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CHEMISTRY AND IATROCHEMISTRY
IN EARLY EIGHTEENTH-CENTURY PORTUGAL:
A SPANISH CONNECTION

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Portuguese science and medicine in the period between the great geographical discoveries of the fifteenth and sixteenth centuries and the educational reforms of the Marquis of Pombal in the third quarter of the eighteenth century remains a subject relatively unexplored by scholars. Many of the books essential for such a study are yet to be identified and it is still too early to make any general assessment for this period. Accordingly, I must confess at the outset that the present study of Portuguese chemistry in the early eighteenth century is at best an exploratory one.

However, in contrast with the Portuguese scene the study of Spanish science and medicine in the sixteenth and seventeenth centuries has been a subject of intense interest for more than two decades¹. Because of this it is possible to compare Spanish developments with those in other countries of Western Europe. I believe that this is a fruitful approach in the case of chemistry for Portugal.

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Accordingly it will be the purpose of the present paper to give a rapid overview of Spanish chemistry during the period of the Scientific Revolution paying special attention to the reputation and influence of the sixteenth-century Swiss medical reformer, Paracelsus (1493-1541), and then move on to the state of chemistry and chemical medicine in Portugal first as viewed by António Nunes Ribeiro Sanches and those who supported the educational reforms of Pombal and then by examining the works of several authors who wrote on chemistry earlier in the century. As a final example I will turn to Francisco Suarez de Rivera of the University of Salamanca who spent most of his life in Madrid and whose work points to the close ties existing between Spanish and Portuguese scholars in the early eighteenth century and indicates as well the intense interest existing at that time in chemistry as a requisite subject for the physician.

THE PARACELSIAN TRADITION IN SPAIN IN THE 16th AND 17th CENTURIES

If we turn first to Spain we readily see that the course of Spanish science was strongly influenced by the Reformation². By the mid-sixteenth century there was widespread heresy with large numbers of Protestant tracts entering the country from Geneva. For Charles V this seemed no less than rebellion. The first Spanish Index of prohibited books appeared in 1559, the same year in which a series of auto-da-fés practically extinguished Spanish Protestantism. The decision had already been made to separate Spain from foreign ideas (1557/1558) and the Council of Castile and the Inquisition were charged with overseeing and licensing the publication of books. Death and confiscation of goods were the punishment for introducing to the country, publishing or circulating books without the proper license. By order of Philip II all Spanish students abroad were ordered to return home within four months except those in certain colleges that seemed theologically safe at Bologna, Rome, Naples and Coimbra. This decree was enforced.

The results of these draconian measures might well have been predicted. To be sure, Spain's religious orthodoxy was restored, but the country's universities and the level of scholarship were dealt a severe blow. The number of students declined precipitously in the course of

the seventeenth century and most of those attending sought programs in the career professions. Foreign visitors were rare, but those accounts we have deplore the state of learning compared to the rest of Europe. In 1664 Francis Willughby was astonished that the students of Valencia had not heard of the new philosophy while Lorenzo Magliotti (1668) wrote that anatomy had not been taught at Alcalá in a decade and that medical instruction was still based on the works of Galen³.

And yet, these were the very years that were to see the beginning of change. During the minority of Charles II his brother, Don Juan of Austria, exercised power⁴. Censorship, formerly strict, was now relaxed and Don Juan, an enlightened prince, patronized the sciences and medicine. It is in this period that we find the first Spanish references to Harvey, the Copernican theory and the corpuscularian philosophy.

But how did these events effect Spanish chemistry and its relation to medicine? Here we must turn specifically to the work of Paracelsus who had called for the end of the domination of the ancients in both the study of natural philosophy and medicine⁵. He had argued that the search for fresh observations in nature would be a better basis for a new learning than study in a university based on learning by rote and disputation. And the key to this should be chemistry which through the proper use of the fire would reveal God's hidden secrets to man. Above all, this was to provide medicine with a new observational foundation.

But Paracelsian chemical medicine was set in a mystical-religious context which made it the subject of intense debate among European scholars in most countries from the mid-sixteenth through the end of the seventeenth centuries. The result was a gradual evolution of a «Chemical Philosophy» of nature. The situation differed in Spain. Here the religious views of Paracelsus were looked on first with suspicion and then with horror. The 1585 issue of the Spanish *Index* called for the expurgation of only a few passages of his lesser work on surgery⁶, but, by 1632 Paracelsus was classed as a Lutheran, practically all of his work were forbidden, and he was placed in the «Prima classis auctorum damnatae memoriae, quorum opera edita, et edenda sunt prohibita». Only one rather short and relatively unimportant Paracelsian work by Llorenç Coçar was published at Valencia in 1589⁷ and then — although heated Paracelsian debates were taking place in Paris, London and the major cities of Central Europe — the conservative medical faculties of Spain were silent, well content with their Galenic tradition.

Not until the period of Don Juan of Austria do we find a revived interest in chemical medicine in Spain⁸. But having avoided the debates over the mystical philosophy and the medical innovations of Paracelsus that had aroused the anger of most European Galenists for the past century, the Spanish medical community was presented with a chemical medicine drawn chiefly from the works of recent authors such as Thomas Willis (1621-1675) and Franciscus de la Boë Sylvius (1614-1672) whose views were associated with the «new philosophy». The Paracelsian origins of this medical sect were not clearly evident to those who saw in iatrochemistry a new observational and experimental answer to medical tradition.

