. Once he became patriarch, his political and religious preoccupations prevented him from continuing to be an active scientist, but he contributed to winning recognition for the new sciences and their tools, scientific instruments, among the ruling class of the Orthodox world.[7]

Patriarch Chrysanthos considered "Latin" science the flower of civilization: "It was a common saying among the Greeks that what was not Hellenic was barbarous. In those days the barbarian nations were Germany, France, Holland, and others. But when they had received Hellenic wisdom, when they had established academies, gymnasia, and other schools, it was the barbarians who became Hellenes and the Hellenes who became barbarians by losing all these things."[8] His project was to create schools in the Orthodox world: in Romania, Palestine, the Peloponnesus, Macedonia, and Thrace. He believed that princes should contribute financially to the foundation of what would be the "best of the commonwealth." Spending on education meant that "sacred revenue does not diminish but increases; whereas once they nourished laziness and idleness, now they are being encouraged to nourish and sustain wisdom, knowledge of God, the sciences, and all psychic and physical needs."[9] In the Romanian school in Jassy, he promoted teaching physics, mechanics, geometry, navigation, and astronomy. Nevertheless, the entry of the Orthodox world into the scientific era that Chrysanthos envisaged came more via the traditional curriculum rather than the new sciences and philosophy developed in Europe after the sixteenth century.

In a report on the organization of the Academy of Bucharest, he called for three professors, the first to teach Aristotle (*Logic, Rhetoric, On Heaven, On the Soul, Metaphysics*, etc.); the second to teach Isocrates, Sophocles, Euripides, Gregory the Theologian, Synesios, Pindar, Xenophon, Plutarch, Thucydides, Demosthenes, and the Letters of the Apostle Paul; the third to teach Chrysoloras, Cato, Pythagoras, Aesop, and Homer. This was the Byzantine humanist curriculum; the time was not yet ripe, at the start of the eighteenth century, to revolutionize science education. First, education needed to be reestablished fully in the Orthodox world.

Separate Philosophy from Theology? Antrakites between Descartes and Euclid

One of the scholars who reestablished science education was Methodios Anthrakites (c. 1660–c. 1736). Anthrakites, after studying at the School of Jannina, took his monastic vows and around 1697 went to Venice as priest at the Orthodox Church of Saint George. During the decade of his stay in Italy, he studied science, probably in Padua. Around this time he must have met and become friends with Chrysanthos. Returning about 1708 to Ottoman Greece, he taught at the School of Kastoria and the "Great School" of Jannina. He wrote an enormous textbook in three volumes, the *Mathematics Course*, which would shape science education in the Greek Orthodox world during the first half of the eighteenth century.[10] This book provides a complete course, detailed and rigorous, of the "mathematical sciences" as they were taught in Padua at the start of the eighteenth century, plus some Byzantine texts. In addition to Euclidean geometry, Anthrakites presented books by Ypsicles and Anthemios, the *Sphere* of Theodosius, geometric constructions and trigonometric tables, logarithms, the sphere of Proclus, two Western-influenced treatises on the astrolabe, instructions for using astronomical instruments such as the quadrant (but not the telescope), theoretical geometry, and pre-Newtonian optics. In astronomy, the Copernican and Tychonian systems were presented—before being rejected by arguments along the lines used by Cremonini (who was professor in Padua during Anthrakites' stay in Venice), while Kepler was not even mentioned.

There was nothing revolutionary in the teaching of this monk and friend of Chrysanthos's. However, Anthrakites seems also to have included—or at least presented—the philosophical ideas of the French philosophers Nicolas Malebranche and René Descartes. No doubt this novelty, and the fact that he clearly stressed the teaching of science and not philology, led Orthodox fundamentalists to accuse him before the Holy Synod of being a heretic. In 1723 Anthrakites was summoned to Constantinople to refute these accusations. Condemned, he was excommunicated and his educational books banned. After Anthrakites confessed his Orthodox faith and ceremoniously burned some of his own manuscripts, the church lifted his excommunication and authorized him to teach again, on condition that he use the course of Korydaleus (see chapter 10). In a novel defense of himself, Anthrakites claimed that the church was condemning him for his philosophical ideas and not for having departed from Orthodox dogma. Thus, he reopened the debate within the church on the separation between philosophy and theology. His stance succeeded in heightening the anger of the Holy Synod, which reaffirmed its position that only the Peripatetic philosophy of Aristotle should be taught.[11]

This controversy bore on general principles and not on the subjects actually taught in natural philosophy. In fact, Anthrakites always remained an Aristotelian, and he perpetuated into the eighteenth century the Orthodox humanist ideas of the previous century, which featured the renaissance of Greek science. His student Balanos Vassilopoulos, who in Venice had edited his teacher's manuscript *The Mathematical Course*, wrote in 1755 a treatise that he sent to the Academy of Science in St. Petersburg in which he claimed—wrongly—that he had found the solution to one of the three mathematical problems of antiquity, that of doubling the cube with the aid of a ruler and compass (Delos's problem).

