FIT FOR PRINT: DEVELOPING AN INSTITUTIONAL MODEL OF SCIENTIFIC
PERIODICAL PUBLISHING IN ENGLAND, 1665–CA. 1714

by

N. MOXHAM*

*School of History, St Katharine's Lodge, The Scores,
St Andrews KY16 9BA, Fife, UK*

This paper explores the contested afterlife of *Philosophical Transactions* following the death of its founder, Henry Oldenburg. It investigates the complex interrelation between the institution and the periodical at a time when the latter was supposedly independent, and outlines the competing proposals for institutional publishing in science contemplated in the Royal Society, linking some publications that were actually attempted to those proposals and to the Society's attempts to revitalize its experimental programme between 1677 and 1687. It argues that the Society was concerned to produce experimental natural knowledge over which it could claim ownership, and intended this work for publication in other venues than *Transactions*, whereas the periodical was seen as a more suitable site for work reported to the Society than for research that the institution had primarily produced. It was only from the early 1690s, after the collapse of the Society's experimental programme, that *Transactions* gradually became a more straightforward reflection of the mainstream of Royal Society activity, paving the way for its formal reinvention as the official publication of the Society in 1752.

Keywords: Royal Society; Henry Oldenburg; scientific journals;
learned societies; early modern experiment;
Philosophical Transactions

INTRODUCTION

As is well known, the Parisian *Journal des Sçavans* and the London *Philosophical Transactions*, compiled by Denis de Sallo and Henry Oldenburg respectively, both began life in 1665.¹ These learned periodicals each emerged alongside one of the most important and durable natural-philosophical organizations in early modern Europe—the Académie Royale des Sciences and the Royal Society. *Journal* was published under royal privilege at the initiative of Louis XIV's chief finance minister, Jean-Baptiste Colbert, and *Transactions* under the Royal Society's cherished privilege of licensing books for

*njm24@st-andrews.ac.uk

publication on its own authority.² Both had strong institutional associations, but despite these neither had the status of an official publication.

In this paper I investigate the nature of the link between periodicals and early modern institutions of science in England. The importance of the periodical form to the construction and dissemination of scientific and technical knowledge has long been admitted by historians and, as the earliest scientific periodicals, *Transactions* and *Journal* between them receive a lot of the credit for this.³ Such a straightforward identity between science and the periodical was by no means inscribed in the form from the beginning, however, and it masks the degree of early uncertainty and contestation over natural-philosophical publishing and the purpose of the periodical form in particular. The purpose of the present paper is to uncover it and to show how institutional periodical publishing arose in England from the working-out of those instabilities.

The link between periodicals and institutions was emphasized by David Kronick, who pointed out, in his survey of early scientific and technical periodicals, that titles with an institutional association tended to be longer lasting.⁴ By the nineteenth century, 'memoirs' or 'transactions' had come to be regarded as essential elements of the identity of learned societies and were becoming the dominant mode for the publication of scientific research (though they were increasingly being joined by commercial rivals). However, despite their early institutional connections, *Philosophical Transactions* was not an institutional periodical until the mid eighteenth century, nor was *Journal des Sçavans* until the early nineteenth century.

Beyond the broad explanations provided by Kronick, the detailed reasons for those early survivals outside an institutional context have not been fully explored by scholars. Such an exploration is necessary, because, as Adrian Johns has shown, natural-philosophical publishing in the seventeenth century was fraught with difficulty, and the engagement of the manufacturers of natural knowledge with the print trade threatened the integrity and credibility of their claims.⁵ Johns focused on the period of Oldenburg's editorship, however, and he gave only brief overviews of what happened to the periodical after Oldenburg's death in 1677. His analysis emphasized discontinuities and disruptions in the early *Transactions*, occasioned by plague, fire, English and Continental literary piracy, and challenges to the intellectual and ethical probity of the enterprise from mistrustful contemporaries. The emphasis on discontinuity has transformed our understanding of the impact of book trade conditions and practices on the formation of natural knowledge. But by its very nature it militates against an explanation of why the form of the periodical survived, and I suggest that if we are to understand this we need to pay detailed attention to the institutional context of early modern publishing in natural philosophy.

Two important questions underlie Kronick's correlation between early learned periodicals and institutions. First, how did *Philosophical Transactions* survive for so long without formal institutional patronage? Second, why did the members of learned societies want to publish periodicals in the first place? The demonstrable importance of periodicals to nineteenth-century and twentieth-century learned societies has disguised the fact that seventeenth-century societies were not so straightforwardly committed to periodical publication (or any publication). Why, then, might early modern learned societies potentially *not* want to publish periodicals? And why did the Royal Society in particular take so long to decide that it did?

To answer these questions it is necessary to establish the extent to which *Transactions* was truly independent of the Society. The point was repeatedly insisted on by the institution and

also by successive editors.⁶ Yet the distinction remained unclear to much of the reading public, and thus the status of the periodical was ambiguous for much of its existence before 1752, when the Society assumed formal responsibility for it.⁷ To account for this ambiguity I examine in detail the period after Oldenburg's death, relating the variety of possible modes of publication explored during this period to the shifting patterns of institutionality in the early Royal Society. Specifically, I account for the transition of *Transactions* from a varied news medium seeking to broaden and inform the natural-philosophical community, to a stable record and repository of individual, discrete knowledge claims, by arguing that the variety of publishing schemes mooted or attempted in the late 1670s and early 1680s reflects growing institutional concern on the part of the Royal Society with whether and how to involve itself in publishing. In particular, this was focused on the ownership of experimental knowledge production and of research contained in the Society's manuscript registers, which were the original, fundamental record of the Society's activity.

The paper's final section argues that the essential change governing what we might call the institutionalization of *Transactions* was in the function of registration at the Royal Society. Registration recorded and accredited to the knowledge claims of individuals, and potentially helped to bestow credibility on them through collective witnessing, particularly if the claims were actually the results of experiments or observations performed before the Society; but the registers were also the repository of research paid for by the Society *and* conducted under its eyes. The Society's role in the construction of matters of fact could be similar in both cases, but only in the latter did the institution have a plausible claim of ownership over the matters of fact thereby produced. There was thus potentially a three-part distinction between what the Society heard reported, what it had witnessed, and what it might claim to own. The difficulty of reconciling this rendered the form of the periodical epistemically unstable and led to contestation about the proper form in which to publish the Society's proprietary research. Matters were simplified during the eighteenth century, when the Society effectively abandoned its hope of performing and publishing research under its own auspices: registration then became mainly a matter of recording what was communicated to the Society. *Transactions* remained an important venue for disseminating news of the natural-philosophical world, but with the Society lacking alternative means of proclaiming its own productivity, it also became the chief means by which the Society secured its scientific reputation, as the institutional emphasis shifted from producing programmatic research to hearing and selecting among the fully documented research communications of individuals. There could no longer be a question of Society ownership of the knowledge claims thus communicated, and the functions of *Transactions* and the register effectively merged. The Society no longer aspired to be the progenitor of knowledge but to be its midwife; however, this made room for a more significant institutional role for the periodical.

SOCIETY INVOLVEMENT IN THE SEVENTEENTH-CENTURY *TRANSACTIONS*

At the turn of the eighteenth century, the Society faced a choice with regard to *Transactions*. The editor, Hans Sloane, and the publication itself had been savaged in *The Transactioneer* (1700), an anonymous pamphlet whose authorship caused a good deal of heated speculation in the Society.⁸ One of the men on whom suspicion had fallen, John Harris, wrote to the

Society's Vice-President, Sir John Hoskyns, in February to deny the accusation.⁹ Harris pointed out that Sloane's claims that his editorial control was absolute, and that he was entitled to print whatever he chose in the journal, were ultimately useless. It was impossible to convince men of Sloane's sole editorial responsibility, he wrote, 'while Papers Read before ye. Society are published there, while Letters to members of it are there inserted, & while Experiments made before them are there Printed'.¹⁰ He argued that the Society needed either to assume formal responsibility for *Transactions* or to disown it publicly.

