

FROM PARACELSUS TO NEWTON
MAGIC AND THE MAKING OF
MODERN SCIENCE

CHARLES WEBSTER

*The Eddington Memorial Lectures
Delivered at
Cambridge University
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The Eddington Memorial Lectures

FROM PARACELSUS TO NEWTON
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THE EDDINGTON LECTURESHIP

Sir Arthur Stanley Eddington, O.M., F.R.S., Plumian Professor of Astronomy at Cambridge 1913–44 was one of the greatest astronomer-mathematicians of his day. He was not only world famous as an astronomer but also as a brilliant exponent of the new developments in physics and cosmology. Two of his best-known books, *Stars and Atoms* and *The Nature of the Physical World*, were, between them, translated into twelve different languages. He was also a profound thinker; in religion and ethics as in science. His Swarthmore Lecture, *Science and the Unseen World* was deservedly one of the most valued and widely read of the series. It was produced in French, German, Danish and Dutch editions.

Eddington was a life-long Quaker; and on his death the Society of Friends, in order to provide for an annual lecture in his memory, established (as the result of a widely supported appeal for funds) a Trust with four Trustees; one each to be appointed by the Royal Society and Trinity College, Cambridge (of which Eddington was a Fellow for thirty-seven years) and two by the Society of Friends.

The scope of the lectureship, which has remained unchanged since the foundation in 1947, is as follows:

The lectures are to deal with some aspect of contemporary scientific thought considered in its bearing on the philosophy of religion or on ethics. It is hoped that they will thus help to maintain and further Eddington's concern for relating the scientific, the philosophical and the religious methods of seeking truth and will be a means of developing that insight into the unity underlying these different methods which was his characteristic aim.

Man's rapidly increasing control over natural forces holds out prospects of material achievements that are dazzling; but unless this increased control of material power can be matched by a great moral and spiritual advance, it threatens the catastrophic breakdown of human civilisation. Consequently, the need was never so urgent as now for a synthesis of the kind of understanding to be gained through various ways – scientific, philosophical and religious – of seeking truth.

In recent years it has become the custom of the Trustees to ask a distinguished scholar to deliver a short course of lectures which can then form

the basis of a subsequent book. In the Michaelmas Term, 1980, this task was undertaken by Dr Charles Webster of the Wellcome Unit for the History of Medicine in the University of Oxford. It is a pleasure now to see his clear and learned account of the interpenetration of magic and mechanism from Paracelsus to Newton, to which we listened with such pleasure, being made available in a fuller form to a wider public by the publication of this monograph.

Trinity College, Cambridge
5 March 1982

J.C. Polkinghorne
*Chairman of the Eddington
Trustees*

TO JOSEPH NEEDHAM AND WALTER PAGEL

All things began in order, so shall they end, and so shall they
begin again, according to the ordained order and mystical
mathematicks of the city of heaven. *Garden of Cyrus*

PREFACE AND ACKNOWLEDGMENTS

The essays contained in this volume comprise a slightly modified version of the Eddington Lectures delivered in Cambridge in the autumn of 1980. The broad survey treatment of the original lectures has been maintained. Notwithstanding amplification of certain points in the published version, it is hoped that the spirit of the original lectures has been preserved. In the course of revision I have also tried where relevant to take account of literature published in the first half of 1981.

This short book is respectfully dedicated to Joseph Needham and Walter Pagel, both of whom have assisted the author in many different ways over the last fifteen years. These two scholars were drawn together by the events of the thirties, when, at Cambridge, they played an important part in pioneering the history of science. They became respectively chairman and secretary of the committee formed to promote the history of science in the University. Sir Arthur Eddington was one of the contributors to the volume of essays based on the first lecture series delivered under the auspices of this committee in 1936. The aims which Needham and Pagel expressed for the history of science in their introduction to this volume (*Background to Modern Science*, Cambridge, 1938), remain acceptable to many of us writing today. With respect to the present essays it is particularly noteworthy that Needham and Pagel have worked to broaden the base of the history of science by relating the process of discovery to the cultural environment in which science was prosecuted. They have also secured a new level of respect for the cultural values of renaissance natural philosophy, much of which was hitherto disregarded as irrelevant to the main currents of scientific thought. Among the benefits of their methods there emerged a much fuller appreciation of the religious motives of science. This latter theme is pertinent to the remit of the Eddington Lectures.