Don Juan appointed and supported these «new» physicians who rejected scholastic tradition and had joined iatrochemistry with an interest in the concept of the circulation of the blood and the scientific methodologies of Bacon and Descartes. One of the first of these reformers was Juan Bautista Juanini (1636-1691) who utilized current iatrochemical thought as a basis for the new medicine in a series of books beginning in 1679. More striking was the *Carta filosófica, médico chymica* (1687) of Juan de Cabriada which pointed to Spain's backwardness in the sciences and called for the adoption of the new chemical medicine, the building of laboratories, and the establishment of a Royal Academy of Science⁹.

Cabriada's book initiated a decade of debate between the supporters of tradition and those who demanded reform. The latter successfully separated their «new» chemical medicine from the theologically tainted name of Paracelsus. Thus, in the *Verdadera Apologia en Defensa de la Medicina Racional Philosophica* ... (1690) Diego Mateo Zapata wrote of the «Chemicos, ò Modernos» who were to be distinguished sharply from others

incapazes de razon, hechizeros, sortilegios, magos, y sycophantas que suplè con los illicitos diabolicos tratos, y comercios, lo que les falta de sabiduria, como se viò en el infame Heresiarca de los Chemicos Paracelso, y sus sequazes, cuyos nefandos escriptos detextò, y prohibiò justissima mente el recto de la Santa Inquisicion, y à todos los que siguen, apoyen, y professan sus falsas dogmas, y Diabolicas, Doctrinas, como consta del Expurgatorio del año de 40 ...¹⁰.

Here he referred to the 1640 edition of the *Index*. At a time when even the most recent iatrochemical views seemed to be suffering a gradual decline throughout Europe it is interesting to see how well they were

defended and made the basis of the new scientific movement in Spain. And if Cabriada and his friends failed in their bid to establish a Royal Academy of Medicine and the Natural Sciences, they did witness the establishment of the «Regia Sociedad de Medicina y otras Ciencias» in Seville in 1697.

But scientific development is seldom simple progress. Early in the new century Miguel Marcelino Boix y Moliner (b.c. 1646) sought to reestablish medicine on Hippocratic principles. In his *Hippocrates defendido* (1711) he painted a scene in which physicians of each major medical sect sought to cure a patient. Here the chemists, pictured as followers of Paracelsus and van Helmont, debated with Galenists, Iatrophysicists, and Cartesians and it was left to the follower of Hippocrates to lead the others to truth¹¹.

Nor with the advent of a reformed medicine did interest cease in the occult. Hernando Castrillo's mid-seventeenth century *Historia, y Magia Natural, ò Ciencia de Filosofia Oculta* (1643) was reprinted in 1692 and again in 1723. Here the reader was informed that «... el Arte Magica es absolutamente Ciencia, que procede en gran parte con principios evidentes, alcançados à conocer con la observacion y experiencia, que suele ser madre de la ciencia»¹². This fundamental knowledge was first communicated to Adam and is concerned with the discovery of the secrets implanted on earth by the Creator. Castrillo, a member of the «Compañia de Jesus», was careful to point out his interest in the propagation of the faith.

Nor had alchemy yet lost its appeal. The *Open Entrance to the Shut Palace of the King*, an esoteric tract ascribed to one Eiraeneus Philalethes which had been read with care by Isaac Newton was translated into Spanish as part of *El Mayor Tesoro* in 1727. Included were letters from a Theophilo to an unnamed physician of Seville and a six part introductory tract on the possibility of metallic transmutation¹³.

Thus, as one might expect, the chemistry of late seventeenth- and early eighteenth-century Spain offers a complex mix reflecting many contemporary themes in the literature. On the one hand the new iatrochemists consciously referred to their ties with Harvey, Bacon and Descartes as well as with Willis and Sylvius. It is understandable that they sought to dissociate themselves from the work of Paracelsus. On the other hand remnants of Renaissance natural magic and alchemy

are to be found as well. All of these strands are to be found in the works of Francisco Suarez de Rivera and the Portuguese authors of the early eighteenth century.

THE PORTUGUESE SCENE

Our view of the state of the sciences in Portugal in the eighteenth century has been strongly influenced by the reports associated with the educational reforms of the Marquis of Pombal. This was a period of anti-Jesuit feeling throughout Europe and most Portuguese education was administered by the Jesuits at this time. The University of Évora, a Jesuit institute, was closed in 1758 and its curriculum was criticized as being badly out of date. One author noted that there was

Nothing of Newton, of Gassendi, of Descartes; the fathers of the University had never seen the works of Wolf, Leibniz, Verney, Locke, Malebranche, Boyle and many others who in their time wrote with such taste and criticism. I never saw a philosophical history, ancient or modern. I found only one philosophical or mathematical dictionary; whence I plainly perceived that these men could not know, nor did not know anything because they had no books¹⁴.