Enlightened Clerics and the New Science: Voulgaris and Theotokis

Because of the links between Orthodox scholars and the Greek community of Venice, the introduction of the new science into the Orthodox world followed on the heels of its introduction into the University of Padua, the leading university in the Venetian Republic. Until 1678, the chairs of physics at this university were called *ad lecturam meteororum Aristotelis* (lessons on Aristotle's Meteors) and *ad lecturam meteororum et parvorum naturalium Aristotelis* (lessons on Aristotle's minor publications concerning nature). Evidence of the new physics did not appear until 1715, and it was not until 1739 that the new physics was fully taught by Giovanni Poleni (1683–1761), the chair of *ad mathesim et ad philosophiam experimentalem* (mathematics and experimental philosophy), who created his famous Teatro di Filosofia Sperimentale (theater of experimental philosophy), equipped with four hundred instruments to teach experimental physics. Poleni was succeeded by Alberto Colombo, who was in turn succeeded in 1777 by the

Cretan Greek Simon Strattico (1733–1824), who had studied at Kottounios's Greek College in Padua and would be fired by the Austrians for political reasons in 1798, when the latter took control of Venice. This new chair in experimental physics spelled the end of Aristotelianism in Padua, a change that had repercussions in the Orthodox world.[12]

The first reactions by Orthodox students to these reforms were negative. If they went to Italy, it was usually to study Greek sciences, which were being taught at a rather elementary level in the Greek schools of the Ottoman Empire. But gradually a new discourse arose that aimed to reconcile the existence of the new science with a presumed renaissance of ancient Greek science. This new discourse appeared in the prologues of Greek science books around the middle of the century, some fifteen years after the establishment of the chair of experimental physics in Padua. Until that time, Greek scholars conceived of the history of science as solely about Greek and early Byzantine science. Henceforth, the new European science would be integrated into this history as the brilliant heir of ancient Greek science.

Eugenios Voulgaris (1716–1806), the most influential Greek scholar and cleric in southeastern Europe in the second half of the eighteenth century, was born in Corfu, a Venetian dominion. He studied at Padua, where he followed the first courses in experimental physics given by Poleni, and in 1742 became director of the Maroutsis School in Jannina. There Voulgaris taught Gottfried Leibniz, John Locke, and Voltaire, which exasperated Anthracites' student, Balanos Vassilopoulos, director of another school in the city, who forced Voulgaris to go teach "these insanities" elsewhere. Voulgaris went to Kozane, where he was better paid. When Kozanians showed appreciation for his innovative teaching, he was invited back to Jannina with an even higher salary. In 1753 the enlightened patriarch Cyril V created a school (called the Academy) on Mount Athos and appointed him to direct it. At the heart of mystical Orthodoxy, Voulgaris taught, according the scholarly terminology, the "new science" and the "new philosophy," meaning the ideas of the European "scientific revolution" developed after the sixteenth century. His teaching attracted many students as well as many troubles, which obliged Voulgaris to quit the Academy in 1758. Meanwhile, he had translated and adapted a number of science textbooks that would later be printed, including *Elementa geometriae planae et solidae et selecta ex Archimeda theoremata* by the Jesuit Father Andrea Tacquet (1612–60), based on the 1710 edition by William Whiston.[13] In 1759, Seraphim II, a patriarch who supported the Greek revolt against the Turks, called Voulgaris to head the Patriarchal School in the capital of Orthodoxy, Constantinople. The experiment lasted two years, until Seraphim's

fall. The new patriarch, Ioannikios III, and the majority of bishops were hostile to this intrusion of Western civilization into Orthodoxy. Voulgaris would leave again, and after a stay in Romania (then administered by Greek princes named by the sultan), he arrived in Leipzig with the goal of publishing teaching manuals such as his *Elements of Mathematics*, based on a book by Andreas Segner.[14] There he met the Russian marshal Theodore Orlov, who introduced him to Catherine the Great. Voulgaris, disappointed at resistance to new ideas and the intrigues in the circles around the Patriarchate of Constantinople, finally settled in Russia, where he was named archbishop of Slavonia and Chersonesos. In 1779 he left the archbishopric and in 1802 retired to the monastery of Alexander Nevsky, where he died at the age of ninety. In 1776 he was named a member emeritus of the Science Academy of St. Petersburg.[15]

Voulgaris is a good example of the relations between cosmopolitan Orthodox clerics and the Enlightenment. On the one hand, he considered himself as heir of the ancient Greeks and was proud of it; on the other hand, he thought that the Greece of his day—confused with the millet of the Ottoman Empire—was totally decadent and would owe its salvation to the teaching of the new European science. For him, the new science relied on developing the science of the ancients. He considered Diophantus, for example, as "the sovereign of all arithmetical thinking." Nevertheless, "his marvelous invention, the art called algebra, was developed and perfected by François Viète, René Descartes, and others."[16] Similar sentiments were expressed by other Greek partisans of the Enlightenment, who considered the great European savants to be the children of the ancient Greek philosophers.