The Society debated what to do, but took no action. And so the ambiguity persisted. The Swiss traveller Zacharias Conrad von Uffenbach, visiting London in 1710, assumed that the relative worthlessness of recent volumes of *Transactions* was an effect of the Society's lassitude (further reflected in the horrifying state of disrepair he found in the Society's repository).¹¹ In the 1720s, and indeed much earlier, it is evident from the Society's journal books that the institution did frequently order the editor to publish particular papers.¹² Authors communicated their papers to the Society in the express hope that they would appear in *Transactions*, a fact that is sometimes recorded.¹³ *Transactions* may not have formally belonged to the Society, but everyone (except the editors) behaved as though it did. This was particularly apparent in 1721/2, when two rival proposals to continue John Lowthorp's 1705 abridgement of *Transactions* were adjudicated by the Society. Despite being the work of eight different editors, *Transactions* was considered as a single piece of literary property stretching back to 1665—one controlled by the Society.¹⁴

How, then, had the Society arrived at this situation? What was its level of involvement with *Transactions*? Council had been involved since 1665 by licensing monthly issues, but this process has left only faint archival traces; it tends not to record any deliberation or discussion but only the bare fact of the imprimatur.¹⁵ It may not be a fully accurate reflection of the Society's input into the work of producing the journal, however. Throughout the period of private ownership the Society would occasionally recommend particular papers for publication, using the formula 'ordered for the Transactions', although the force and effect of these recommendations is nowhere specified. Perhaps more significant, though difficult to substantiate, were Oldenburg's regular meetings about Society business (and probably also *Transactions*) with the Society's President, William, Viscount Brouncker, in the latter's rooms.¹⁶

There were more obvious links. The periodical was published by a succession of Officers of the Society. As is well known, the early journal was closely intertwined with Oldenburg's activity as a correspondent. Much of this was linked to his official responsibility as Secretary of the Society, and much of the research communicated to him by scholars outside London and natural philosophers on the Continent (that is, in mainland Europe) and beyond he received precisely because of his official position; sending material to Oldenburg was a well-understood way of communicating with a wider natural-philosophical audience.

Yet Oldenburg's original appointment as Secretary was also an implicit recognition of the network of natural-philosophical contacts he had independently built up over the previous two decades and also of his unusual gift for languages; the robustness and integrity of this network depended on him personally. This is directly discernible in the content of *Transactions* during his editorship: almost half the material in *Transactions* between 1665 and 1677 was never communicated to the Royal Society.¹⁷ Similarly, the proportion of material in *Transactions* from the Continent was at its highest in this period. Both the ratio of material not communicated in Society meetings and the emphasis on Continental

news declined after Oldenburg's death. This careful equilibrium allowed Oldenburg to orient his periodical in two ways at once: a Fellow of the Society could read it and expect to learn about natural-philosophical activity outside England and the metropolis, while provincial and foreign readers would receive news of the Society.

This balance of Royal Society and non-Society content in the periodical, combined with the dense networks of correspondence with Oldenburg at their centre, made *Transactions* in effect into a newsletter of natural-philosophical goings-on. That Oldenburg was striving for this effect can be demonstrated by considering briefly the form of the items it contained. Full descriptions of experiments were set alongside stray observations or second-hand scraps of information, often no longer than a single paragraph, as well as summaries of recent books, translated excerpts from recent works in other languages, requests for information on specific topics, and previews of forthcoming books (especially by Robert Boyle). Often an item in the early *Transactions* had no single author but was instead compiled by Oldenburg from disparate, frequently anonymous, sources. Oldenburg, then, enjoyed a high degree of editorial independence—but it suited him commercially to create an impression of association between the institution and the periodical while preventing perfect identity between them. This was not a trivial consideration, because Oldenburg hoped to make his living from *Transactions*, and was wholly financially responsible for it.¹⁸

The ambiguity of the periodical's position was partly Oldenburg's deliberate creation, and his death afforded the Society (notionally, at least) an opportunity to clarify it. Yet it did not do so. Instead we continue to find evidence of publications that were technically the sole property of their editors appearing within the ambit of the Society and subject to its influence. The Society continued to recommend particular papers to the editors for publication; it continued to express its desire for the periodical to appear whenever it threatened to lapse; it replaced failing editors; and it even began for the first time to encourage the publication financially, in the form of an institutional subscription of 60 copies of each issue.¹⁹ Yet the editors were manifestly highly independent, in practice and in theory. I now focus briefly on Edmond Halley and Robert Hooke here because, by comparison with Oldenburg, their cases represent the most significantly different institutional and professional relationships to *Transactions* among its early editors.

Between 1679 and 1682, *Transactions* was replaced by Robert Hooke's *Philosophical Collections*. Hooke, who had profoundly mistrusted Oldenburg and was determined to replace *Transactions*, lobbied the Society extensively for permission to produce his own periodical, and eventually prevailed.²⁰ The fact that Hooke had to fight so hard shows at the very least that the Society supported the continuation of *Transactions*; although there was no theoretical obstacle to Hooke's launching an alternative title independently, his eagerness to secure its endorsement suggests that proceeding without it would have meant doing without the Society's imprimatur and perhaps being deprived of material communicated to it.

The closest the Society came to bringing the periodical formally under its oversight was in 1686, in response to the abrupt resignation of both the Society's Secretaries, who had revived *Transactions* after Hooke's *Collections* lapsed in 1682 and published it jointly. From 1682 to 1685 one Secretary was usually London-based and the other in Oxford,²¹ in an attempt to establish closer institutional links between the Royal Society and Oxford's nascent Philosophical Society. In 1686 Edmond Halley was appointed as the Society's salaried clerk, and the publication of *Transactions* was soon added to the list of his duties.²² This is unique in the Society's pre-twentieth-century history, in that editorial

responsibility for the journal now belonged to one of the Society's salaried employees, the clerk, rather than to an honorary officer and member of Council (the Secretary). The institution had not merely specified the clerk's duties but had apparently imposed the financial risk of publication upon him.²³ The clerkship was explicitly intended to absorb the 'laborious part'²⁴ of the Secretary's functions, responsible for keeping the minutes and drafting correspondence as well as *Transactions*, and his subordinate status was spelled out.²⁵ Strikingly, the financial risk remained Halley's.

Adrian Johns views this episode as the Society assuming control of *Transactions*, by putting it in the hands of a man who was supposed to take instruction from Council, and did not enjoy Oldenburg's 'freedom of action of a gentleman'.²⁶ Yet Halley evidently did not view his instructions as binding. He justified a long interval between issues in 1687 by explaining that his energies (and his finances) had been tied up in the publication of Isaac Newton's *Principia Mathematica*, which Halley gradually coaxed out of the Cambridge mathematician over a period of years and supervised through the press.²⁷ He also put out no issues of *Transactions* between 1689 and 1691.²⁸

Halley was also a rare early instance of a highly active researcher having editorial responsibility for the periodical. During both his periods of editorship—as clerk, between 1686 and 1692, and as Secretary, between 1714 and 1719—he published a great deal of his own work in *Transactions*: 16 of his own research papers appeared during his first stint, and 20 during the second (rising to 29 if we include the papers he submitted to volume 31 (1720–21), retrospectively compiled by his successor as Secretary, James Jurin). By using *Transactions* as a vehicle for his privately conducted research, Halley fulfilled his obligations to the Society to produce the periodical, but also refashioned it to his own ends. In 1692 he offered to support *Transactions* by supplying 'de proprio' a quarter of the material for the journal. The Society apparently turned him down, and Richard Waller, Secretary since 1687, agreed to take over the editorship, although Halley nevertheless contributed nine papers over the next two years.²⁹

Nonetheless, a pattern emerges. Halley and Hooke both used their editorial positions for publishing their own work, or for promoting their own research agendas. The Society was willing to countenance alternative titles or structures of editorship—but only for as long as the periodical continued to appear reasonably regularly (meaning, in practice, at least once a quarter, and ideally monthly). Waller took over the editorship from Halley in 1692 after complex negotiations, and Hans Sloane from Waller in 1695.³⁰ Sloane and Waller are among the earliest instances of what would prove to be a durable tradition, at least until 1752, of appointing Secretaries with significant independent incomes, who could weather with equanimity if not indifference the costs that publishing *Transactions* usually entailed. These were by no means insignificant—Sloane estimated that publishing *Transactions* had cost him more than £1500 in 20 years.³¹ (The fact that the Secretaries personally bankrolled the periodical probably contributed to their editorial independence.)