In 1759 a system of free grammar schools was established throughout the country and a new curriculum was established for these schools¹⁵. As one of the oldest and most prestigious universities in Europe, the University of Coimbra presented a special problem. Coimbra also had a history of Jesuit control and a study of the state of the university was prepared at the request of the Marquis of Pombal. The resulting *Compêndio Histórico do Estado da Universidade de Coimbra* was published in 1771 and here the authors pointed to a decline in all of the disciplines under the Jesuits. Considerable attention was given to medicine and to related sciences in this report. They wrote that although Portugal had trained world famous physicians in the sixteenth century that this was no longer the case¹⁶. Much of the blame was placed on the inadequate language training in the Portuguese universities. It was for this reason that students had left for Salamanca, Alcalá, Paris and Bologna where the languages flourished¹⁷. And in the course of the seventeenth century the importance of chemistry for medicine had been established in other

countries. But although Boerhaave's *Elements of Chemistry* was now taught in conjunction with the standard medical training elsewhere, such was not the case in Portugal. And who did teach the fruits of the new philosophy?, — the works of Bacon, Descartes, Gassendi, Galileo, Basson, Boyle, Pascal, Newton, Halley, Leibniz and Wolf¹⁸ — no one. Our medical students must read these authors as well as Harvey, Malpighi, Borelli, Pitcairne, Sydenham, Baglivi and Boerhaave¹⁹. They continued noting that today all Europe benefits from the influence of those who have reformed natural philosophy. But our Jesuits have chosen to defend Aristotle and they have prohibited the Cartesian philosophy as heretical²⁰.

Only a few years earlier António Nunes Ribeiro Sanches had published his *Método para aprender a estudar a Medicina* (1763) in which he sharply criticized the current state of medical instruction at Coimbra. He recognized that the most up to date medical teaching in Europe was associated with the work of Boerhaave at Leiden and his many disciples who had carried his system to other universities²¹. Ribeiro Sanches was convinced that medical students should be exposed to the humanities²² as well as the sciences and he was specific in regard to textbooks. Thus the student taking physics should read Peter Van Musschenbroek's *Elementa Physicæ*²³ while the courses in chemistry should require either Boerhaave's *Elementa Chemiæ* or Hoffmann's *Observationum Physica Chemicarum*²⁴. Offering a sample curriculum for medical students, Ribeiro Sanches called for required courses not only in chemistry, but also in the history of medicine²⁵.

The stage was set for reform. King Joseph I ordered Pombal to proceed to Coimbra as Lieutenant General of the University and to carry out the needed reforms²⁶. He acted quickly expelling some professors and appointing others. In the new Statutes of 1772 he instituted the faculties of mathematics and the Natural Sciences and ordered the building of an astronomical observatory, laboratories — including the historically significant Chemistry laboratory, the botanic garden and the Natural History Museum²⁷. It was an impressive achievement worthy of the best of the period of Enlightened Despotism.

PORTUGUESE CHEMISTRY IN THE EARLY EIGHTEENTH CENTURY

Given the sweeping nature of these reforms it is little wonder that relatively little attention has been given to the sciences in Portugal prior to the last quarter of the eighteenth century. However, if we look at the books published by Portuguese authors in the period before the reforms we see a state of the sciences that is in many ways reminiscent of Spain. There certainly was an awareness of the new science. João Marques Correa, «Medico formado» and graduate of the University of Coimbra, had published his defence of the circulation of the blood in 1735²⁸. It was republished in 1761, just two years prior to Ribeiro Sanches' work on medical education. No less interesting is Jacob de Castro Sarmiento (1691-1760), a member of the Royal Society of London, who published extensively on medical subjects. Perhaps more important is the fact that he presented Newtonian physics to Portuguese readers in 1737²⁹.

With these authors we have no indication of the influence of Paracelsian or chemical thought. Nor do we see this a century earlier in the work of the famed Abraham Zacutus, «Lusitanus» (1575-1642)³⁰. And although Walter Pagel has shown that Estêvão Rodrigues de Castro (1555-1637), the «Phoenix of Medicine», was a Paracelsian, his basis for this judgment depended less on any chemical interest to be found in his work than on his mystical world view³¹.

To be sure, an acceptance of the Macrocosm-microcosm universe was persistent. It is still to be found in Brás Luís de Abreu's (1692-1756) massive *Portugal Medico ou Monarchia Medico-Lusitana* (1726) which was also to include a section on medical magic³². Nor was alchemy yet forgotten in the eighteenth century. An otherwise obscure Doctor of the University of Coimbra and a Familiar of the Holy Office, Anselmo Caetano, discussed the philosophers' stone and the possibility of metallic transmutation in his *Ennæa* (1732)³³. In his text he drew heavily on both the critiques of Benito Jerónimo Feijóo Montenegro (1676-1764) in his then recent *Theatro critico universal* and also the older *Mundus subterraneus* of the Jesuit polymath, Athanasius Kircher (1602-1680).

But it is in the realm of pharmacy that we see the most conclusive evidence of the acceptance of chemistry among Portuguese physicians. In addition to a two volume *Historia das Plantas da Europa e das*



Mais Uzadas que vem de Asia, de Affrica, & da America (1718) Joam Vigier prepared a *Thesouro Apollineo, Galenico, Chimico, Chirurgico, Pharmaceutico* (1714)³⁴. More important for the history of chemistry is his *Pharmacopea Ulissiponense, Galenica, e Chymica* published at Lisbon in 1716. Here the fifth part described chemical medicines and the author included a short chemical primer with definitions and a discussion of the five chemical principles (mercury, salt, sulphur, phlegm and earth)³⁵. There is a chart of chemical symbols and practical directions on the use of the fire, luting and the types of furnaces. The work is embellished with six folding plates depicting furnaces, distillation equipment and glassware of all types. Although much shorter, this work by Vigier is a faithful reflection of the chemical textbooks of Lemery and others that had developed in France in the course of the seventeenth century.

More ambitious is the *Pharmacopea Tubalense Chemico-Galenica* (1735, 1760) of Manoel Rodrigues Coelho (b. 1687). Here, too, we meet with a theoretical introduction in which the author discussed the origin of the word chemistry and the belief of chemical philosophers that the principles are spirit (mercury), sulphur (oil), salt, earth and water³⁶.