Voulgaris's adherence to the new sciences, which were accompanied by the philosophical and political ideas of the Enlightenment, was strongly shaken by the French Revolution. A portion of the clergy as well as conservative circles of the Phanar (Constantinople's Greek aristocratic quarter) close to the Sublime Porte feared the impact of republican ideas on Greek supporters of the Enlightenment, not to mention atheistic fallout from the revolution itself. As in Russia, even enlightened people who had favored new ideas made retractions. In 1805 the almost ninety-year-old Voulgaris, then in Russia, gave his assent to the publication of his old manuscripts, including a translation he had done almost fifty years earlier of the fourth part (titled "De systemate Universi") of a book by Fortunatus a Brixia (1701–54).[17] This book presented cosmological systems from Plato to Newton, via the church fathers, Kepler, Gassendi, Descartes, and others, and it came out in favor of the Tychonian system, which retained phenomena while remaining faithful to sacred texts.

Voulgaris's fame as well as his title of archbishop gave great prestige to the science manuals he wrote. In natural philosophy, two of them had some success: *Those Who Please Philosophers*, a compilation from books he had read during his study in Italy at the end of the 1730s that included numerous references to Descartes, Newton, and Leibniz; and a translation he had completed in the 1750s of a book by Johan Friedrich Wucherer (1682–1737), *Institutiones philosophiae naturalis eclecticae* (Jena, 1725).[18]

Voulgaris's books were soon eclipsed by those of his junior Nikephoros Theotokis (1731–1800), who followed a similar career. Also born in Corfu, he, too, had studied experimental physics with Poleni and then mathematical sciences with Eustachio Zannoti, director of the Bologna Observatory. After his studies in Italy, he returned to Corfu, took his monastic vows, and created a school where the new science was taught. In the 1760s he was called by the patriarch to Constantinople, where he was appointed preacher of the Grand Church. His teaching of the new science and philosophy shocked conservative circles of the church and Phanar; so Theotokis went to Jassy in Romania, where the ambience seemed more liberal than in the capital of the Ottoman Empire. He soon left for Leipzig, where (like Voulgaris) he went to publish his manual *Elements of Physics*.[19] In 1773 he returned to Romania, where he directed the Academy of Jassy. Facing resistance to his teaching and considered a revolutionary by both clerical and secular conservatives, he accepted in 1776 an invitation from Voulgaris to join him in Russia, where three years later he succeeded him as archbishop of Slavonia and Chersonesos. In 1782 he became archbishop of Astrakhan and Stavropol. In Russia, he engaged in polemics against Old Believers, those who had refused to follow the reforms of Patriarch Nikon in 1652, and he worked to end this century-old discord by promulgating the principle of Edinoverie (unity of faith). In 1792 he retired to the monastery of Saint Daniel in Moscow, where he died eight years later.[20]

Theotokis's *Elements of Physics* became the book of reference for the diffusion of new science in the Orthodox world for at least two reasons. First, this textbook was printed as early as 1776 (other books, such as those of Voulgaris, had circulated as manuscripts for several decades before being printed). Second, Theotokis was not content with presenting "novelties"; he taught physics in a rigorous manner that required solid mathematical skills, available in another of his manuals, the *Elements of Mathematics Compiled from the Ancients and the Moderns*. This book was printed in Moscow in 1798–99, but it circulated in manuscript form as early as 1764. The two books together spread mathematical physics in the Orthodox world at a level approaching that of the University of Padua. *Elements of Physics*, like almost all science books written by Greek savants in the eighteenth century, was a compilation of European manuals with some additions. Two principal sources for Theotokis, both no doubt acquired in Italy during his student period, were the physics of Pieter van Musschenbroek (Italian edition, *Elementa Physicae conscripta in usus academicos a Petro van Musschenbroek)*, and the Italian translation of the physics of Abbé Nollet, of which the five first volumes were published between 1746 and 1766. Peter van Musschenbroek's physics was very popular among Greek savants who had studied in Padua with Poleni, a correspondent of the Dutch scholar's. Abbé Nollet also corresponded with Poleni. In order to write his physics manual, Theotokis used Musschenbroek's book as well as Nollet's to complement it. He organized his manual into ten thematic units: general properties of matter, kinetics, mechanics, liquids, optics, heat, aerostatics, acoustics, electricity, and magnetism. Thanks to this manual and the one on mathematics, Theotokis was the first to present differential calculus to Greek schools in a rigorously didactic way. The *Elements of Mathematics* devoted eighty pages to it, using Leibniz's terminology.