The Society itself, by contrast, spent almost nothing on publishing before 1682.³² There are some negligible exceptions: a couple of small payments to the Society's designated printer, John Martyn, for jobbing printing and for an occasional small stock of copies of *Transactions*, and for 100 extra copies of an early issue entirely dedicated to a natural-historical questionnaire for distribution for seamen and travellers bound on distant voyages.³³ Potentially more significant was the £40 salary paid annually to Oldenburg from 1667 until his death, which could be considered a partial subsidy of *Transactions* on the part of the Society.³⁴ This was the last instance of a regular payment to a Secretary

until 1719, however. Robert Plot and Edmond Halley were offered salaries of £40 specifically to undertake the publication of *Transactions* along with the Society's correspondence;³⁵ both turned the offer down. The general impression is that publishing, particularly during the Oldenburg era, was a very low institutional priority. The Society spent nothing on any of the books associated with its first two decades—either on Hooke's *Micrographia* (1665) or even on Sprat's *History of the Royal Society* (1667), a work produced at the Society's behest and under their direct supervision.³⁶

Throughout the post-Oldenburg period, and for the rest of the seventeenth century, we find the Society's Council simultaneously concerned to ensure the smooth continuation of some form of periodical publishing in natural philosophy, while not wishing to have to assume direct editorial or financial responsibility for it. *Transactions* was evidently convenient for the Society as a vehicle by which to be able to order the publication of particular papers; yet editors were allowed to run it as they thought fit, with considerable discretion over periodicity, content, and even where the printing was done.³⁷ On one point the Society remained consistent: the person in charge of *Transactions*, or its equivalent, was also the person responsible for the Society's correspondence. Hooke was given permission to start a periodical at the moment that his fellow-Secretary, Nehemiah Grew, stepped back from his role as correspondence secretary, and the same responsibility had devolved to Halley as clerk before he was asked to take on *Transactions*.

EXPERIMENTING WITH PUBLISHING: WHAT PURPOSE DID THE SOCIETY SEE FOR PUBLISHING NATURAL PHILOSOPHY?

Despite its apparent concern for the continuation of *Transactions*, however, there is plenty of evidence that the Society did not regard *Transactions* as a fully adequate representation of its activity in print. The Society's reluctance to take direct control of the periodical is circumstantial evidence for this; and the decision to publish Thomas Sprat's *History* is also suggestive. The longest of the three parts of Sprat's book consists of research presented or conducted in meetings of the Royal Society, none of which had previously appeared in *Transactions*. Along with Hooke's *Micrographia* it is one of two important books issued under the Society's imprimatur that may be said to have been commissioned by the institution.³⁸ This separate presentation of the Society's work, in a specifically apologetic context, at a time when *Transactions* had been in print for two and a half years, indicates doubts that the periodical reflected enough credit on the Society to deflect the criticisms that had begun to be aimed at it.³⁹ This is not surprising: much of what was published in *Transactions* manifestly had nothing to do with the Society, and there was little evidence of programmatic institutional research in the rest. Both propositions are also circumstantial evidence for the idea that the notion of *Transactions* as a natural venue in which to publish discrete, adequately complete pieces of research had not yet taken hold.

In December 1676 the Society contemplated a new form of publication that would specifically promote Society-sponsored research. It elected a committee, with both Oldenburg and Hooke among the members, to comb the Society's archives for publishable material.⁴⁰ Then Oldenburg's sudden death, in the late summer of 1677, cast sudden doubt on the future of *Transactions*.⁴¹ The Society took the opportunity to

re-examine the whole question of institutional publishing.⁴² On 2 January 1677/8, Council passed the following two orders:

That there be prepared once a year a collection of all such matters, as have been handled that year, concerning four, five or more subjects, which have been well prosecuted, and completed; which may be printed in the name of the Society against the anniversary election-day:

That the Register-books of the Society be perused; and that what shall be thought fit by the council to be published, be drawn out and printed accordingly.⁴³

This envisages two strands to Royal Society publishing, both of them more closely tied to the institution than any that had previously existed: one formally linked to a renewed programme of experimentation and the other taking advantage of a repository of material languishing unpublished in the Society's archives. Strikingly, there is no mention in this model of *Transactions*, or anything like it. The first order calls only for annual periodicity, and for the production of books or pamphlets grouped by subject rather than in periodical form; the second involves no periodicity at all. It is not clear from the order alone how the Society proposed to manage the research programme, but a related issue was discussed in the Society in December 1677 that may have fed into the broader discussions of the Society's publishing strategy.

Nehemiah Grew, newly appointed alongside Hooke as Secretary, was a rare early instance in the Royal Society of an individual being paid to undertake a particular programme of research.⁴⁴ And in 1676 and 1677, he was again paid for a series of botanical demonstrations accompanied by illustrations. Grew gave the twelfth of these, 'concerning flowers', on 6 December 1677, after which it was proposed that he be encouraged to print it. John Wallis suggested 'that it was proper to print all that kind in quarto, that they might be bound together'.⁴⁵ The example of Grew's Society-sponsored research, coupled with Wallis's input about the appropriate format for publishing such research, may have informed the proposals for future publications made in the following month.

The Society also had models from the Continent for the institutional publishing of sustained research programmes. *Saggi di Naturali Esperienze*, of the Florentine Accademia del Cimento, had been published in 1667, consisting of a selection of the academy's experiments in book form.⁴⁶ Between 1669 and 1676 the Académie Royale des Sciences had published four volumes of collaboratively produced botanical and anatomical research performed under its auspices. *Mémoires pour servir à l'histoire naturelle des Animaux*, in particular, was the serially expanded result of anatomical dissections conducted in the Royal Library at Paris over several years, starting life as an account of a single dissection reported in a quarto pamphlet and ending in 1671 as a Royal Folio volume, lavishly illustrated by Sébastien Leclerc, of 31 anatomical descriptions (supplemented in 1676 by a further 19). Both the Académie in Paris and the Cimento seem to have viewed book form as the appropriate form of publication for institutionally sponsored research; a view the that Society seems, on the evidence of the January orders, to have shared.⁴⁷

At first glance, neither form of publishing proposed by the Royal Society in January 1677/8 materialized.⁴⁸ There were no thematic collections issued annually in the Society's name, nor were anthologies of material from the Society's archive issued under the editorial control of Council, despite Council's returning to the idea several times over the course of a year and more. Instead, *Philosophical Transactions* resumed

publication, edited by Grew, in February 1678 and continued to appear until February 1679. Yet several things were published that, on closer inspection, closely resemble Council's proposals.