Coelho divided medicine into three parts, «Diatheutica, Cyrurgia e Pharmácia». Pharmacy, in turn, had two parts, Galenic and chemical. He described the latter as

He a que ensina, e dà fundamentos para conhecermos, e especularmos de que partes, ou substancias se compoem os corpos naturoes, a separação, e resolução das partes puras, das impuras, e crassas, e fazer medicamentos mais exaltados, e essenciaes, mais breve, Pharmacia Chimica, he que os Modernos exercem, como muy essencial para elaboração, e preparação dos medicamentos³⁷.

A folio volume of nearly one thousand pages, this book describes a great number of chemical processes and preparations. Coelho was clearly influenced by the pharmacopeia of Nicholas Lemery and his work has an added interest in his discussion of medicinal preparations to be made from products obtained from Portuguese possessions in South America, Africa and South East Asia.

João Curvo Semmedo (1635-1719) was also interested in medicinal substances obtained from the colonies³⁸ and he was to achieve an international reputation through translations of his work made into Spanish, Italian and French. A Lisbon physician and a familiar of the Holy Office, Curvo published his vast *Polyanthea Medicinal. Noticias Galenicas, e*

Chymicas in 1697. There were at least four editions to 1727. This work may be characterized primarily as a chemical pharmacopoeia with a first part on vomitories, a second on the use of antimony in medicine, and a third treatise on «chemistry and the many fine remedies prepared by it».

At the beginning of the section on chemistry Curvo discussed the education of a physician³⁹. No less than Ribeiro Sanches sixty years later, Curvo insisted that a student of medicine must be trained in all subjects. He must study music, poetry and arithmetic and he must know anatomy in order to understand the proper virtues of herbs, metals and minerals. Indeed, this means that the physician should understand the meaning of a chemical anatomy, or anatomy by fire, as well as the gross anatomy of the human body⁴⁰.

Although no reference is made to Paracelsus, Curvo directs the reader to the many works of his disciples Crollius, Ruland, Porta, van Helmont, and Beguin. There is also to be found in the work of Curvo a lengthy discussion and defence of the circulation of the blood⁴¹.

FRANCISCO SUAREZ DE RIVERA (c. 1680-1754)

As a connecting link between the chemical medicine of Portugal and Spain we may turn to Francisco Suarez de Rivera who studied at the University of Salamanca and received his doctorate in medicine in 1711⁴². He practiced in Seville and other cities in Spain before moving to Madrid where he became a physician to the nobility and the royal family. Suarez published more than forty books between 1718 and 1751, a total of some fifteen thousand pages. These works are all medically oriented and range from clinical observations to botanical texts and discussions of anatomy. Although Suarez' medical theory was basically Galenic, he was an eclectic and he sought information from authors representing all medical sects. He was careful to cite his sources and while he had read the best medical authorities from all countries of Europe, he made a special point to refer to the works of Iberian physicians⁴³. He was proud of his membership in the Regia Sociedad Medico-Chymica of Seville and by the date of his final book published in 1751 he added to his affiliations his membership in the Real Academia Medico-Porto-Politana Portuguesa⁴⁴.



Suarez had clearly read the work of Paracelsus and he openly approved of the fact that he had written in German rather than in Latin. After all, the ancients had written in Greek and the Arabs in Arabic. These were their native languages. Why should they not use them? For the same reason he defended his own use of Spanish and he called for more translations for better understanding.

No impide el que la Medicina se comunique à otros Reynos, aunque su Autor la escriba en lengua Francesa; ò en la Anglicana, ò en la Portuguesa, &c. Sirva de exemplar el Curso Chimico, que escribió Nicolàs Lemerì, pues no faltò en nuestra Corte vn Palacios, que la traduxo en Castellano. Sirvan también de exemplar todas las Obras, que hasta aora he sacando al publico; pues estando en nuestra idioma, se hán traducido yà en lengua Portuguesa, para vtilidad de aquel Reyno ...⁴⁵.

For Suarez the works of Paracelsus deserved study by physicians whether or not they had been condemned by the Inquisition.

Si Paracelso trae supersticiones, y remedias inventadas por Cacodemon, y aprendidos de los Nigromanticos, no es para mì; porque este punto pertenece al Santo Tribunal de la Inquisicion, quien tiene tachadas, y reprobadas algunas proposiciones, para que emendados de ellos sus escritos puedan correr libremente, y aprovecharse de su Doctrina Paracelsistica, considerandola util para la salud publica⁴⁶.

In fact, Suarez cited Paracelsus and his best known disciples.

Suarez placed great emphasis on the importance of the new «Phylosophia Experimental» and noted that «Quatro son las partes necessarias para hacer con acierto la investigacion Physica; conviene à saber la *Mathematica*, la *Mechanica*, la *Hydraulica*, y la *Chemica*»⁴⁷. But if chemistry was one of the four pillars of experimental physics, it was even more essential for the physician. How could one understand the circulation of the blood other than in a chemical context?

Este es el circulo de la sangre, movimiento circular, ò circulación, que imita la operacion chimica llamado circulación, por los vasos circulatorios, para mayor espiritualizacion, y otra cosa no se entiende por circulacion, sino el passage de toda la sangre por el corazon, y la buelta à èl, para cuya clara inteligencia se explicará todo lo que contribuye à este doctrina necessaria, y principalmente debe declararse la estructura de el corazon⁴⁸.