New Science and Traditionalist Society: The Case of Moisiodax

A prominent teacher of new science was the Romanian Iosipos (born John) Moisiodax (c. 1725–1800), from Cernavoda, a village on the banks of the Danube. After having followed in Thessalonica the Aristotelian course taught by Iannakos, a sworn enemy of any attempt at modern education and of new science teaching, he sought to enlarge his knowledge by going to Smyrna in 1753, to the brand-new Evangelical School where the curriculum was also totally traditional. For a young man who had already crossed the Balkans at a time when the modernist spirit of the Enlightenment was spreading in the Orthodox world, this was as boring as could be. As another student described the school, "The professor [Ierotheos Dendrinos] and the school resembled all the other professors and schools of Greece, that is to say, they dispensed an impoverished education, accompanied by plenty of drubbings."[21] And so Moisiodax tried to find financial support to pursue study in Padua.

Although this university was the place to study for many bishops and patriarchs of the Eastern Church, Orthodox clergy did not unanimously approve of it. The thousand-year-old debate between pro-Latins and fervent Orthodox believers could resurface at any moment in the Orthodox world. When the young

Moisiodax requested financial aid to study in Padua, the professor of the Evangelical School, Ierotheos, angrily replied: "All those who study in the French [i.e., Catholic] countries become atheists and upon their return they lead others astray."[22]

Surprisingly, the Serbian monk Dositheos Obradovič (1742–1811), who would become a crucial figure in the introduction of new educational ideas in Serbia, described Ierotheos as sympathetic to the Enlightenment, praising him as very erudite, the "new Socrates of Greece," and an enemy of the monks who profit from superstitions.[23] Obradovič himself remained an Orthodox who provided his Serbian compatriots with exemplary Greek teachers, in order to inspire them to develop a national educational system.[24]

Moisiodax's trajectory in quest of scientific learning and his experience as a teacher illustrate the complex relations between sciences and Orthodoxy at the end of the eighteenth century. Disappointed in the traditionalist education in Smyrna, he went to Mount Athos, probably in 1754, to follow for two years the modern scientific education of Eugenios Voulgaris at the school that had just been founded by the patriarch of Constantinople, Cyril V. At this time, Voulgaris was teaching algebra according to Christian Wolff, the geometry of Andrea Tacquet, and the physics of Musschenbroek, an education quite compatible with (and comparable to) that of secondary schools of several countries in western Europe. Alongside the purely scientific courses and in his effort to free Orthodox education from sterile Aristotelianism, Voulgaris also taught the *Essay on Human Understanding* by John Locke, one of the principal sources of the empiricism that so influenced Enlightenment philosophers. The education offered at the Sacred Mountain of Orthodoxy, which reflected the new science and its methodology, contrasted strikingly with the outdated and unimaginative education offered in the lively merchant town of Smyrna. The old and the new frequently intermingled during the eighteenth century. Among the pupils of Voulgaris, we find future scholars at both ends of the spectrum: Athanasius Parios, an Orthodox fundamentalist who wrote pamphlets full of hatred, and Christodoulos Pamplekis, an Enlightenment militant who broke all ties with the church, refusing to give it any authority whatsoever.

Despite the modern character of Voulgaris's teaching, Moisiodax was not yet satisfied. He thought that the proportion of scientific education should be greater: "Our results in philosophy would be much better if the savant [Voulgaris], weighing exactly the poverty of the situation and the brevity of his associates' time, and also the urgent necessity of the Hellades, would dispense and profess lectures (mainly oral), especially in mathematics and physics."[25] Moisiodax had not abandoned his old dream of going to Italy. A good way for someone who did not have the means was to enter the ranks of the unmarried clergy, which offered remuneration and mobility.[26] Thus John Moisiodax, under his new name Iosipos (Joseph), arrived in the Greek Orthodox community of Venice around 1759 in order to study the natural sciences at the Università degli Artisti in Padua. There he followed the last courses of the elderly professor Giovanni Poleni, who taught experimental physics in his laboratory Teatro di Filosofia Sperimentale, and of his successor Giovanni Alberto Colombo. The instruments of the Teatro introduced Moisiodax to the world of experiments and technology, which was still unavailable in the Ottoman Empire. This world and its methodology were what Moisiodax wanted to incorporate in Orthodox education back home; the circle of his learning was closing, and the circle of his teaching was opening.

