The First Professional Scientist: Robert Hooke and the Royal Society of London by Robert D. Purrington

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This slender work has a non-slender price which it fails to justify. The notes (here quaintly called 'annotations') are placed in the most useless and inconvenient place possible at the end of each chapter. There is a goodly sprinkling of misprints; while infelicities of phrase, inconsistencies of statement, and omissions from the bibliography reveal that the text has not been competently copyedited. The paperboards are less than robust. After a few days of traveling in a briefcase for reading on trains, the book looks distinctly battered.

All this would hardly matter if the content were distinguished, but Robert Purrington has written a curious book. His Robert Hooke is a man who was eclipsed during his lifetime by Newton and then forgotten for nearly three centuries before being resuscitated in the mid 20th century to become 'nearly *fashionable*' during the last two decades. This, to say the least, is a highly over-simplified view of the trajectory of Hooke's reputation. If he was eclipsed by Newton, that eclipse took place after Hooke's death in 1703, not during his lifetime. Indeed it was Hooke's persistent and essential presence in the Royal Society, a presence that Purrington takes pains to underline, that led Newton largely to ignore the Society during the first seven and half years that he lived in London. Although, as president from 1703, Newton could apparently not abide even the mention of Hooke's name, this did not prevent Hooke's posthumous works from being published with a life by Richard Waller, a close friend of Hooke and joint-secretary of the Royal Society [Waller 1705], ironically with a dedication to Newton. In 1726, a selection of Hooke's philosophical papers was published [Derham 1726] and a further life in 1740 [Ward 1740]. That Hooke's writings and his ideas about nature had

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diminishing usefulness in the course of the 18th and 19th centuries is surely the case, but the man himself was not forgotten. His life was included in the 1721 edition of the *Athenae oxoniensis* [Wood 1721] and in the *Biographia Britannica* [1747–1766, vol. 4]. As Purrington underlines, Hooke's role in the Royal Society was clearly revealed in Birch's close transcription of the Society's journal books [Birch 1756] and neither was he forgotten in 19th-century histories of the Society [e.g., Weld 1848]. Thereafter, rather little was published about him [see Keynes 1960, app. 3] for the best part of a century, although this is true also of most of the early members of the Royal Society. Hooke indeed seems exceptional for the amount of material that was published about him.

Purrington, however, needs Hooke and his role in the Royal Society to have been neglected in order to validate his own work. After a summary of studies of Hooke produced from 1930 onwards,[1] he can nonetheless write 'But for most of the twentieth century Hooke has been ignored—indeed it could be said that Hooke's eclipse *has been his identity* (to paraphrase Adam Gopnik)' [xv]. The remark is breathtaking but unfortunately representative of the lack of historical understanding betrayed throughout the book. The historiography of Hooke's reputation is presented in isolation. No comparison is made with that of other contemporary members of the Royal Society (except Newton) and we are thus given a false picture of an unduly neglected figure. In fact, Hooke has been far better known in the last three centuries than men such as Laurence Rooke, William Ball, or even Brouncker and Moray, all founding members of the Society and socially more prominent than Hooke.

Hooke's reputation needs to be considered in the context of the historiography of the sciences in general just as Hooke's intellectual life needs to be presented in the general context of late 17th-century activity. Throughout the book, however, Purrington makes no effort to distinguish which of Hooke's multifarious activities were original to him and which arose from the common stock of technical and intellectual preoccupations of the period. The only contexts in which Hooke is here presented are those of the Royal Society, physics, Newton, and London.

[1] A fuller, more analytical, account will be found in Hunter and Schaffer 1989, 3–6.

But this parochial approach to Hooke will not do. In the address 'to the Reader' with which Richard Smith prefaced the sale catalogue of Hooke's books [Feisenberger 1975, 59], he tells us that '. . . for many years he [Hooke] hath been on all occasions Collecting at Home and been assisted by his Friends Abroad.' Of Hooke's 'friends abroad' we learn nothing in the present work. Hooke is presented as a purely English, indeed purely London, figure. For Purrington, London is all Hooke's world and he is thus amputated from the Republic of Letters. But Hooke corresponded with naturalists throughout England (Peter Nelson in Durham, Andrew Paschall in Chedsey, Somerset, to name but two), just as he did with naturalists and savants throughout Europe.[2] As the catalogue shows, his library was rich in Latin, French, Italian, and Spanish books. Some 5% of his nearly 3500 volumes were in French, about 6% in Italian and Spanish, about half were in Latin, and the rest in English. Hooke, it seems, was well supplied with the books of Renaissance and contemporary European learning. What use he made of them, the content and extent of his European correspondence and reputation are not, however, matters discussed here except for some passing references to Huygens and Hevelius. Hooke nonetheless was, at least by reputation, known in the Republic of Letters in part thanks to the correspondence of Oldenburg, in part because of his own. European savants responded to his ideas just as he did to theirs. Purrington has not understood the essentially European nature of the everyday practice of scholarship during the Early Modern period and treats Hooke in a purely English context. He is by that much diminished.