Indeed, the importance of chemistry for Suarez is evident no matter what the subject might be. His two most important chemical works are the *Cirurgia Methodica Chymica Reformada* (1722), but with introductory letters dated 1718 which was published first in Portuguese translation the year before — and the *Anatomica Chymica, Iviolable, y Memorabile* (1743). With titles referring to surgery and anatomy the reader might think that these works are primarily of medical content, but such an assumption would be misleading. For Suarez there are two types of surgery⁴⁹. One of these, as expected, is the manual surgery of the person who cuts with a knife and heals with instruments. But a second type of surgery is «Cirurgia Medica o Medico-Pharmaceutica». It is the latter surgeon who learns to cure the sick with medications. Thus surgeons need chemistry to cure wounds and ulcers. These produce an acid which destroys the sulphur or natural balsam. The surgeon trained in chemistry will know how to dissolve the acid through his knowledge of alkalinity⁵⁰.

The relation of chemistry to pharmacy is similar to the relation of anatomy to surgery. Indeed, for sixteenth and seventeenth-century chemists a proper understanding of the word «anatomy» referred to the analysis of mixed bodies. Thus Suarez defined chemistry: «Es Anatomia de las cosas natural, es hecha por el fuego, por cuyo medio tiene virtud de disolver, y coagular los cuerpos naturales, para componer medicamientos gratos, y seguros»⁵¹. Much of the *Anatomia Chymica* is devoted to the use of the «cuchillo chymico», or fire, as a means of analysis and preparation. And in these works Suarez adheres to the three Paracelsian principles, mercury, sulphur and salt⁵².

Suarez' interest in practical remedies did not mean that he rejected some of the more mystical concepts of the period he lived in. He wrote of the great antiquity of magic and of the great magicians of the past. Indeed, Paracelsus was the «grande Medico Magico»⁵³.

... luego con razon debemos afirmar, que de lo dicho se infiere ser la Magia la mas subtil ciencia de la Phisica, que consiste en investigar los phenomenos que en diversos cuerpos naturales se observan, y no solo los naturales, mas tambien los celestes⁵⁴.

Suarez accepted the fact that physicians often hid their secrets and he openly sought the proper formula for van Helmont's universal solvent, the alkahest⁵⁵, for Paracelsus' magnetic or sympathetic powder⁶⁵ and for the true preparation of the *aurum potabile*. He wrote that his

CIRURGIA METHODICA,

E
CHYMICA REFORMADA

SEU AUTOR

O DOUTOR FRANCISCO SOARES DA RIBEYRA
do Gremio, & Claustro da Universidade de Salamanca.

Traduzida de Castellbano em Portuguez

PELO LICENCIADO MANOEL GOMES PEREYRA,

OFFERECER

A' SOBERANA

VIRGEM MARIA,

MAY DE DEOS, E SENHORA NOSSA,

Com o Milagroso Titulo

DE PENHA DE FRANÇA

Seu humilde Escravo

JOSEPH GOMES CLARO,



LISBOA OCCIDENTAL,
Na Officina FERREYRENCIANA.

M.DCC.XXI.

Com todas as licenças necessarias, & Privilegio Real.

«Elixir de Oro» had no corrosive effects on the body since he had made it with a new menstruum, his «Mercurio Philosophico»⁵⁷. Mercury preparations had been in use for the venereal diseases for well over a century, but Suarez argued that mercury metal itself could be administered safely: «El argento vivo se puede dár por la boca à los galicadas, sin peligro: luego el argento vivo se puede administrar por la boca, para curar el morbo galico»⁵⁸.

Suarez wrote of Curvo Semmedo as that «Ilustre Portugués»⁵⁹, and he looked on his books as a most valuable source of medico-chemical secrets. In 1732 he published a collection of seventeen secrets taken from the *Polyanthea Medicinal*. He assured his readers that although it might be difficult to believe that the remedies were really true, that this was indeed the case as «the most wise Curvo shows in his text»⁶⁰. The importance of Curvo Semmedo's *Polyanthea* at this time is underscored by the fact that another collection of his secrets had been translated and published the year before in Madrid by Dr. Thomas Cortijo Herraiz⁶¹. And in 1735 Dr. José Díez de Medina produced his own edition of Curvo's seventeen secrets pointing to the errors to be found in both the earlier Spanish editions of Suarez de Rivera and Cortijo Herraiz⁶².

CONCLUSION

In this very brief survey of the literature of the early eighteenth century we have seen that chemistry was recognized as a significant part of medicine by many physicians and pharmacists in Portugal. The works of Vigier and Coelho reflect the pharmaceutically oriented chemical textbooks of Lemery and other French authors while the *Polyanthea* of Curvo Semmedo attained an international reputation not only for its description of chemically prepared medicinals, but also for its medical secrets.

The connection with Spain is best seen in the case of Suarez de Rivera who was proud that his books been translated into Portuguese and that he had been elected to the Real Academia Medico-Porto-Politana Portuguesa. His interest in the work of Curvo Semmedo is evidenced by the fact that he personally had translated some of Curvo's secrets into Spanish. The medicine of Suarez drew from many sources,

but it is clear that for him chemistry was an essential subject for the study of both natural philosophy and medicine.