Thanks to his comrade at the university, Constantine Karaioannis, who was the personal physician to the prince of Moldavia, Gregory Ghikas, Moisiodax became professor and then director at the Academy of Jassy. In this era, the princes of Danubian principalities, Gregory Ghikas and Alexander Ypsilanti, Enlightenment men influenced by the Encyclopédistes (i.e., the French writers who compiled the *Encyclopédie* edited between 1751 and 1772 by Denis Diderot and Jean le Rond d'Alembert) were trying to introduce the new culture and especially French culture into their lands. Thanks to this ambience, Moisiodax had the opportunity to teach science as he had studied it in Padua. On his arrival at the Academy in the autumn of 1765, he gave a public lecture that was a manifesto in defense of the new science. In Moisiodax's account, mathematics was the spearhead of the new philosophy, which owed its grandeur, on the one hand, to the learning of great scholars—he cited Plato, Aristotle, Leibniz, and Newton—who, since antiquity, had contributed to its development and, on the other, to the idea that advances were no longer based on the irrefutable authority of any of them. This manifesto, calling for a veritable cultural revolution, shocked traditionalist Jassy society, which was composed of local seigneurs, Phanariot princes, the emergent petite bourgeoisie, and Orthodox clergy, none of whom were accustomed to any discourse questioning the authority of the ancients.

Moisiodax's problems were not long in coming. Shortly after the speech, a discussion between Moisiodax and a scholarly member of the clergy turned into a debate on the physics of Aristotle. Moisiodax was immediately accused of Latinophilia and was obliged to defend himself in a statement (distributed in writing to the court, to physicians, and to the nobility of the city) in which he answered his interlocutor's accusation. He especially refuted Aristotle's theory of matter and defended an atomistic theory that held that God moves atoms. Moisiodax's statement went much farther than a debate over science; he attacked the control of the Aristotelians over the church for political and personal purposes and concluded by saying he was not ashamed to say that it was Greece that needed Europe, for it lacked everything while Europe possessed everything.[27]

Moisiodax did not last long at the Academy, preferring to retire (around 1767) to Bucharest, where he earned his living by teaching private courses and writing science textbooks. Nine years later, the Academy of Jassy found itself again without a director, because Nikephoros Theotokis, encountering the same resistance as Moisiodax, was also obliged to retire. Despite these withdrawals by "renovators," Prince Gregory Ghikas continued his efforts to promote change, putting fresh pressure on Moisiodax to return to lead the establishment. So Moisiodax came back to Jassy, where he introduced in his classes a much more recent textbook than Tacquet's, the *Elementary Lessons in Mathematics* (1741) by Nicolas Louis de Lacaille, which had already been successfully marketed in Europe. Despite assurances given by his friends at the court, conservative circles did not approve of an education so oriented to science, and they put such pressure on him that he was again obliged to retire, less than a year after his return. His detractors attacked him on two fronts, a well-known tactic employed by Orthodox fundamentalists: they accused him of being a Latinophile and of teaching lessons for grocers, meaning mathematics. In effect, these fervent conservatives willingly confused mathematics with practical arithmetic.[28]

Although the detractors of Moisiodax employed the religious argument of Latinophilia, their polemic was not just a reaction by Orthodox fundamentalists to any kind of innovation (specifically, the introduction of the new European science). The reaction against Moisiodax came from a whole society that felt threatened by a new culture that represented the irresistible rise of European power, which would soon sweep away the outdated and exhausted Ottoman Empire. At the start of the second half of the eighteenth century, a new wind coming from the West, a tardy current of the European Enlightenment, blew through the Orthodox world. Its disturbing effects forced the Orthodox believers to find a balance between their convictions and their submission to the Muslim power, on which they depended for their privileges. Obviously, the prime condition for keeping those privileges was to prevent any part of the millet from rising up against the Sublime Porte. But the new scientific ideas that criticized the past with an investigative and open spirit, and which demonstrated the scientific and technical superiority of Europe, undermined any spirit of submission. Thus, attempts by some educated princes of Danubian hegemonies or by a few innova-

tive patriarchs in Constantinople to introduce the new science into education met with strong resistance.