The issues of *Transactions* put out by Grew—especially those covering the six months between January and June 1678—could in fact be seen as embodying Council's plan to mine the Society's archive for material, with number 137 (January/February 1678) featuring items originally communicated to the Society by Sir Robert Moray in 1661. Other items dated from 1661, 1666 and 1668.⁴⁹ Although *Transactions* continued to be printed under the same title, evidently the injunction to scour the early archives for publishable contributions had been obeyed. The next few issues were a mixture of material drawn from the Society's earliest years with letters communicated since Oldenburg's death.⁵⁰

Meanwhile several publications were put out within the Society's orbit that seem to relate to the order to prosecute and publish thematically grouped research. Grew's lectures on flowers and seeds, whose collective publication Wallis had advocated, eventually appeared as part 4 of *The Anatomy of Plants* (London, 1682); Robert Hooke also published a series of thematically organized collections of papers and lectures, some by himself and some by other people, under the general title of *Lectures and Collections* (not to be confused with his *Philosophical Collections* discussed above) in 1678. *Lectures and Collections* consist of two sets of discourses, one entitled *Cometa* and the other *Microscopium*. Both collections have multiple authors, but are signed and paginated as a single volume. The immediate occasion for *Cometa* was Hooke's observations of the comet of April 1677; these are linked to a set of general speculations based on his own observations (and those of others) of the comets of 1664 and 1665.⁵¹ From there he segues into a problem proposed by Christopher Wren for finding a comet's parallax, and a discussion of the properties of luminescent bodies. This sets the scene for a paper of Boyle's on two new types of phosphorus, and a series of astronomical observations by Jean Gallet, Giandomenico Cassini and Edmond Halley.⁵² Cassini's observations and reflections on them, as well as his 'Observation of the Diurnal motion of [Saturn]', are extracted from *Journal des Sçavans*.⁵³

Microscopium is similarly constructed—in this case the point of departure is a pair of letters received from Leeuwenhoek in 1677, followed by an account of Hooke's efforts to replicate Leeuwenhoek's observations (made necessary by the fact that Leeuwenhoek refused to share the technology he used to make them). Hooke then moves on to a critique of the claims of a French book on microscopy by P. Cherubine, which he claimed to have 'casually met with' 'whilest this Discourse was Printing' and whose author had seen fit to criticize some of Hooke's own efforts published in *Micrographia*.⁵⁴ The last item is a letter of anatomical observations communicated by James Young, not microscopical and not particularly connected to the theme proposed by the tract's title.

In short, these are thematic tracts drawing on multiple authors, published under the Society's imprimatur. They feature accounts of recent books and excerpts from foreign periodicals, and draw upon work in allied fields. They bear a similarity to the publications called for by Council in January 1677/8 that has never been remarked on; a similarity striking enough to suggest either that they were produced in response to Council's directive, or that Council's directive had originated with Hooke himself, as a way of gaining the Society's approval for a venture he had in mind. They rely on the same range of resources as Oldenburg's *Transactions*—Royal Society activity, private communication, books, and foreign printed periodicals—but configure them differently,

using Hooke's own experimental work, accounts of his methodology, and speculations as their binding thread.

It is true that these thematic tracts were not published in the Society's name. Nevertheless, examining Hooke's tracts alongside Grew's efforts as editor of *Transactions*, there are good grounds for seeing the publishing activities of the Society's two Secretaries in 1678 as a two-pronged solution to the problem of how to replace Oldenburg and his periodical, a solution founded on a simultaneous attempt to draw upon experimental work linked to the Royal Society while endeavouring to include the best of the research communicated to it.

Oldenburg's periodical had put the Society at the centre of a network of scientific communication; Grew's and Hooke's respective publications had the capacity to demonstrate its productivity in matters of research.⁵⁵ It is also notable that Hooke's tracts and Grew's *Transactions* were flexible enough to absorb some of the functions of Oldenburg's journal. Grew published more recent communications alongside work from the furthest recesses of the Society's archive, whereas Hooke attached current work by Continental scholars to his tracts that did not strictly address the theme of his own experiments and observations but was at least in allied fields (planetary astronomy in *Cometa*, anatomical observations in *Microscopium*).

WHOSE KNOWLEDGE? RESEARCH, REGISTRATION AND PUBLISHING, 1677–87

The Society theoretically had the basis for an alternative model to *Transactions*. Hooke and Grew, in their attempts to satisfy Council's directives, were drawing in different ways on the Society's registers. Originally the generic name for the Society's records (and for the man who kept them—a post that became the secretaryship after the Society's incorporation in 1662), the registers had come specifically to mean the record of experiments shown to the Society and of research communications brought in by Fellows, set down in the Register-book series. Various functions originally embodied in the register split off and became separate archival series around the time of the Society's incorporation in 1662 and 1663. The records of debates in the Society, for instance, became the Journal-books. The record of specific orders became the Council minutes. Letters were copied into separate books. Thus, the register's purpose became more closely identified with the accreditation of discoveries and knowledge claims.⁵⁶

Despite their role as an independent and impartial record of individual discovery, the registers were also intended as a record of the Society's research productivity. This is clear from the Society's early account books. The Society from 1663 to 1687 laid out considerable sums of money—often up to one-third of its total outlay, and sometimes more—on salaries for experimental staff, the Curator of Experiments and his assistants (Richard Shortgrave and later Henry Hunt), and on paying bills for equipment and materials. There were also piecemeal payments to Grew for his botanical lectures.⁵⁷ This investment gave the Society plausible claims of ownership on the resulting experimental research in its registers. The write-ups of Hooke's work as Curator belonged in them. As Curator—though not as Secretary—Hooke was a paid employee; and the experiments he devised and performed in that capacity were paid for by the Royal Society. The absence of social equality between Hooke and the majority of the Fellowship, most crucially expressed in the fact that Hooke was successively the salaried employee of Robert Boyle and of the Royal Society, has been a major theme of work

documenting the struggles that Hooke faced in securing credit for his discoveries. Both Steven Shapin and Stephen Pumfrey note that Hooke resisted the Society's attempts to curb his freedom of action as Curator.⁵⁸ In many cases Hooke had not handed over his work as directed, because he distrusted the Society's communication practices as embodied in Oldenburg.⁵⁹

Neither Pumfrey nor Shapin tackle this directly, but the question of *why* the Royal Society sought to bring Hooke firmly under control, other than simply to assert their authority and remind him of his place, is crucial to understanding the development of an institutional publishing strategy—of how knowledge was to be used and disseminated, as well as made, by the institution. The gap left in the record by Hooke's failure to deliver his work was plainly a matter of concern: Hooke was repeatedly called on either to submit, publish or methodize his curatorial work for the Society between 1679 and 1687, and Council resolutions were passed to make sure that he could not continue to withhold future work from the Society. At the same time the Society moved to restrict the Curator's freedom, insisting on prior approval of written descriptions of proposed experiments and written accounts to be delivered the following week.⁶⁰ The Society was doing all it could to secure a supply of experimental knowledge claims that it could claim as its own and dispose of as it saw fit.

Where the Society could not claim direct ownership of knowledge claims, it was more circumspect. Hooke was put in charge of the Society's correspondence in December 1678 and he immediately endeavoured to bring the institution's communicative function under close control. He proposed a journal specifically of 'particulars read in the Society, that ... shall not be sold or sent' to anyone except Fellows and officially designated correspondents of the Society, who would be identified by their capacity to communicate useful material of their own. Timeliness was also an important factor—external contributions were to be communicated to the Society as soon as received.⁶¹ This is an intensely restricted idea of publication, so much so that it scarcely deserves the term. For Hooke, uncontrolled communication so thoroughly compromised the rights of the individual discoverer that the Society had to become a virtually closed circuit to make it a secure space for disclosing discovery.

Hooke's limited-circulation journal never materialized. Soon afterwards, in August 1679, Hooke agreed to undertake a philosophical newsletter based on information from the Society's correspondents. There was a crucial proviso, however: if he wished to draw material from the registers for publication, he would require the author's and Council's approval before it was published.⁶² This is an important clarification of the Society's position with regard to the registers. The authority to publish such material, vested jointly in the Society and the author, claims at the very least joint ownership not just of experiments conducted before the Society but also of any material communicated to the Society that they thought worthy of registration. Council's formulation is probably best understood as a joint power of veto over material freely communicated to it, and seems mainly intended to distinguish between what was suitable for a periodical (correspondence) and what was not (properly articulated knowledge claims read or performed before the Society and attributed to particular authors).