Admittedly the research for this paper has concentrated on the early eighteenth century in order to determine the state of Portuguese chemistry prior to the reforms of Pombal. It would, of course, be of great value to study the chemistry to be found in the medical and pharmaceutical works published in Portugal in the seventeenth century. When this work is completed I think that we will find that an interest in chemistry appeared relatively late as it had in Spain—and for the same reason, the fact that the work of Paracelsus was theologically suspect until late in the seventeenth century.

In conclusion we might suggest that if the case of chemistry holds for the other sciences that the state of learning before the Pombalian reforms was not as bleak as suggested by Ribeiro Sanches in 1763 or the authors of the *History of the University of Coimbra* in 1771. It should be kept in mind that the Marquis of Pombal sought not only educational reform, but also to discredit the Jesuits. The official reports were predictably negative. But while it is true that the Portuguese educational establishment did not reflect the newer scientific trends to the extent that they were to be found in other countries during the Enlightenment, it is also true that Portuguese scholars would have had little difficulty finding accounts of recent trends in the sciences in their own language before 1760.

FOOTNOTES

¹ This research is very extensive and there are several bibliographies. Of these one of the most recent is J.M. López Piñero, V. Navarro Brotóns and E. Portela Marco, «Selección bibliográfica de estudios sobre la ciencia en la España de los siglos XVI y XVII», *Anthropos*, 20 (1982), no. 20, 28-36. The standard monographic study is José María López Piñero, *Ciencia y Técnica en la Sociedad Española de los Siglos XVI y XVII* (Barcelona: Editorial Labor, 1979) to which may be added his *La Introducción de la Ciencia Moderna en España* (Barcelona: Ediciones Ariel, 1969). J.M. López Piñero, V. Navarro Brotóns and E. Portela Marco have also prepared a book of source materials in their *Materiales para la Historia de las Ciencias en España: S. XVI-XVII* (Valencia: Pre-textos, 1976). Luis S. Granjel has prepared a four volume history, *La Medicina Española* (Salamanca: University of Salamanca Press, 1978-1981) which runs from antiquity through the eighteenth century and López Piñero, Navarro Brotóns, and Portela Marco have prepared with Thomas F. Glick an invaluable two volume *Diccionario histórico de la ciencia moderna en España* (Barcelona: Ediciones península, 1983). For those seeking a summary of this new research see the two chapters by J.M. López Piñero on «La Ciencia en la España de los Siglos XVI y XVII» in Manuel Tuñón de Lara, Editor, *Historia de España*, volume 5, *La Frustración de un Imperio (1476-1714)* (Barcelona: Editorial Labor, 1982), pp. 357-427 or Henry Kamen, *Spain in the Later Seventeenth Century 1665-1700* (London and New York: Longman, 1983), pp. 311-327.

² Henry Kamen, *Spain 1469-1714: A Society of Conflict* (London and New York: Longman, 1983), pp. 118-120.

³ Kamen, *Spain in the Later Seventeenth Century*, pp. 313, 319.

⁴ *Ibid.*, pp. 328-356 (Chapter 13, «The Regency and Don Juan») and the numerous references to his significance in the books and papers of López Piñero.

⁵ On Paracelsus and his followers see Allen G. Debus, *The Chemical Philosophy: Paracelsian Science and Medicine in the Sixteenth and Seventeenth Centuries* (2 vols., New York: Science History Publications, 1977) and *Man and Nature in the Renaissance* (Cambridge, New York et al.: Cambridge University Press, 1978).

⁶ The problem of Paracelsus and the Spanish Index is discussed in anon., «La Historia de la Ciencia en España como Realidad Marginal en su Organización y Contexto Social», *Anthropos*, no. 20 (1982), 2-15 (4).

⁷ Reprinted with an introduction by J.M. López Piñero as *El «Dialogus» [1589] del paracelsista Llorenç Coçar y la cátedra de medicamentos químicos de la Universidad de Valencia [1591]* in the *Cuadernos Valencianos de Historia de la Medicina y de la Ciencia XX (Serie B—Textos Clásicos)* (Valencia: Cátedra e Instituto de Historia de la Medicina, 1977).

⁸ In addition to the works by López Piñero and Granjel cited above see José M.^a López Piñero, «La Medicina del Barroco Español», *Revista de la Universidad de Madrid*, 11, 479-515; «Paracelsus and His Work in 16th and 17th Century Spain», *Clio Medica*, 8 (1973), 113-141 and «La Iatroquímica de la Segunda Mitad

del Siglo XVII» in Pedro Laín Entralgo, *Historia Universal de la Medicina* (Barcelona and Madrid: Salvat Editores), 279-295.

⁹ See also J.M. López Piñero, «La Carta Filosófica-Médico-Chímica (1687) de Juan de Cabriada, Punto de Partida de la Medicina Moderna en España», *Asclepio*, 17 (1965), 207-212 and another otherwise unidentified paper by the same author titled «Juan de Cabriada y las primeras Etapas de la Iatroquímica y de la Medicina Moderna en España» (paginated 1-30).

¹⁰ Diego Matheo Zapata, *Verdadera Apología en Defensa de la Medicina Racional Filosófica...* (Madrid: Antonio de Zafra, 1690), p. 46. On Zapata see also José Guillermo Merck Luengo, *La Quimiatria en España* (Madrid: Instituto «Arnaldo de Vilanova», 1959).

¹¹ See the review of Miguel Marcelino Boix y Moliner, *Hippocrates defendido* which appeared in two issues of the *Journal des Sçavans* (Amsterdam: Janssons à Waesberg, 1712), 52, 212-228, 276-283. See also José F. Prieto Aguirre, *La obra de Boix y Moliner; historia de una polémica* (Salamanca: Estudios de historia de la medicina española, nueva ser, t. 1, no. 6, 1960).