Throughout the book, Purrington treats Hooke primarily as a physicist since this seems to be the category of modern scientific work which approximates most closely to a part of Hooke's work. Since 'Hooke understood the implications of his own discoveries and those of his contemporaries', he was also 'one of the important natural philosophers of the seventeenth century' [149]. Quite how Purrington reconciles these statements with his view that Hooke failed to understand the new mathematical techniques of analysis that alone were capable of resolving the problems of planetary motion and would also transform natural philosophy is not clear, although he spends

[2] For the names of some of these, see Keynes 1960, 80–86.

some time seeking excuses for this failure on Hooke's part. He considers Hooke's natural philosophy to have been neglected but then gives a restricted account which fails to discuss Hooke's methodology and omits all consideration of the religious component in Hooke's thought. This, however, was fundamental, for not only was Hooke imbued with the sense that his successes in investigation and research came directly from God, but one of his motives as a naturalist was to illustrate the providence of God which naturally provoked admiration and adoration of Him.

Although Purrington accepts that the basis of Hooke's work was not mathematics but a highly developed system of empirical enquiry which used experiments both to investigate and to demonstrate, he fails to give a convincing analysis of how this may have emerged from mid 1650s Baconianism, how it was influenced by Hooke's exposure first to the Oxford experimentalists and secondly to Boyle; and he fails totally to place the underlying 'philosophical algebra', so strongly vaunted but never clearly explained by Hooke, in the context of the ideas about a philosophical language and a universal character which so exercised his mentors John Wilkins and Seth Ward. This failure is in part a consequence of Purrington's imperfect command of the secondary literature concerning Hooke. Mary Hesse's fundamental article on the philosophical algebra [1966] seems to be unknown to him as is work on Hooke as a language reformer [Slaughter 1982]. Another work not used by Purrington, the entry on Hooke in the *Oxford Dictionary of National Biography* [Pugliese 2006] contains in a single page a more incisive and informative account of Hooke's method than the 13-page chapter in this book. Pugliese 2006 and Hunter 2003 remain the best accounts of Hooke's natural philosophy.

Inconclusive analysis uninformed by all the relevant literature is alas characteristic of Purrington's accounts of many specific episodes in Hooke's often intolerant life. As an example, examine the discussion of Hooke's 'first original contribution to science' [81].

It seems to have been in 1655–1656 that Hooke made his first original contribution to science. In fragments of an autobiography written in 1697, he recounted his early attempts to improve the pendulum clock for timing astronomical observations and reported that

> in the Year 1655 or 57, I contriv'd a way to continue the motion of the Pendulum, so much commended by Ricciolus

> in his *Almagestum*, which Dr. Ward had recommended me to peruse. [81]

Purrington assumes that this describes Hooke's invention of the recoil anchor escapement, which would eventually replace the verge and crown wheel escapement that Huygens had invented in 1658. For Purrington, this discovery is not without some controversy, since the earliest extant clock with an anchor escapement is one made by William Clement, dated 1671, and Joseph Knibb has also been given credit. But, Purrington maintains, the evidence favors Hooke, including references in the minutes of the Society from 1669 describing what was probably the anchor escapement. 'It was, in any case, effectively the first of a very long string of inventions' [81].