Retiring to Vienna, a city with a flourishing Greek merchant community, Moisiodax wrote and published in 1780 a counterattack on this resistance to the new science and, just a year later, a book on geometry and cosmology.[29] It is remarkable that at the end of the eighteenth century, he felt forced to write ten pages in defense of the heliocentric system, which had been the spearhead of the new science since the start of the seventeenth century. Moisiodax explained to the reader that philosophers should advance the most probable ideas, without ever holding them as certain. His position was not the one held by some defenders of the heliocentric system who explained that it was only a convenient mathematical solution that did not necessarily represent physical reality. Moisiodax's caution derived from his revolt against any authority and his thesis that the modern scholar should always doubt his findings and participate in a constant process of research. However, his prudence and his adherence to Orthodoxy are both visible in his discussions of the calendar problem. Despite the evident discrepancy between the Julian calendar and the seasons, the Holy Synod of the Orthodox Church was still not disposed to adopt the "papal" Gregorian calendar, for the Synod would be accused of submitting to that heretic, the pope. Moisiodax defended the Eastern Church to Western detractors who accused it of obscurantism, explaining that the Gregorian calendar had been rejected not out of ignorance but out of caution, because uneducated people were not yet ready to accept such a change, which they felt would mean abandoning Christian faith and traditions.[30]

As in the cases of Voulgaris and Theotokis, Moisiodax was not actually departing from Orthodox dogma. The dissidents who would spread the new European science did not adhere to either Catholicism or Protestantism; they would fight inside Orthodoxy to change mentalities and to adopt modern attitudes to science and technology. This battle would be conducted within the Phanariot milieu of the Danube principalities. Despite his setbacks, Moisiodax returned one last time to the court of the princes of Walachia as tutor to the sons of Prince Alexander Ypsilanti (*hegemon* from 1774 to 1782). The presence of Moisiodax influenced Enlightenment activists such as Rigas Feraios, who popularized the new science, and Panagiotis Kodrikas, who translated and published in 1794 a provocative French book then almost a century old, Fontenelle's *Conversations on the Plurality of Worlds*.[31] Moisiodax's successor at the Academy, Procopios from Peloponnese (who had also studied in Europe), also defended the new science.

After the French Revolution: Popularization of the New Science

The spread of the new science in the Orthodox world did encounter some resistance on the part of the church, but overall opposition was moderate, coming from conservative circles of the ecclesiastical hierarchy as well as from a society that was afraid of change, especially when it derived from the Latins. As we have seen, Voulgaris, Theotokis, and Moisiodax were all forced by such pressure to resign from the schools where they taught. The first two preferred to continue their ecclesiastical careers in Russia; their fame in the Orthodox world was such (particularly after they became archbishops) that the church did not dare to condemn their scientific ideas openly. Thereafter, professors could use the textbooks of Theotokis to teach the new European science, and soon many other books of this kind were published. This change in scientific education was fostered by the fact that after wars between Russian and Turkey (1768–74) had brought about agreements favoring the Orthodox communities of the Ottoman Empire, the merchant classes of these communities had begun developing and establishing themselves in various counties of Europe. The result was a generation of educated Greeks who were directly influenced by the French Enlightenment. Though much less scientifically talented than the generation of Voulgaris and Theotokis, these men worked to propagate European science to the greatest possible number of Christian subjects of the Ottoman Empire. Their goal was now much wider: national emancipation, not just the development of science as such. Most of the new publications were books of scientific popularization based on French or German encyclopedias—often taken from the very *Encyclopédie* of Diderot and d'Alembert and written by educated people who had not necessarily studied science. For those people, the *Encycoplédie* was a main source of inspiration to propagate the European Enlightenment's ideas to the Orthodox world.[32]

The case of Rigas Feraios (1757–98) is characteristic of this movement. Rigas was not a scholar but a politician, who, inspired by the French Revolution, conceived of a Greek-speaking Balkan Republic. One of his first books was an *Anthology of Physics*, which he published in Vienna in 1790, at the same time (significantly) as his translation of a French romantic novel. Although different in essence, both books were of the same order: addressed to an Orthodox audience to whom Rigas offered various aspects of the French Enlightenment spirit. As its title indicates, the *Anthology of Physics* was an anthology of articles on the natural sciences mostly based on the *Encyclopédie*: why it rains or snows, the nature of the galaxy, how an electrostatic machine works, where the heat of the sun

comes from (the fashionable answer was "from electricity"), how many satellites Saturn has. The laws of nature explained everything; Rigas included no appeals to the supernatural. The book's conversational language was extremely simple. "My goal," Rigas explained in his prologue, "is to benefit our nation and not accumulate words in order to show off knowledge; I intend to explain with as much clarity as possible so that everybody can understand and acquire a small idea of incomprehensible physics."