The Society's vision of a natural-philosophical periodical at this time therefore seems to have been limited to seeing it as a vehicle for communications from outside the institution—a vision that Oldenburg had helped create by refashioning letters into items of natural-philosophical news and by the continuous stream of external material he brought into the

Society and into *Transactions*. This has an epistemic aspect: it implied that knowledge claims in *Transactions* had a different status from those to which the Society could credibly stand witness.⁶³ Not only did these external knowledge claims not belong to the Society, the Society could have little role in assenting to them and thus help to create them as facts. Work conducted *inside* the Society, over which it could claim ownership by virtue of having paid for it and which the Fellowship could help secure epistemically by acting as witness to it, required an independent experimental programme and, ideally, a different publishing format: books or tracts, a form that lacked the ambiguous status and authorship of a periodical and could clarify the distinction between what the Society might *claim* and what it merely reported.

After the early efforts, represented by Grew's version of *Transactions* and Hooke's *Lectures and Collections*, these modes of publication fizzled out. The initial obstacle to the project proved to be Hooke himself: simultaneously responsible for the Society's experimental programme, its correspondence, maintaining its books and papers, the ordering and publishing of his work as Curator of Experiments, for the compilation and publication of a periodical, his two endowed lectureships, and his architectural work, he simply failed to keep up. The minutes from this period are full of gaps, his curatorial work was not published in his lifetime, and only seven issues of *Philosophical Collections* were published in the three and a half years from 1679 to 1682.⁶⁴

Yet Hooke's failures did not mean that these projects were immediately abandoned. The Society continued to solicit his experimental back catalogue until the late 1680s. Meanwhile new, specialist Curators of Experiments were appointed in 1682.⁶⁵ They were committed to particular courses of experiment and specific subjects, probably in the hope that their work would naturally yield the kinds of annual thematic tracts envisaged in the 1670s. The institution reconfigured itself to produce more systematic, publishable research of a kind it could claim to own—because it had paid for it. Meanwhile, virtually all Society directives concerning *Transactions* during this period—concerning specifically *periodical* publishing, in other words—connect it with correspondence.⁶⁶

Oldenburg's death forced the Society to consider what *Transactions*—or its equivalent—ought to consist of, and the Society opted for the communication of natural-philosophical news, seeking to relay information from individual correspondents back to all. At the same time it put more effort into developing itself as a research institute, as a producer of collectively witnessed natural and experimental knowledge that it had the right to dispose of as it pleased. It invested its limited funds in experimental knowledge production rather than in publishing or communication. The difference is between being an *entrepôt* for knowledge claims and being a manufacturer of them. The latter does not necessarily imply that the Society claimed the right to final adjudication of knowledge, but it does imply an important epistemic difference between what was to be published as a periodical and what was to appear in 'the Society's name'.⁶⁷

THE ABANDONING OF EXPERIMENTAL ENTERPRISE

By 1687, however, the attempt to publish Society-sponsored research had more or less collapsed. The last serving Curator, Denis Papin, left to take up an offer of employment on the Continent, and the specialist Curators of 1682 had left office. Halley, invited to take up a curatorial post in 1684, declined. The Society employed no experimental

demonstrator for most of the next 20 years.⁶⁸ The shift was the result of a combination of factors. First, Hooke's being voted out of the secretaryship in 1682, and simultaneously out of Council, probably removed some of the pressure to keep the Society's involvement in periodical publishing entirely distinct from its research practice. It is notable, for instance, that from 1682 the prefaces or advertisements attached by successive editors to the first issues of their respective tenures start to refer to *Transactions* as a kind of safety net and friendly surround for fugitive pieces '[that] collects small tracts, that would otherwise be lost'.⁶⁹ They also begin to connect the activity of the periodical more explicitly with work carried on before the Royal Society. Second, the Society began in 1686 to dabble in other forms of publishing, and to do so for the first time as an investor. The Fellows elected to fund the posthumous publication of Francis Willughby's *Historia Piscium* (1686), a hugely expensive illustrated work that proved essentially unsellable and stretched the Society's thin resources even further—Francis Aston noted his relief and astonishment that the Society would still have £135 cash in hand 'after all our great expense'.⁷⁰

The third factor was Edmond Halley's appointment as editor. Here we must distinguish carefully between Halley's position and Hooke's: although Halley as clerk was technically Council's subordinate, over whom it had more direct and explicit authority than any of his predecessors, it had none over his extensive astronomical and mathematical research—which it had over Hooke's, Grew's and the succession of paid Curators of the early 1680s. Halley used many of his own communications to the Society, as we have seen, to flesh out issues of *Transactions* put out under his editorship, but the publication of these was freely undertaken; it belonged to him, not to the institution, in spite of his subordinate position. Equally crucially, very little appeared in *Transactions* under Halley that had not also been presented or communicated to the Society. The combination of publishing distractions, financial difficulty and the inability to retain Curators all added to the importance of *Transactions* to the Society, and it became a fuller representation of what the Society was doing.

The fourth factor, and probably the most effective in the long term, was Hans Sloane. When he assumed the editorship in 1695, the Royal Society's sponsorship of experiment had essentially been in abeyance for eight years. He served as editor for 19 years, and later as President for a further 14. Cromwell Mortimer, who served as Secretary-editor from 1728 until 1750, and thus for most of Sloane's presidency, became his neighbour in Bloomsbury Square at Sloane's request, and the number of papers edited for *Transactions* during this period that have ended up in the Sloane papers in the British library suggest his continuing influence.⁷¹ Sloane thus provided a long spell of institutional continuity, something that *Transactions* had lacked for the two decades after Oldenburg's death.

Transactions manifestly stabilized under Sloane. It settled into a slower periodicity, usually coming out every two or three months, and it scarcely rated a mention in the Society's Council during his editorship. When Sloane stepped down as Secretary in 1714 and was replaced by Edmond Halley, Halley explicitly enumerated the periodical's functions. First, the preservation of fugitive tracts too short for a book; second, the publication of letters communicated to the Society (stripped, as Halley rather baldly put it, of 'preambles, conclusions and . . . useless parts'); and third, the printing of such experiments performed before it 'as the Society shall be pleased to order or permit the publishing of'. This formally acknowledges the Society's input, identifies the periodical's

function with registration, and sets correspondence and primary research on an equal footing in *Transactions*. Crucially, it is also the first preface not to insist on the official separation between *Transactions* and the Society. From this point it can safely be said that the quasi-official status of *Transactions* was established, and editors did not bother to try to proclaim the independence of *Transactions*. No subsequent editor affixed a preface to the periodical; and in 1719 James Jurin (then only an author, but from 1721 Secretary-editor as well) was blithely content to explain to John Woodward, who complained of the treatment of his work in a paper of Jurin's, that the Society had ordered its publication.⁷²

As the functions of registration and communication increasingly merged in *Transactions*, it came to provide a more straightforward reflection of Royal Society activity—itsself simplified by the long-term abandonment, during the 1690s and early 1700s, of systematic, Society-sponsored experimental research.⁷³ The Society's chief resource, for knowledge production or communication, was now the papers that correspondents chose to share with it. With the mainstream of Royal Society activity now taken up with listening to the papers of individual researchers, the dual function of the register—to be a durable register of individual knowledge claims and a repository of the Society's research—was gone. These factors effectively turned *Transactions* into something indistinguishable from a representative institutional periodical.

The distinction between the functions of registration and communication was finally effaced in the 1730s and 1740s, when the Society abandoned its practice of archiving letters (external communications) and papers (accounts delivered directly by Fellows or of experiments actually performed before the Society) in separate series. Cromwell Mortimer, the Secretary, could by 1742 argue that the distinction was pointless, since they were 'absolutely of the same nature'.⁷⁴ He proposed replacing them for the future with a continuous series of Guard-books of original papers, arranged in chronological order, to which the Journal-books of the Society's meetings would serve as a guide. *Transactions* was part of the organizing principle—papers selected for printing were marked in the archive with their published title and a number indicating where they came in the printed sequence, and it is very rare to find that the archival and printed sequences do not match. The new role for *Transactions* of reflecting the Royal Society was thus symbolized by its formal incorporation into the archive.