To begin with two factual errors. Huygens did not invent the verge and crown wheel escapement in 1658. In that year, he published an account of his application of the pendulum to a clock mechanism. This entailed replacing the foliot controller of the verge escapement (known since the late 13th century) by the pendulum. To do this the verge and its associated escape or crown wheel had to be swung through 45° into a horizontal position. Huygens did not devise the escapement and made no improvements or innovations to it. Secondly, the earliest extant clock with an anchor escapement is not by William Clement—the clock referred to is not dated; 1671 is its date of acquisition by King's College, Cambridge—but is that supplied by Joseph Knibb to Wadham College Oxford in early 1670 and therefore built in 1668/1669. From this it can be seen that the passing remark 'and Joseph Knibb has also been given credit', is a serious distortion of the facts. It arises no doubt from Purrington's use of totally outdated sources. If 'the evidence favors Hooke, including references in the minutes of the Society from 1669 describing what was probably the anchor escapement', it would be of the highest interest and should have been cited. But no reference to the Royal Society minutes is provided, let alone quoted. Had it been, it might have revealed whether what was mentioned in 1669 had anything to do with Hooke's researches in 1656/1657.

From what Hooke says there is no reason to assume this. 'I contriv'd a way to continue the motion of the Pendulum' [81] is more likely to mean that Hooke had thought of a way of keeping the hand-held and hand-impulsed pendulum used by Galileo, Mersenne, and

Riccioli for timing short-duration observations in physics and astronomy in continuing movement. To do so he may have applied some kind of clock-drive to it; but if so, nothing in the remark suggests of what kind, let alone what kind of controller it employed. To assume that it was a recoil anchor escapement is completely unwarrantable. But, for Purrington, precision of detail is unimportant. What matters is that this 'seems' to be Hooke's 'first original contribution to science' (for which read horology, astronomy, or mechanics) and his conclusion betrays a lack of interest in the details: 'It was, in any case, effectively the first of a very long string of inventions.'

Such an approach clearly will not do, but is alas characteristic. Purrington's treatment of Hooke's work on combustion—'a germ of a theory of combustion to which Hooke would return from time to time' [103]—is another case in point. This is discussed only briefly in half a page and no reference is made to the work already done on it [see Lysacht 1937, Turner 1956]. This leads Purrington to ignore completely the relation of Hooke's work with that carried out by, among others, Boyle, Thruston, and particularly John Mayow whose election to the Royal Society Hooke seconded in 1678 and whom he saw frequently in London between 1674 and 1677 when both were investigating the linked subjects of combustion and respiration. Later, of course, Hooke would accuse Mayow of plagiarizing him [Hunter 2003, 105].

Inaccuracies and inconsistencies unfortunately abound in this book. Some are trivial, some not. Among the former can be noted that Waller's life of Hooke (from the *Posthumus Works*) is not 'appended' to the edition of the diary [Robinson and Adams 1935, 8n2]; that the account of the air pump would have benefited from a close reading of the studies by Shapin [1984] and by Shapin and Schaffer [1985], which although mentioned [58] are absent from the bibliography as are Agassiz 1977 and Webster 1965. Most readers will be baffled by the word 'lagniatte' [20: see *OED Supplement*]. Hevelius was never a Danish astronomer any more than Samuel Hartlib [204] can be considered an 'important' one.

Rather more seriously misleading is the claim (not discussed and not substantiated) that Hooke was an equal partner with Wren in the design of Greenwich Observatory [7, 58n2]. As usual Purrington's claim derives from a secondary source [Willmoth 1993, 183]. But

while one of the relevant entries in Hooke's diary 'At Sir Ch. Wren['s,] order ... to direct Observatory in Greenwich Park for Sir J[onas] More' [Robinson and Adams 1935, 165] makes it clear that Hooke was in direct charge of the construction, there is no evidence that he had any part in the design. To say that Hooke's account of the 'pores or cells' of cork in *Micrographia* Observation xviii [1665] 'represents the first observation of the cellular structure of biological material, in a sense the origin of microbiology' is to risk perpetuating the old myth that Hooke had a concept of the cell as it is understood in modern biology [Hunter 2003, Turner 2005]. For Purrington, Hooke was the first to measure temperature relative to the freezing point of water [28n29, where Celsius appears as Celcius], which may be the case. But Huygens had proposed such a base-point to Sir Robert Moray on 2 January 1665/1666 in his reply to a letter in which Moray described Hooke's thermometer-making. Whether the idea was original to Huygens or Hooke seems to be an open question.