The French Revolution and its consequences in the Balkans (the advance of Napoleon, movements of insurrection) led the Orthodox to react more violently than in previous decades to the introduction of new scientific ideas—a reaction that soon became a reaction against any kind of scientific education at all. Shortly after the publication of Panagiotis Kodrikas's translation of Fontenelle's *Conversations*, Sergios Makraios (c. 1740–1819), one of the directors of the Patriarchal School of Constantinople, published an astonishingly backward-looking book titled *Trophy of the Panoply of the Hellades against the Partisans of Copernicus*. In the classic style of questions and answers in an archaic language, Makraios demolished the heliocentric system—not by denying the theory of universal gravitation but by interpreting it in the manner of Aristotle (any matter separated from its natural milieu has a tendency to return to it). Makraios vehemently opposed "Westerners": "The lightweight Fontenelle was foolishly mistaken to think he could reach Olympus by getting mixed up in celestial things. Seeking the plurality of worlds, the crazy Descartes got lost among his whirlpools, maneuvering as he wished."[33] But this tardy reaction could not contain the growing educational movement in favor of the new science. European science in all its aspects was now too well anchored in Greek education.

Take the example of astronomy. In 1803, seven years after Makraios's book was published, a Greek translation of Joseph-Jérôme de Lalande's *Treatise of Astronomy* appeared, enriched with new discoveries such as the small planets found by the Italian priest-astronomer Giuseppe Piazzi on January 1, 1801. Lalande's book, originally published in 1764 (and reissued in 1771 and 1792), was until the start of the nineteenth century a "standard" textbook in Europe; rich in information on astronomical instruments and methods of calculation. The Greek edition was the product of two partisans of the Enlightenment who came from Milies in Thessaly, Daniel Philippides and Anthimos Gazis.

Cubocubes and Trigonosquares: The Apogee of the Patriarchal Reaction

The French Revolution that erupted in 1789 prompted the supreme leader of the Orthodox millet, the patriarch of Constantinople, to take a stand against the diffusion of the new science, often associated with radical French thinkers. The church's hardening position toward science was triggered locally by the revolts that broke out in the Balkans after the Serbian uprising in 1804 and by the impulse to independence by Ali Pasha of Jannina. During the early nineteenth century, the Serbs revolted several times against the Ottoman Empire, aiming both to constitute a national state and to abolish feudal obligations. Ali Pasha (1740–1822), the Albanian ruler of western Greece, attempted at the beginning of the nineteenth century to establish a semi-independent state, and in 1820 he openly revolted against the Sultan Mahmud II. The Turkish powers were very disturbed by these developments and put pressure on the patriarchate to quell any liberal aspirations. At the same time, reactionaries in the Orthodox Church took some comfort from the conservative ambience created by the Holy Alliance of European powers, as well as from the weakening, after the Napoleonic Wars, of the merchant caste, which had been the principal pillar of support for innovative scholars. Between 1819 and 1821, reactionary forces succeeded in closing or reorienting the principal Greek schools of the Ottoman Empire, where new ideas had been taught. The subject that suffered most from these measures was science.

The more the head of the church hardened his position, the more aggressive the partisans of Enlightenment became. Nicolas Piccolo (1792–1865), a philosopher and physician of Bulgarian origin, published in 1820 a poem, barely allegorical, against the obscurantism, superstition, and ignorance of the church and in favor of Western education. Piccolo denounced the "disgusting mob" that was tearing Greece apart and despaired that a "band of monsters" had thrown itself on Smyrna (an allusion to the closing of the School of Smyrna by reactionary forces led by the church).[34] This diatribe provoked an immediate attack from the Patriarchate of Constantinople, represented by the *hēgoumenos* Ilarion, the abbot responsible for educational matters and for the new Greek printing press of Constantinople. Ilarion imposed censorship not only on what was published by the Greek printer but on all books sold in Constantinople. One of Piccolo's Constantinople friends wrote to him, saying that "Ilarion, appointed examiner of the press, and having received a promise that he would be given an archbishopric, has now become the most despotic of despots. He decided that five or six of those who wanted to spread revolution should be condemned to death in order for the rest to be brought back to reason." This news prompted Piccolo to conclude, "The *inquisition* is now perfect, for nothing in Constantinople can be printed or sold unless it is examined beforehand by Ilarion."[35] It should be noted that the accusations of obscurantism leveled at the Orthodox Church by Catholics had a counterpart in the accusations by the Orthodox Church that the Inquisition had been one dark aspect of "Latin dogma." Thus, Piccolo's accusation of establishing an Inquisition was equivalent to accusing the patriarchate of lapsing from Orthodoxy.