The author would like to express sincere thanks to the Eddington Trustees for their courteous hospitality, to Renate Burgess and William Schupbach for advice concerning illustrations, to Margaret Pelling for comments on the text and for editorial assistance, to Jean Loudon for invaluable typing assistance, and to Jonathan Barry for preparing the index. The author's many other debts to good friends will be evident from the notes to the text.

In quotations in the text standard contractions have been expanded,

and in a few cases obvious errors have been silently corrected. Italicization in the originals has been omitted.

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1 INTRODUCTION

One of the chief effects of the history of science as the subject has developed in the present century has been to drive a wedge between the cultures of Paracelsus and Newton. It may even seem like an act of perversity or lapsed historical judgement to bracket together the names of Paracelsus and Newton in the title of a book. By convention the two are regarded as inhabiting entirely discrete intellectual worlds. Our image of Newton is firmly associated with the values of the Enlightenment and the modern world, whereas the name of the enigmatic and inaccessible Paracelsus conveys alien associations of a tortured mind wrestling unsuccessfully to escape from the labyrinths of the dark ages.

Accounts of the 'Scientific Revolution' or 'Mechanization of the World Picture' have understandably concentrated on the appealing story of technical and conceptual innovation. As a natural adjunct to this operation, there is a tendency to generalize the distinctions between the dark age of pre-Copernicanism and the Enlightenment of Newtonianism. The remarkable extent of progress at the descriptive level in the sciences is thought to be correlated, and at least partly explained, by a similar transformation at the conceptual level. Often unwittingly, processes of selectivity have operated tending to highlight modern elements in the thought of Newton's generation, while discreetly allowing anything of a contrary nature to fall into the background. On the other hand, with respect to the generation of Paracelsus, there is a tendency to concentrate on credulity or vain respect for the authority of antiquity, while overlooking the wide evidence of critical analysis and independent judgement. By this means we have come to accept an almost perfect correlation between the rise of science and the decline of magic. Indeed the growth of the scientific movement is regarded as one of the primary manifestations of the demystification of the worldview occurring in the course of the seventeenth century. The above construction has its heroes and casualties. Newton is the premier hero, and Paracelsus is arguably the major casualty.

It is not the intention of the present essays to question the idea of the progress of science at the technical or descriptive level. According to separate, acceptable, and clearly defined criteria each of the natural sciences can be shown to have advanced, often in a spectacular manner, over the period between Paracelsus and Newton. It is also not my intention to suggest that there was nothing new in the new philosophies. But it

is clear that there were remarkable elements of continuity sufficient to indicate an important degree of contiguity between the worldviews of the early sixteenth and late seventeenth centuries.

Paracelsus and Newton were not subsisting in intellectual worlds completely alien from one another. Both Paracelsus and Newton regarded assurance of personal salvation as their absolute priority. The working-out of the nature of humanity's relationship with the creator constituted their primary intellectual mission. Paracelsus contributed to the stream of reformation theology in which Newton was immersed. Among their contemporaries Neoplatonism was as much a vital force in the late seventeenth as in the early sixteenth century. Newton's acculturation occurred in the context of the ascendancy of the Cambridge Platonists. The situation at Cambridge represented a remarkable late echo of the Florentine Platonism of the renaissance, both schools being characterized by an intensity of fidelity to the spirit of ancient theology and philosophy.¹ The self-evident impact of Neoplatonism in England after 1660 should discourage any attempt to describe science at the time of the Royal Society in terms of the unquestioned dominance of the 'mechanical philosophy'.