CONCLUSION

This new role formally collapsed what had once seemed an important distinction between letters and papers. These categories are partly the manifestation of formal attributes, but they also imply an epistemic change, one that is important in the conception of the natural-philosophical periodical—a distinction related to the question raised above, between the status of material witnessed by the Society and what was merely communicated to it. The epistolary form of many early scientific articles drew attention to the role of wider social relations in the constitution of natural knowledge, emphasizing newsworthiness, dialogue and provisionality; the paper, and the system of registers underlying it, in theory amounted to an adequately complete, indeed publishable, account of a particular knowledge claim. Papers were of two kinds: those brought in by Fellows, sometimes with accompanying demonstrations, and the results of experiments performed by Curators and paid for by the Society. As Halley's 1714 preface showed, the difference

between letters and papers had by that time effectively disappeared in *Philosophical Transactions*. The deliberate elimination of the distinction as an archival category reflects the extent to which it had ceased to be important at the institutional level as well; this represents a tacit abandoning of the Society's expectation of publishing courses of experimental work, but it also shows the extent to which *Transactions* had ceased to be primarily a clearing-house for natural-philosophical information and had instead become a reflection of the mainstream of Royal Society activity. The Society had taken a long time to recognize these facts in practice, and would take even longer to admit it formally, but by ceasing to distinguish between letters and papers it acknowledged that a transformation had taken place, both in institutional structure and in the nature of *Transactions*. A form of periodical publishing had emerged that would later be characterized as 'learned society Transactions' in the historiography of science of the eighteenth and nineteenth centuries. This category has assumed increasing importance in recent research, as scholars argue that these 'learned society Transactions' and the earliest scientific 'journals', properly so called, were distinct actors' categories.⁷⁵

The Royal Society assumed financial and editorial responsibility for *Transactions* in 1752. As in 1700, it was faced with a choice to acknowledge or repudiate the periodical after it had been publicly attacked; this time, the Society took it over.⁷⁶ Yet to do so was no longer a significant leap but an admission that *Transactions* did in fact represent the Society, and that the Society might take care to exercise more control and extract more advantage from the association—that the periodical should actually be run 'for the sole use and benefit of this Society', as the Earl of Macclesfield put it.⁷⁷

The periodical survived for so long partly because the Society wished it to, and took some steps—although well short of serious investment or proper editorial control—to ensure that it did. In other words, even before 1752, the Society provided *Transactions* with a valuable measure of institutional care and assistance. Yet the arm's-length support of the Society did not guarantee the periodical form primacy within the world of natural-philosophical publishing, nor even within the Society itself. Indeed the Royal Society's discussions in the late 1670s and early 1680s about the appropriate formats for natural-philosophical publishing reveal that the scientific periodical was regarded as being better suited to the reporting of individual claims to knowledge than asserting the Society's own. The point was not so much that the periodical form itself had secondary epistemic status, as that much of the material that went into it could not have been primarily witnessed or assented to by the Society itself; the Society could neither consistently claim ownership of such material nor guarantee its epistemic status. The Society wanted *Transactions* to continue, but it did not, at least for a long time, regard it as the proper outlet for its own research ambitions.

The transformation of *Transactions* into a record of Society activity in the very late seventeenth century and the first decades of the eighteenth century indicates a shift in the communication of natural knowledge. The early history of the periodical reflects a gradual shifting of priorities in the institution too, as the foundational expectation that the learned society would be as much a site of primary knowledge production as of dissemination and accreditation was abandoned, and the notion of periodical publishing was reoriented accordingly. Knowledge production in the Royal Society came to be invested in the individual research communication, in either letter or in paper form, rather than an experimental programme. David Kronick's observation that periodicals associated with learned societies had a better chance of survival is undoubtedly right, but in order

actually to *become* a learned society periodical, *Transactions* had to absorb functions of registration and research communication that the Society had at certain times been resolved to keep separate.

NOTES

- 1 Jean-Pierre Vittu, 'La formation d'une institution scientifique: le Journal des Savants de 1664 à 1714', in *J. Savants*, 179–203 (2002).
- 2 For an account of Colbert's oversight see Jacob Soll, *The information master* (University of Michigan Press, Ann Arbor, MI, 2009), pp. 100–103.
- 3 See, for instance, James E. McClellan III, *Science reorganised: scientific societies in the eighteenth century* (Columbia University Press, New York, 1985), pp. 52–54; Peter Dear, *Revolutionising the sciences: European knowledge and its ambitions, 1500–1700* (Palgrave, Basingstoke, 2001), pp. 120–122; Steven Shapin, 'O Henry', *Isis* **78**, 417–424 (1987); John Henry, 'The origins of modern science: Henry Oldenburg's contribution', *Br. J. Hist. Sci.* **21**, 103–109 (1988); Charles Bazerman, *Shaping written knowledge: the genre and activity of the experimental article* (University of Wisconsin Press, Madison, WI, 1988); Alan Gross, Joseph Hamron and Mike Reidy, *Communicating science: the scientific article from the seventeenth century to the present* (Oxford University Press, 2002), pp. 3–4; Adrian Johns, *The nature of the book: print and knowledge in the making* (University of Chicago Press, 1998), pp. 531–532.
- 4 David Kronick, *A history of scientific and technical periodicals: the origins and development of the scientific press, 1665–1790* (Scarecrow, Metuchen, NJ, 1976), pp. 110–112.
- 5 Johns's arguments on the engagements of natural philosophy with the early modern print trade in general are advanced in *The Nature of the Book*, and the specific case of *Philosophical Transactions* in Adrian Johns, 'Miscellaneous methods: authors, societies and journals in early modern England', *Br. J. Hist. Sci.* **33**, 159–186 (2000).
- 6 Henry Oldenburg, 'Advertisement', *Phil. Trans. R. Soc. Lond.* **1**, 213–214 (1667); Richard Waller, 'Preface', *Phil. Trans. R. Soc. Lond.* **17**, 581–582 (1692); Francis Aston and Robert Plot, 'The Preface', *Phil. Trans. R. Soc. Lond.* **13**, 2 (1683); Royal Society Council Minutes (Originals) [hereafter RS CMO], vol. 4, 20 Feb. 1751/2.
- 7 Aileen Fyfe, Julie McDougall-Waters and Noah Moxham, 'Guest editorial: 350 years of scientific periodicals', *Notes Rec.* **69**, 227–239 (2015) (<http://dx.doi.org/rsnr.2015.0036>).
- 8 The pamphlet was actually by William King: *The Transactioneer: with some of his Philosophical Fancies, in two Dialogues* (London, 1700). For a discussion, see Palmira Fontes da Costa, *The singular and the making of knowledge at the Royal Society of London in the eighteenth century* (Cambridge Scholars Publishing, Newcastle upon Tyne, 2009), pp. 93–98.
- 9 Harris was a cleric, an author, a lecturer on natural-philosophical subjects and a recent Boyle lecturer. L. Stewart, 'Harris, John (c. 1666–1719)', *Oxford Dictionary of National Biography* (Oxford University Press, 2004) (<http://www.oxforddnb.com/view/article/12397>, accessed 4 June 2015).
- 10 British Library [hereafter BL] Sloane MSS 4026 f. 253.
- 11 W. H. Quarell and M. Mare (translators), *London in 1710: from the travels of Zacharias Conrad von Uffenbach* (Faber & Faber, London, 1934), pp. 97–102.
- 12 See, for example, RS JBO/13, 7 June 1722, 25 October 1722, 23 November 1722, 6 December 1722 and 17 January 1722/3.
- 13 From the same period as in note 6, see RS JBO/13: 12 January 1721/2, 17 May 1722 and 18 October 1722.