¹² Padre Hernando Castrillo, *Historia, y Magia Natural, o Ciencia de Filosofía Oculta, Con nuevos noticias de los mas profundas mysterios, y secretos del Universo visible, en que se trata de Animales, Pezes, Aves, Plantas, Flores, Yervos, Metales, Piedras Aguas, Semillas, Parayso, Montes, y Valles... Donde trata de los Secretos que pertenecen a las partes de la tierra* (Madrid: Juan Sanz, 1723), p. 53.

¹³ Aerenaeo Philaletha, Cosmopolita, *El Mayor Tesoro. Tratado del Arte de la Alchimia, o Chrysopoea, que ofrece la Entrada Abierta, al Cerrado Palacio del Rey*, trans. Theophilo (Madrid: Con Licencia, 1727).

¹⁴ H.V. Livermore, *A History of Portugal* (Cambridge: Cambridge University Press, 1947), p. 373.

¹⁵ *Ibid.*

¹⁶ University of Coimbra, *Compêndio Histórico do Estado da Universidade de Coimbra* (Lisboa: na Regia Officina Typografica, 1771; reprinted University of Coimbra Press, 1972), p. 307.

¹⁷ *Ibid.*, p. 308.

¹⁸ *Ibid.*, p. 335.

¹⁹ *Ibid.*, p. 337.

²⁰ *Ibid.*, p. 336.

²¹ António Nunes Ribeiro Sanches, *Método para aprender e estudar a Medicina* (1763) reprinted in *Obras* (2 vols., Coimbra: University of Coimbra Press, 1959, 1966), 1, pp. 2-200 (5).

²² *Ibid.*

²³ *Ibid.*, p. 17.

²⁴ *Ibid.*, p. 58.

²⁵ *Ibid.*, p. 60.

²⁶ John Smith, Esq., *Memoirs of the Marquis of Pombal; with Extracts from his Writings and from Despatches in the State Paper Office, Never Before Published* (2 vols., London: Longman, Brown, Green and Longman, 1843), 2, pp. 165-166.

²⁷ Livermore, *op. cit.*, p. 374.

²⁸ João Marques Carrea, *Tratado Physiologia, Medico-Physico, e Anatomico Da Circulação do Sangue* (Lisboa Occidental: Na Officina de Antonio Correa Lemos, 1735).

²⁹ Jacob de Castro Sarmento, *Theorica das Mares, Conforme à Philosophia incomparavel cavalheiro Isaac Newton...* (London: no publisher given, 1737). It should be mentioned also that King John V tried to bring Boerhaave to the University of Coimbra From Leiden.

³⁰ Abraham Zacutus, Lusitanus, *De Medicorum Principum Historia Libri Sex* (1629) lists the major authors for all branches of medicine. There is no reference to Paracelsus or to the use of chemistry in medicine.

³¹ Pagel based his judgment on his analysis of Castro's *De meteoris microcosmi* (1621). Walter Pagel, *William Harvey's Biological Ideas: Selected Aspects and Historical Background* (Basel and New York: S. Karger, 1967), pp. 94-102.

³² Brás Luís de Abreu, *Portugal Medico ou Monarchia Medico-Lusitana. Historica, Practica Symbolica, Ethica, e Politica. Fundada, & comprehendida No dillatado ambito dos dous Mundos Creados Macrocosmo, e Microcosmo...* (Coimbra: Na Officina de Joam Antunes, 1726), pp. 596-611.

³³ Anselmo Caetano Munho's, *Ennæa, ou Applicação do Entendimento sobre a Pedra Philosophal...* (Lisboa Occidental: Na nova Officina de Mauricio Vicente de Almeida, 1732). I am grateful to the Academia das Ciências de Lisboa for photocopying this rare book from their library for me.

³⁴ Joam Vigier, *Historia das Plantas da Europa e das Mais Uzadas que vem da Asia, de Affrica, & da America...* (2 vols., Lion: Anisson, Posuel & Rigaud, 1718); *Thesouro Apollíneo, Galenico, Chimico, Chirurgico, Pharmaceutico ou Compendio de Remedios para ricos, & pobres* (Lisboa: Na Officina Real Deslandesiana, 1714).

³⁵ Joam Vigier, *Pharmacopea Ulissiponense, Galenica, e Chymica...* (Lisboa: Na Officina de Pascoal da Sylva, 1716), part 5, pp. 281-334.

³⁶ Manoel Rodrigues Coelho, *Pharmacopea Tubalense Chimico-Galenica* (2 parts, Lisboa Occidental: Na Officina de Antonio de Sousa da Sylva, 1735), p. 1.

³⁷ *Ibid.*, p. 3.

³⁸ Joam Curvo Semmedo, *Memorial de Varios Simples Que da India Oriental, da America, & de outras partes do mundo vem ao nosso Reyno* appended to the *Polyanthea Medicina. Noticias Galenicis, e Chymicas* (4th impression, Lisboa Occidental. Na Officina Antonio Pedrozo Galram, 1727).

³⁹ Curvo Semmedo, *Polyanthea Medicina. Noticias Galenicis, e Chymicas* (Lisbon: Miguel Deslandes, 1697), p. 760.

⁴⁰ *Ibid.*

⁴¹ *Ibid.*, p. 777.