The late revival of Neoplatonism in the seventeenth century and the eager absorption of this philosophy by the *avant garde* also brings into question the characterization of seventeenth century science in terms of the ascendancy of the 'moderns' over the 'ancients'. Paracelsus and the Neoplatonists were 'moderns' to the degree that they opposed the authority of scholasticism in theology and science, but 'ancients' in the manner of their adoption of a source of wisdom more venerable than scholasticism. The revolution towards which they worked was firmly rooted in the search for means of reviving the wisdom possessed by Moses, or Adam before the Fall.

Despite his celebrity as the conqueror of the ancients and founder of the propaganda platform of the new science, Francis Bacon also acknowledged a philosophical ancestry among the pre-Socratics and based his whole approach on the scriptural idea of return of man's dominion over nature, which was finally to counteract its sacrifice at the Fall. It is an interesting paradox that the very first manifesto in the ancients versus moderns controversy attacked the *modern* Galenic establishment and singled out Paracelsus as the reviver of *ancient* knowledge.²

This mode of representing modern science was purposely designed to appeal to the mentality of an age accustomed to the rhetoric of reformation theology, with its stress on the return of the church to the primitive purity of the early church fathers and more distant appeals to the model of the children of Israel. The famous defence of the moderns in *The History of the Royal Society* (1667), in openly drawing comparisons between the

new science and the reformed church in England, represented nothing more than the application of a trusted tool which had been resharpened after long use by Francis Bacon and which was originally ground and honed to a fine edge by Paracelsus.

An important distorting element has been introduced into accounts of the rise of modern science through underestimation of the degree to which authors like Paracelsus, or authors belonging to the tradition of Neoplatonism or hermeticism, remained an integral part of the intellectual resources of the educated elite into the late seventeenth century. The magnitude of evidence indicative of the tenacity of interest in philosophies running contrary to the mechanical philosophy is so great that the only way of accommodating this vast anomaly has been to separate the leaders of science – judged representative men of their age – from the unrepresentative and more gullible majority. It is unfortunate for any proponent of this line that figures of outstanding importance, including Newton himself, turn out to display a lively interest in the occult. The only means of saving the phenomenon in this case is to adopt the unconvincing device of postulating a split personality for the scientists convicted of lapsing from consistent practice of the enlightenment ideal.

It is more realistic to come to terms with the persistence of the influence of figures such as Paracelsus, and to recognize that ideas falling into the non-mechanist tradition were not necessarily regarded by the scientists of later generations as the relics of an outmoded and scientifically unproductive dark age. Only recently have historians of science, largely upon stimulus from the outside, begun to appreciate the disadvantages to their craft of writing such figures as Paracelsus out of history.

It is particularly useful to take the example of Paracelsus because he is one of the principals from the pre-Copernican period thought to have least in common with the scientists of the late seventeenth century. We have been too prone to take at face value the image of Paracelsus as a deranged drunkard which derives almost entirely from a single, prejudiced pen, that of Johannes Oporinus.³ The emotive violence directed against Paracelsus in the sixteenth century tends to be replaced in the modern literature by derision, even in the case of distinguished authorities as diverse as R. Lenoble and D.P. Walker.⁴ It should be remembered that Oporinus's attempt to discredit Paracelsus on behalf of the humanists was totally unsuccessful at the time, and his letter should not be allowed to blind us to the virtually unimpeded rise of the influence of the medical reformer.

The degree to which Paracelsus stirred up the passions of his opponents is a measure of his success in sabotaging efforts aimed at permanently establishing the authority of Galen in the field of medicine. Thus the first

major confrontation of the Scientific Revolution was between Paracelsus and Galen, rather than between Copernicus and Ptolemy. The significance of this confrontation was evident to contemporaries. In planning the first general history of medicine Le Clerc unhesitatingly placed Paracelsus at the beginning of the movement aimed at breaking completely with antiquity and constructing a completely new form of medicine from first principles. The respected sixteenth-century chronicler, Daniel Specklin, regarded the year 1517 as one of particular importance in the cultural history of Europe, marked by the efforts of Luther, Paracelsus and Dürer.⁵ Paracelsus became known as the Luther of medicine, just as Kepler was to call himself the Luther of astrology. The comparison between Luther, Paracelsus and Dürer gains added weight from their combination of special interests and broader-ranging cultural concern.