Although the extremist reaction of the patriarchate seems to have been solidly based in Orthodox society, the upper hierarchy of the Eastern Church was not unanimous. The bishop of Sina, Constantius, on whom Ilarion depended, wrote in 1820:

> The liberal philosopher Descartes the Frenchman, despite all the absurdities of his system, was the first in Europe to break [the ties] and liberate prisoners of the tyranny of preconceived Platonic and Aristotelian ideas, thus becoming the guide for lovers of science and of theory and research about beings. . . . In accord then with Descartes, his contemporaries, and the glorious ones who have prospered with him in wisdom and discoveries, notably the immortal Englishman Newton, in their sage thinking they have once again introduced the human species to the right that was abolished two thousand years ago, to think and judge matters for itself and to freely demonstrate the present things.[36]

Constantius had studied in Jassy; so he knew science. But despite his very courageous attitude (given the reactionary atmosphere that reigned when he wrote these lines), when he became patriarch of Constantinople (1830–34), he forbade a memorial service for Diamant (Adamantios) Coray (1748–1833), one of the most important scholars of the Modern Greek Enlightenment, who lived in Paris, where he edited Hippocrates, Strabo, and other ancient Greek writers.

The church's opposition to teaching the new science took an institutional form with a patriarchal encyclical written in March 1829 that dealt with education:

> Everywhere there reigns a disdain for matters of grammar, and the arts of logic and rhetoric and the teaching of the elevated theology are completely ignored. This disdain and ignorance come from the exclusive love of students and professors for mathematics and science, and turning cold toward our faith. . . . For the Nation, the teaching of grammatical classes is more beneficial and neces-

> sary than mathematical or scientific classes . . . for what is the advantage for the students who follow these courses to learn figures and algebra, cubes and cubocubes, and triangles and trigonosquares, and logarithms, and symbolic calculations, and projected ellipses, and atoms and voids and whirlpools, and forces and attractions and weight, and qualities of light, and polar auroras, and optics, and acoustics, and thousands of similar and monstrous things, in order to count the sand on the shore and the drops of dew, and to move the earth—if support is offered via Archimedes. Yet they are barbarous in their speech and poor in their writing, ignorant in their religion, perverse and corrupt, and noxious to politics, these obscure patriots who are unworthy of the hereditary vocation.[37]

It was not rare in these tumultuous years for the church to denounce scholars to the Turkish authorities as revolutionaries advocating the overthrow of the sultan. The patriarch Gregory V and the metropolitan of Chios, Plato, used this tactic against the director of the Chios Gymnasium, Neophytos Vamvas, as did the metropolitan of Smyrna against Constantine Economos, director of the Smyrna Gymnasium. The struggle against science reached its paroxysm in March 1821, when the Holy Synod was convened in Constantinople in order to put a stop to "philosophical" classes. The exact date was 23 March, after Christians had been arrested and executed following the rebellion of Prince Ypsilanti in Romania—but news of the Greek national uprising in Peloponnese had not yet reached the capital. Shortly afterward, on 10 April, the same Gregory V who had condemned scholars as subversive elements would himself be hanged, on the order of the sultan, because he had not been able to contain the rebellion. However, the victory of this rebellion seven years later would dramatically change the geography of Orthodoxy by dismantling the unifying Orthodox millet into several independent states, each with its own Orthodox church and distinct educational and scientific cultures.

CHAPTER THIRTEEN

The Scientific Modernization of an Orthodox State

Greece from Independence to the European Union

The rise of nationalism at the start of the nineteenth century upset the unity of the Orthodox Church and at the same time changed the cultural landscape for Christians of the Ottoman Empire. Each nation-state that emerged sought to establish its own autonomous church and its own educational structures in its own language. And so the Patriarchate of Constantinople lost the decisive role it had played for more than a thousand years, keeping only the title of *ecumenical*.[1]

The Greek Revolution of 1821 was the first European national revolution to result in the creation of a sovereign state. The leaders of this revolution had set themselves the goal of founding something modeled on their contemporary European nation-states. Born of the Enlightenment, the French Revolution, and also the romantic movement that engendered philo-Hellenism across Europe, the Greek Revolution succeeded thanks not only to European support secured by the philo-Hellenic movement but also to the geopolitical interests of the major powers. In 1828 Greek independence was imposed militarily by France, England, and Russia, which combined to achieve the "controlled" dismantling of the Ottoman Empire. However, the creation of a Greek national state stirred up nationalist revolts in other Christian nations of this empire, notably among the Serbs, who were not content with the level of autonomy that had recently been granted them. The perennial Balkan question, initially linked to Russia's ambition to govern the territories of Orthodox Slavs that formerly belonged to the Ottoman Empire, came onto the agenda. It was provisionally solved in 1878, when the Congress of Berlin, which brought together the European powers and the Ottoman Empire, recognized the independence of certain Balkan nations.

The creation of the Greek state in 1830—and, after the Congress of Berlin, the formal creation of Serbian, Romanian, and Montenegrin states and the recognition of Bulgaria—posed the fresh problem of frontiers that were not only political but cultural. Until then, the existence of a common political space (the Otto-