There is, however, no question that the group to whom Purrington refers as the 'Oxford Society', the 'Oxford Club' or the 'Oxford Philosophical Society' 'actually met for four decades' [34]. It did not. Here he has confused the informal circle of *virtuosi* which formed around Wilkins in the mid 1640s with the formally established and so-named Oxford Philosophical Society which met in the newly founded Ashmoleaen Museum from 1683 to 1690 with Robert Plot and John Wallis as its principal members. Purrington's error probably derives from Gunther even though it was corrected by Purver [1967, 126–7], whom he cites elsewhere. In general, in his account of the Royal Society, Purrington follows received wisdom which means that this account is particularly thin for the late 1680s and 1690s, a period which he describes as one of 'malaise' with 'a growing divide between the Newtonians and natural historians' [73]. In fact, we know rather little in detail about this period and this seems to place such division as there was too early by at least two decades. There is a typically exaggerated claim for Hooke: 'as the new decade opened, with his physical and intellectual vigor beginning to decline, Hooke was no longer able to carry the Society on his own' [73]. The constructive work of Southwell as President to maintain the Society during the first half of this decade is ignored. Only Halley receives an appreciative acknowledgement as an active Fellow while Sir John Hoskins, Sloane, and Waller, we are told, 'provided what little direction there

was' [74]. Only Newton's election as president would restore scientific direction. But the Royal Society was not a purely 'scientific' body (in the modern sense that Purrington uses the word) in the late 17th and early 18th centuries. Its problems were as much administrative and financial as intellectual. Purrington's characterization misses the point entirely.

This is the basic problem of the book. Hooke is discussed in a historical context which is partial and largely misunderstood. Only that part of his work is discussed that can be assimilated to the modern context of physics; he is at once implicitly condemned and then excused for not having been Newton, whose mathematical physics is for Purrington the touchstone. 'Newton's legacy' he writes, 'is the modern world' [243]. This is to see the past purely as precursor of the present, not to see it as it was.

Hooke was neither a transitional figure as Purrington presents him (in a sense any historical figure is a transitional figure—the expression means virtually nothing), nor was he a creative mathematician or theoretician. Still less was he, in his own mind, a pioneer of the scientific revolution although he may have had some sense of the difference, even the novelty, of some of the activities in which he engaged. What Hooke was is perfectly expressed by the author in the notice of him in the *Biographia Britannica*, 'an eminent mechanic genius' [1747–1766, 4.2652]. Hooke's career is here presented by Purrington in a splintered, partial fashion, with a constant insistence that Hooke could not concentrate on his scientific work because he was distracted by surveying and architecture. As he sums it up:

> The twenty years Hooke devoted to surveying, building codes and practices, and architecture, were in a way peripheral to his life as an experimental natural philosopher, and yet they were not. No doubt Hooke's success in the mechanical arts specifically architectural engineering, was a direct outgrowth of his understanding of forces and how materials respond to them. This took concrete form in his buildings, of course, but in his famous Cutler lecture *De potential* [sic] *Restituva* of 1678, he explored the physical basis for it. He also undoubtedly advised Wren on questions of the designs of arches and masonry construction, at least implicitly playing a role in the design of the dome of St Pauls. [246]

Ignoring the unsubstantiated, perhaps unsubstantiable, conjectures in the last sentence, one wonders whether Purrington's proposition should not be inverted. Hooke seems to be an archetypical mathematical practitioner, skilled in geometry, drawing and painting, in land-surveying, the design of machines and architectural constructions. He differed from the standard mathematical practitioner, men such as Ralph Greatorex or William Leybourne, by his education, by the fact that he did not teach, and more importantly because he extrapolated from these subjects, influenced no doubt by Bacon, Boyle, and the Royal Society, to build up a rational method by which to frame philosophical hypotheses on the nature of the world—hypotheses which he developed most fully in the study of planetary motion, elasticity, optics, and the nature of the Earth. Formed in both the workshop and the schools, able to draw nourishment from the European wide Republic of Letters, Hooke has a highly unusual, perhaps unique, profile among 17th-century *virtuosi*. Emblematically, we can see his career as the apotheosis of the mathematical practitioner at the same time as it displays the limits of attainment for such men. A full portrait of Hooke in these terms remains to be drawn although it has been adumbrated by Bennett, Chapman, Cooper, and Wright among others. Such a portrait cannot perhaps be undertaken until his remaining known papers, which Purrington mentions but does not exploit, have been fully analyzed and his correspondence collected and critically published. The variety of Hooke's interests and activities requires a far broader treatment than the partial and present-centered account of them given here in a book of which the very title betrays the lack of historical understanding that its pages reveal.

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