- 14 RS JBO/13, 19 January 1721/2; John Lowthorp, *The Philosophical Transactions and Collections to the end of the year 1700. Abridg'd and Dispos'd under General Heads* (3 volumes) (Thomas Bennet, Robert Knaplock and Richard Wilkin, London, 1705–07).
- 15 See, for instance, Thomas Birch, *History of the Royal Society of London* (4 volumes) (A. Millar, London, 1756–57), vol. 3, pp. 104, 142, 155, 163, 169, 176, 179, 213, 225, 299, 372, 434, 451 and 488.
- 16 Marie Boas Hall, *Henry Oldenburg: shaping the Royal Society* (Oxford University Press, 2002), p. 156.
- 17 On this, see Moxham, 'Form and genre in early science journals', in *News networks in early modern Europe* (ed. Joad Raymond and Noah Moxham) (Brill, Leiden, in the press).
- 18 Oldenburg had hoped that the periodical would yield up to £150 per annum. Although in practice he claimed it had never made him more than £40; see *The correspondence of Henry Oldenburg* (ed. A. R. Hall and M. B. Hall) [hereafter *Oldenburg Correspondence*], vol. 3, p. 69, and vol. 4, pp. 58–59 (University of Wisconsin Press, Madison, WI, 1965–1986).
- 19 Halley was paid £13 10s. for 60 copies each of five issues of *Transactions* in 1687. Royal Society Account Books [hereafter RS AB], vol. 1, 1/3 (1687). The subsidy was originally negotiated by Francis Aston and Robert Plot as their condition for relaunching *Transactions* in January 1682/3. Birch, *op. cit.* (note 15), vol. 4, pp. 170–171.
- 20 H. W. Robinson and W. Adams (eds), *The diary of Robert Hooke 1672–1680* (Taylor & Francis, London, 1935), p. 331; for the full extent of Hooke's campaign against the continuation of Oldenburg's *Transactions*, see Johns, *op. cit.* (note 5), pp. 172–174.
- 21 Francis Aston in London, and Robert Plot in Oxford from 1682 to 1684, succeeded by William Musgrave in 1684–85. Birch, *op. cit.* (note 15), vol. 4, pp. 170–171.
- 22 Birch, *op. cit.* (note 15), vol. 4, p. 462. The order of Council theoretically required Halley to submit the copy to a Secretary for approval before publication.
- 23 Birch, *op. cit.* (note 15), vol. 4, pp. 453, 455. With Hooke and Oldenburg there had been no question of imposition, because each launched his publication on his own initiative.
- 24 Francis Aston to William Musgrave, 18 December 1685; printed in *Early science in Oxford* (15 volumes) (ed. R. T. Gunther), vol. 12, p. 106 (Oxford University Press, 1923–67). Birch, *op. cit.* (note 15), vol. 4, p. 229.
- 25 Birch, *op. cit.* (note 15), vol. 4, p. 453.
- 26 Johns, *op. cit.* (note 3), p. 540.
- 27 See R. S. Westfall, *Never at rest: a biography of Isaac Newton* (Cambridge University Press, 1987), pp. 444–465, and Alan Cook, *Edmond Halley: charting the heavens and the seas* (Oxford University Press, 1999), pp. 147–164.
- 28 'Advertisement', *Phil. Trans. R. Soc. Lond.* **16**, 297 (1686).
- 29 RS CMO/2, 7 December 1692; Robinson and Adams (eds), *op. cit.* (note 20).
- 30 Not only was Halley apparently considered (see above, and note 26) but Robert Plot was also offered '40ll per an. for corresp. and transactions'; he also turned them down, and Waller, after discussions with Hooke, took over. Hooke continued to be involved, however, negotiating with booksellers on Waller's behalf and correcting sheets for the press. See 'Hooke, Diary: 1688–1693,' in Gunther (ed.), *op. cit.* (note 24), vol. 10, pp. 214–215, 217, 222–224 and 262.
- 31 BL Sloane MS 4026, ff. 270–271. The burdensome costs of publishing scientific periodicals are analysed in more detail and in longer perspective by Aileen Fyfe, 'Journals, learned societies and money: *Philosophical Transactions*, ca. 1750–1900', *Notes Rec.* **69**, 277–299 (2015) (<http://dx.doi.org/rsnr.2015.0032>); the Society published *Transactions* after 1752 at a continuous loss until the mid-twentieth century.
- 32 See note 19 above, when the Society began to take a large institutional subscription.
- 33 RS AB/1/1/1 (1667).
- 34 For payment of Oldenburg's salary, see RS AB/1/1/1 (1667–1672) and RS AB/1/1/2 (1673–1677). The Society understood at that point that they risked losing Oldenburg's services, as he

- petitioned for their assistance with his application for the post of Latin Secretary to the government. Birch, *op. cit.* (note 15), vol. 3, pp. 355–356.
- 35 See note 30 for the proposed salaries for Halley and Plot; and RS AB/1/1/3 (1719) for the evidence of secretarial salaries in 1719.
- 36 On Society involvement with *Micrographia* and its collaborative genesis between Hooke and Christopher Wren, see Lisa Jardine, *On a grander scale: the outstanding life of Sir Christopher Wren* (HarperCollins, London, 2002), pp. 276–278; for the Society's input into Sprat's *History*, see Birch, *op. cit.* (note 15), vol. 1, p. 507, and vol. 2, pp. 2, 3, 7, 47, 51, 158 and 163.
- 37 Francis Aston and Robert Plot agreed that the printing of issues 144–176 should be undertaken in Oxford; see Gunther (ed.), *op. cit.* (note 24), vol. 12, p. 13.
- 38 Royal Society accounts, which survive in reasonable detail for the period immediately after the foundation, record only minute payments to printers in this period, most probably for jobbing printing. RS AB/1/1/1, *passim*.
- 39 Contemporary criticisms of the Society include those of Thomas Hobbes, outlined in Steven Shapin and Simon Schaffer, *Leviathan and the air-pump: Hobbes, Boyle and the experimental life* (Princeton University Press, 1985); Samuel Sorbière's *Relation d'une Voyage en Angleterre* (Louis Billaine, Paris, 1664), misinterpreted as a criticism by Thomas Sprat; and Oldenburg's acknowledgement to Boyle of 18 September 1666 that there were murmurings about the Society's productivity: wherein he mentions seeing Christopher Wren's plan for rebuilding London and reflects that if the model had been shown to the King it would have 'given the Society a name, and made them popular, and availed not a little to answer those who continually ask, what have they done?'. *Oldenburg Correspondence*, vol. 3, p. 231. Lorenzo Magalotti also reports, from a little later, Charles II's habit of referring to the Fellows as 'my fools' (see W. E. K. Middleton, 'What did Charles II call the Fellows of the Royal Society?', *Notes. Rec. R. Soc.* **31**, 13–17 (1977)); and, ironically, the work of the two most notable apologists for the Royal Society, Joseph Glanvill and Sprat himself, provoked a flurry of pamphlets on the other side from Henry Stubbe.
- 40 Birch, *op. cit.* (note 15), vol. 3, p. 328.
- 41 *Ibid.*, vol. 3, pp. 342, 352 and 366.
- 42 *Ibid.*, vol. 3, p. 366.
- 43 *Ibid.*, vol. 3, pp. 369–370.
- 44 Grew's work for the Society had a long history: in 1672–73, the wealthier Fellows had raised a subscription to pay him a £50 salary to give a series of botanical demonstrations in 1672 and 1673. See Michael Hunter, 'Early problems in professionalizing scientific research: Nehemiah Grew (1641–1712) and the Royal Society', in *Establishing the new science: the experience of the early Royal Society* (Boydell & Brewer, Woodbridge, 1989), pp. 261–278.
- 45 Birch, *op. cit.* (note 15), vol. 3, p. 3; RS AB/1/1/3 (1678).
- 46 See Mario Biagioli, 'Scientific revolution, social bricolage, and etiquette', in *The scientific revolution in national context* (ed. R. Porter and M. Teich), pp. 11–55 (Cambridge University Press, 1996).
- 47 The Society knew of the existence of both works. Hooke reported on the contents of *Saggi* in March 1667/8 (Birch, *op. cit.* (note 15), vol. 2, p. 257). Oldenburg reviewed the earliest, pamphlet forms of the Parisian dissections in *Philosophical Transactions* but was unable to obtain copies, because they were produced in very limited print runs (200 copies) and distributed primarily as royal gifts. See Anita Guerrini, 'The King's animals and the King's books: the illustrations for the Paris Academy's *Histoire des Animaux*', *Ann. Sci.* **67**, 383–404 (2010); and Noah Moxham, 'Edward Tyson's *Phocaena*: publishing comparative anatomy in seventeenth-century England and France', *Notes Rec. R. Soc.* **66**, 252–271 (2012).