⁴² On the life of Suarez de Rivera see the short biography (with references) by J.M. López Piñero in the *Diccionario histórico de la ciencia moderna en España*, 2, pp. 339-341 and the two monographs by Luis S. Granjel, *Francisco Suarez de Rivera: Médico salmantino del siglo XVIII* (Salamanca, University of Salamanca, Cuadernos de Historia de la Medicina Española, Monografías IV, 1967) and José-Luis Valverde, *La Farmacia y las Ciencias Farmaceuticas en la Obra de Suarez de Rivera* (Salamanca: University of Salamanca, Cuadernos de Historia de la Medicina Española, Monografías XIII, 1970).

⁴³ This is done frequently, but see for example, Suarez de Ribera, *Medicina Invencible Legal, O Theatro de Fiebres Intermitentes Complicadas* (Madrid: Francisco del Hierro, 1726), p. 280.

⁴⁴ Suarez de Ribera, *Canones Particulares de Cirugia, con que se Libertan Muchos Desahuciados, si al Sagrado de sus fuentes se Refugian* (Madrid: Manuel de Moya, 1751), title page.

⁴⁵ Suarez de Ribera, *Escrutinio Medico ò Medicina Experimentada* (John Crerar Library copy missing title page, introductory letter dated 1723), pp. 323-324.

⁴⁶ Suarez de Ribera, *Anatomica Chymica, Inviolable, y Memorable* (Madrid: Manuel de Moya, 1743), pp. 21-22.

⁴⁷ Suarez de Ribera, *Clavicula Regulina* (Madrid: Diego Martinez Abad, 1718), p. 19.

⁴⁸ Suarez de Ribera, *Medicina Invencible*, pp. 262-263. On p. 298 he goes on to give a lengthy discussion of a Dr. Botoni on the circulation.

⁴⁹ Suarez de Ribera, *Canones Particulares de Cirugia*, p. 73; *Cirugia Methodica Chymica Reformada* (Madrid: Francisco Laso, 1722), p. 8. Of the many promised Portuguese translations this is the only work by him that I have seen in that language: F. Soares da Ribeyra, *Cirurgia Methodica e Chymica Reformada*, traduzida de Castelhana em Portuguez... Joseph Gomes Claro (Lisboa Occidental: Na Officina Ferreyrenciana, 1721).

⁵⁰ *Ibid.*, p. 136.

⁵¹ *Ibid.*, p. 128.

⁵² Suarez de Ribera, *Anatomica Chymica*, pp. 19-27.

⁵³ Suarez de Ribera, *Amenidades de la Magia Chyurgica y Medica, Natural* (Madrid: Fernandez de Arrojo, 1736), p. 75.

⁵⁴ *Ibid.*, p. 38.

⁵⁵ See Suarez de Ribera, *Ilustracion, y Publicacion de los diez y Siete Secretos del Doctor Juan Curvo Semmedo, confirmadas sus virtudes con maravillosas observaciones* (Madrid: Domingo Fernandez de Arrojo, 1732).

⁵⁶ Suarez de Ribera, *Escrutinio Medico*, p. 271; *Amenidades de la Magia*, p. 73.

⁵⁷ Suarez de Ribera, *Canones Particulares de Cirugia*, sig. ¶¶¶¶ 1^v. See also *ibid.*, pp. 56-72.

⁵⁸ Suarez de Ribera, *Arcanismo Anti-Galico, o Margarita Mercurial* (Madrid: Juan de Ariztia, 1721), p. 200.

⁵⁹ Suarez de Ribera, *Medicina Invencible*, p. 280.

⁶⁰ Suarez de Ribera, *Ilustracion, y Publicacion*, sig. 4^v.

⁶¹ João Curvo Semmedo, *Secretos Medicos, y Chirurgicos... Traducidos de Lengua Vulgar Portuguesa en Castellana* (Madrid: Bernardo Peralta [1731]).

⁶² Dr. Don Joseph Diez de Medina, *Declaracion de los Verdaderos diez y siete secretos de Curvo de la incertidumbre de los publicados por el Doctor Rivera, y de algunos errores, que sobre otros Secretos de Curvo cometió el Doctor Cortijo* (Madrid: Antonio Denferzan, 1735).

THE TREND IN HISTORY AND PHILOSOPHY OF SCIENCE

WILLIAM R. SHEA *

Let me begin by saying that half my half my task has already, and egregiously, been performed by my friend and colleague Professor Allen G. Debus. In his lecture on «The History of Science Today» to the Academia das Ciências de Lisboa he showed how recent history of science shifted from a narrow positivism to a much broader and more comprehensive study of what science meant at various periods in the history of mankind¹. I agree with his analysis of the situation and I should like to extend to the philosophy of science the historiographic and conceptual tools that he used so deftly and accurately in his assessment of a new spirit of historical rigour and epistemological tolerance in the history of science.

Allow me to first recall that the mainstream of the philosophy of science in the second quarter of this century — the so-called «logical empiricist» or «logical positivist» movement — assumed that theoretical language in science is parasitic upon observation language and can be eliminated from scientific discourse by disinterpretation and formalization, or by explicit definition in or reduction to observational language.

In the present paper, I propose to show why logical positivism failed to do justice to the basic empirical and logical problems of philosophy of science. I also wish to consider why the drastic reaction, typified by Thomas Kuhn and Paul Feyerabend, fails to provide a suitable alternative, and to suggest some approaches that may hold out a genuine promise of dealing effectively with the central tasks that face the philosopher of science today.

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