Paracelsus was never regarded as a purely medical author. His speculations embraced every facet of the sciences and, like Newton, his biblical commentaries and religious works were both great in bulk and highly esteemed by their author, in comparison with his other writings. As far as Paracelsus was concerned, man and the cosmos were analogues which were inseparably linked. The study of man the microcosm was unthinkable without an appreciation of his place in the physical and spiritual macrocosm. What Paracelsus termed 'astronomy' always found a central place in his accounts of his medical system. This bias is reflected in the title of the major work of his maturity: *Astronomia Magna oder die Ganze Philosophia Sagus der Grossen und Kleinen Welt* (1537/8). Thus, although Paracelsus regarded his primary practical goal as the reform of medicine, his religious standpoint, repeated use of the microcosm-macrocosm analogy, and recognition of the powerful effects of the celestial environment on man, constantly threw him back into the fields of cosmology and cosmogony.

In asserting that the foundations of medicine lay in philosophy, astronomy and alchemy, Paracelsus was in line with an entrenched position established by medieval Arabic and Jewish medical authorities, and reflected in the prevailing bias of the medical education of his day. Natural philosophy and mathematics were taught as an appendage of medical education; astrology was a standard component of medical studies; alchemy occupied a small niche in the study of pharmacology. At the time of Paracelsus astrological treatises poured in abundance from the medical schools of Europe. Leading astronomers and cosmologists of the renaissance were educated as physicians; the two avocations were compatible and partly interchangeable. Rheticus was a successful physician. Copernicus studied medicine at Padua; Copernicus and Tycho Brahe

cherished their skill as amateur medical practitioners. Even Kepler needed to resist pressure to devote himself primarily to the practice of medicine.

Paracelsus shared the traditional priorities, but his conception of philosophy, astronomy and alchemy was sharply different from that practised by the Arabs or in the schools, and he set out to refute most of what was customarily taught as the foundation for medical theory. His approach was thin on the technicalities of astronomy, but to a greater degree than his fellow astronomers he sketched out all aspects of the system, thus explaining the basis of interaction between the human, terrestrial, and celestial spheres. This desire for consistency and comprehensiveness persisted as a background concern for future generations of scientists. It remained important to Newton that his gravitational theory should be consistent with evidence concerning the workings of the terrestrial and human microcosm, and ideas from these latter areas were allowed to influence his thinking on metaphysical issues in general. It was unacceptable to Newton, as it had been to Paracelsus, to adopt physical principles at variance with evidence deriving from chemistry or physiology.

In view of the wide-ranging nature of his speculations it is not surprising that the influence of Paracelsus was felt well beyond the confines of medicine. His attraction to reformers was undiminishing. The influence of Paracelsus is evident in the cases of John Dee and Thomas Mouffet, two of the more adventurous and cosmopolitan English natural philosophers in the generation before Bacon.⁶ Dee, even during the early, mathematical stage of his career, was collecting the works of Paracelsus with obsessive zeal. Mouffet interrupted his medical education at Cambridge to study among the Paracelsians at Basel, and declared Paracelsus to be the new Hippocrates. Mouffet managed to combine his aim of promoting Paracelsus with the more conventional task of completing Gesner's great *Historia Animalium*.

Gesner himself had regarded his fellow countryman Paracelsus with a mixture of admiration and fright, but the next generation, having access to the full body of posthumous works interlaced with beguiling spurious items, welcomed Paracelsus into the ranks of the philosophical reformers. The Paracelsians now became influential court physicians and philosophers. Three of this group, Petrus Severinus, Michael Sendivogius, and Oswald Croll, produced much-needed and accessible expositions of the ideas of Paracelsus, which greatly extended the philosophical life of their hero. Their primers remained actively consulted into the late seventeenth century. Severinus's *Idea medicinae philosophicae* (1571), Sendivogius's *Novum lumen chymicum* (1614), and Croll's *Basilica*