- 48 Marie Boas Hall, in *Promoting experimental learning: experiment and the Royal Society 1660–1727* (Cambridge University Press, 1993), discusses Grew's *Transactions* in connection with the January Council orders but fails to note that the project had been mooted in December 1676, when Oldenburg was still alive, and does not make the connection between Hooke's *Lectures and Collections* and the thematic tracts proposed in January (pp. 107–109).
- 49 Letters from Robert Moray on Hebridean tides published in number 137 are to be found in the Society's register-books dated 1661: by Henry Powle, from 1666, and by Jonathan Goddard, from 1661. RS RBO/1/19, RBO/3/34 and RBO/1/27.
- 50 '[An Account of a Book Entitled] ANTIΔIATPIBH, Sive Animadversiones in Malachiae Thruston M.D. Diatribam in Respirationis Usu primario'. *Phil. Trans. R. Soc. Lond.* **12**, 1072–1074 (1677–78).
- 51 For a discussion of these observations, the international controversy over an aberrant observation by Johannes Hevelius, and the delicate problem of how to discount it without violating codes of civility, see S. Shapin, *A social history of truth: civility and science in seventeenth-century England* (University of Chicago Press, 1994), pp. 266–291.
- 52 Hooke had published short tracts before: *An attempt to prove the motion of the earth from observations* (John Martyn, London, 1673), *Animadversions upon the first part of the Machina Coelestis* (John Martyn, London, 1674), *A description of Helioscopes* (John Martyn, London, 1676) and *Lampas* (John Martyn, London, 1676); however, the tracts in *Lectures and Collections* are unique in the range of authors and materials drawn upon.
- 53 The attributions to *Journal* are made explicitly in Hooke's text. Robert Hooke, *Lectures and Collections* (John Martyn, London, 1678), pp. 73 and 78.
- 54 *Ibid.*, p. 101.
- 55 See note 37.
- 56 Adrian Johns and Rob Iliffe, among others, have written about the function of registration in the Society as a system of accrediting discovery, and they see Hooke's hostility to *Transactions* as evidence that the periodical under Oldenburg extended this function. In addition to Johns, *op. cit.* (note 5), see Rob Iliffe, "'In the warehouse": privacy, property and priority in the early Royal Society', *Hist. Sci.* **30**, 29–68 (1992).
- 57 RS AB/1/1/1; see for instance 1667, during which Shortgrave and Hooke between them are paid more than £100 of a total outlay of a little over £200. For Grew's lecture payments, see RS AB/1/1/2, 1677 and 1678.
- 58 Stephen Pumfrey, 'Ideas above his station: a social study of Robert Hooke's curatorship of experiments', *Hist. Sci.* **29**, 131–156 (1991); and Steven Shapin, 'Who was Robert Hooke?', in *Robert Hooke: new studies* (ed. M. Hunter and S. Schaffer), pp. 253–285 (Boydell, Woodbridge, 1989).
- 59 Birch, *op. cit.* (note 15), vol. 3, p. 501.
- 60 *Ibid.*, vol. 3, pp. 501, 514; vol. 4, pp. 229–230, 237 and 496.
- 61 *Ibid.*, vol. 3, p. 450.
- 62 *Ibid.*, vol. 3, p. 491. The minute specifies that the periodical should be based on material 'he shall meet with from his correspondents'. The future tense indicates that the correspondence should be reasonably current; but 'his' is ambiguous because it makes no distinction between personal and secretarial correspondence.
- 63 For the technologies of collective witnessing, see in particular Steven Shapin, 'The house of experiment in seventeenth-century England', *Isis* **79**, 373–404 (1988).
- 64 For the gaps left by Hooke as minutes secretary, see Birch, *op. cit.* (note 15), vol. 3, pp. 375, 381, 426, 430, 453, 464 and 469. The publication of his works after death was undertaken, in a confessedly unsatisfactory and piecemeal fashion, by Richard Waller in *Posthumous Works* (London, 1705), with some remaining fugitive pieces published by William Derham in *Philosophical Experiments and Observations of the late Eminent Dr. Robert Hooke, S.R.S.* (London, 1726).

- 65 Frederick Slare and Edward Tyson, respectively, with responsibility for chemistry and anatomy. Birch, *op. cit.* (note 15), vol. 4, pp. 177–178.
- 66 See above, but particularly the instructions to Hooke to continue *Transactions* or *Collections* of 3 July and 8 August 1679 (Birch, *op. cit.* (note 15), vol. 3, pp. 451, 491 and 501).
- 67 The formulation used for the proposed publication of thematic tracts in January 1677/8 (see above). It is important to understand this as distinct from merely appearing under the Society's imprimatur; the extent of the effort to secure the supply of experiment from the Curators, and to give them rigorous rules for proposing, performing and submitting experiments, all suggest a Society endeavouring not merely to be casually associated with experimental research but to take possession of it by the only means at its disposal.
- 68 See Hall, *op. cit.* (note 48), pp. 87–89.
- 69 See the prefaces published by Aston and Plot (*Phil. Trans. R. Soc. Lond.* **13**, 2 (1683)) and Waller (*Phil. Trans. R. Soc. Lond.* **17**, 581–582 (1693)) respectively. The quotation is from Waller.
- 70 Aston to William Musgrave, 25 March 1686, in Gunther, (ed.), *op. cit.* (note 24), vol. 12, pp. 309–310. For a detailed account of the book's publication history, see S. Kusakawa, 'The *Historia Piscium* 1686', *Notes Rec. R. Soc.* **54**, 179–197 (2000).
- 71 See especially BL Sloane MSS 4025 and 4026, *passim*.
- 72 A. Rusnock (ed.), *The correspondence of James Jurin (1684–1750)* (Rodopi, Amsterdam, 1996), p. 81. Jurin to Woodward, 15 February 1719.
- 73 With its finances no longer tied up in paying for experiments and Curators, the Society exhibited a willingness for the first time to contemplate paying editors to undertake 'corresp. and Transactions', as discussed in note 30; in the event, the task fell to independently wealthy Secretaries.
- 74 RS CMO/3, 12 July 1742.
- 75 See in particular Jonathan Topham, 'Anthologizing the book of nature: the circulation of knowledge and the origins of the scientific journal in late Georgian Britain', in *The circulation of knowledge between Britain, India and China* (ed. B. Lightman, G. McQuat and L. Stewart), pp. 119–152 (Brill, Leiden, 2013); Iain Watts, 'We want no authors: William Nicholson and the contested role of the scientific journal in Britain, 1789–1813', *Br. J. Hist. Sci.* **47**, 397–419 (2014).
- 76 For a discussion of John Hill's attacks on the Society and *Transactions*, see George Rousseau, *The notorious Sir John Hill: the man destroyed by ambition in the age of celebrity* (Lehigh University Press, Bethlehem, PA, 2012), pp. 65–83.
- 77 RS CMO/4, 19 March 1751/2.